# 2018 THE SCIENCE OF CONSCIOUSNESS

## TUCSON, ARIZONA | APRIL 2-7, 2018 www.consciousness.arizona.edu



Center for Consciousness Studies THE UNIVERSITY OF ARIZONA

## The Science of Consciousness 2018 is sponsored by:





CENTER FOR CONSCIOUSNESS SCIENCE

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## **2018 TSC Program Chairs**

Stuart Hameroff, MD

Director, Center for Consciousness Studies University of Arizona, Tucson, AZ

George Mashour, MD Director, Center for Consciousness Science, Co-Sponsor University of Michigan, Ann Arbor, MI

## Thomas G. Bever, PhD

Regent's Professor Vice-Director, Center for Consciousness Studies University of Arizona, Tucson, AZ

## **Conference Manager and CCS Asst. Director**

Abi Behar Montefiore

center@email.arizona.edu

## 2018 TSC Conference Program Committee

Thomas G. Bever | Mary A. Peterson | John J.B. Allen | Massimo Piatelli-Palmarini Abi Behar Montefiore | Alvin J. Clark | Betsy Bigbee | Olga Bever

## 2018 Center for Consciousness Studies -Advisory

George Mashour | David Chalmers | Harald Atmanspacher | Paavo Pykllanen | Jay Sanguinetti | Vishal Sahni | Nancy Woolf | James Tagg | Erik Viirre

## **GENERAL CONFERENCE Sessions 2018 – Quik Summary**

Forum and Workshops:	Monday April 2 morning 9 - 1, Afternoon 2 - 6
	& Tuesday April 3 morning only 9 - 1
Opening Session:	Monday April 2 Evening Plenary 1 - 7-10 PM Kiva Ballroom Plenary Sessions: continue through Saturday April 7 - (see program)
	Kiva Ballroom
Concurrent Sessions	Tuesday, Wednesday, Friday: April 3, 4, 6 (see program for room assignments)
Welcome Reception:	Tuesday, April 3, 7:30 pm - Cascade Terrace
Posters Sessions:	Wednesday and Friday: April 4 and April 6 - Grand Ballroom B & C
Art-Tech Health Demos:	Wednesday and Friday: April 4 and April 6 - Grand Ballroom Lobby
Film Screening:	Thursday, April 5, 5:00 PM - Catalina Ballroom
<b>Optional Dinner/Show:</b>	Thursday: April 5, Kiva - 7 pm
Exhibit Receptions:	Wednesday and Friday: April 4, April 6 - 6:30-9:30 pm
	Grand Ballroom Lobby
Poetry Slam:	Friday: April 6, 9:30 pm - xx Kiva
Saturday Party:	Saturday: April 7, 8:00 pm - xxx Kiva

## The University of Arizona – Center for CONSCIOUSNESS STUDIES

Presents

## CONSCIOUSNESS

APRIL 2-7, 2018 Tucson, Arizona

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## THE SCIENCE OF CONSCIOUSNESS WELCOME

## The Science of Consciousness 2018 April 2-7, 2018, Loews Ventana Canyon Resort, Tucson, Arizona

**Welcome** to the 25th annual 'The Science of Consciousness' ('TSC'), the world's largest, longest-running and premier interdisciplinary conference addressing fundamental questions regarding consciousness, the brain, reality and existence.

**TSC 2018** is a 6-day gathering consisting of Plenary Sessions, Workshops, Evening Concurrent Talks and Poster Sessions, Technology and Art Exhibits, Social Events and Entertainment. We anticipate that over 800 scientists, philosophers, educators, academicians, students, meditators, artists, interested public and seekers from 50 countries will gather in Tucson.

## 2018 Themes include:

- Does consciousness emerge from complex computation among brain neurons?
- > Or is consciousness an intrinsic feature of the universe?
- > What can we learn from studying anesthetic and psychedelic drugs?
- Is language a feature of biological cognitive structure?
- Where, when and how do brain activities correlating with consciousness occur?
- How do they lead to experiential 'qualia'?
- > What level, or scale of brain organization is required for consciousness?
- > Can AI machines be conscious, and if so, how?
- > What is life, and is it necessary for consciousness?
- > Can consciousness be enhanced by technology and/or genetics?

We thank our sponsors, program committee, support staff, hosts, presenters, registrants and volunteers for making TSC possible. We especially acknowledge the extraordinary efforts and many years of service of Abi Behar-Montefiore, Assistant Director of the Center for Consciousness Studies at the University of Arizona. Without Abi, The Center and TSC conferences would not be possible.

We are grateful to Senior Graphic Designer, Debra Bowles of UAHS Biomedical Communications at the University of Arizona for her overall contribution to present this event through AV production and design concepts.

Continued gratitude to SBS Technology web guru Ed Xia for many years of IT support.

We also thank conference co-chair and co-sponsor Professor George Mashour and his 'Center for Consciousness Science' at the University of Michigan for leadership, rigor and support. Conference co-chair and CCS Vice-Director Professor Tom Bever has been instrumental in organization and integration of CCS and TSC at the University of Arizona, for which we are very grateful. And we thank Professor John Paul Jones, Dean of Social and Behavioral Sciences at the University of Arizona for his vision and assistance. Thank you to Stuart Hameroff's colleagues at Banner University Medical Center Surgery.

## Thank you to our 2018 Plenary speakers (in order of appearance)

Jean-Pierre Changeux | Noam Chomsky | Thomas G. Bever | Massimo Piattelli Palmarini | Robin Carhart Harris | Jimo Borjigin | Anil K. Seth | Charles Fernyhough | Riny Huijbregts | Andrea Moro | Pattie Maes | Steven Gullans | George Mashour | Yan Xu | Marine Vernet | Lucien Hardy | Robert Alfano | Christoph Simon | Paul Verschure | Selen Atasoy | Steen Rasmussen | Stuart Kauffman | Sara Walker | Bruce Damer | George F.R. Ellis | Anirban Bandyopadhyay | Sir Roger Penrose | David Chalmers Deepak Chopra | Hedda Hassel Mørch | Stuart Hameroff | M. Bruce MacIver Robert Pearce | Rod Eckenhoff | Travis Craddock | Ladan Shams | Anthony Hudetz | Paul Werbos | David Hanson | Julia Mossbridge | Sophia the Humanoid Hanson Robot

We offer continued gratitude to our initial sponsors, the Fetzer Institute, and the YeTaDel Foundation who supported us for many years.

## Finally, this year's sponsors have made Tucson 2018 a reality:

The Center for Consciousness Studies, The University of Arizona The Center for Consciousness Science, The University of Michigan The Tianqiao and Chrissy Chen Institute

## Additional Sponsors:

Dayalbagh Educational Institute | Alvin J. Clark | Dennis Balson | YeTaDeL Foundation | Ronald Gruber | The Penrose Institute | The Nice Lab, UNM (Non-Invasive Cognitive Enhancement Lab, University of New Mexico) | Mind Matter Society | University of Arizona Office of Student Affairs, Cognitive Science Program, Honors College, Office of the Provost

The DEI Dayalbagh Educational Institute , Agra, India (DEI) for their special efforts to bring the Integrated East-West-Forum to TSC and to Vishal Sahni for his

## WELCOME to The Science of Consciousness 2017

dynamic coordination efforts on the Forum and the Simulcast.

Special thanks to Jay Sanguinetti, PhD for organizing the Exhibitors and Demos and for bringing a team of volunteers from The Nice Lab (UNM)

Thank you to the Tucson-based Commotion Studios who were able to work with us on this intense program again and to provide us with excellent plenary session video files to upload after the conference. Thank you Matt George and Team.

## **Exhibitors including:**

Vielight | Guger Technologies OG | Hanson Robotics | Jory Bond | Burgarella Quantum Healing | Quantum Touch | Stuart Ross | Gerard Blommestijn | Patrick Palucki | Ricky Gelb and the Wellness Team | Tatiana Ginzburg | Tamara Thompson | Journal of Consciousness Studies | The Nice Lab, UNM | Cirque Roots Productions & Studio

## Thank you to our 2018 volunteers and friends – Thank you for all you do!

**Since 1994** The Tucson Biennial Conference Series – The Science of Consciousness has been held in Tucson Arizona with alternate year international TSC Conferences in cooperation with partner organizations and institutions.

## The 2019 TSC is scheduled for June 25-28, 2019 - Interlaken Switzerland

**PRESS:** Thank you for joining us.

All press must apply for credentials and complete an online registration form. No filming/podcasting or studio set ups without permission

Contact: Abi Behar-Montefiore 520-247-5785 center@email.arizona.edu

## On behalf of the 2018 Program Committee,

Thomas G. Bever | George Mashour | John J.B. Allen | Massimo Piatelli-Palmarini Mary A. Peterson | Abi Behar Montefiore | Alvin J. Clark | Betsy Bigbee | Olga Bever | Jay Sanguinetti | Stuart Hameroff | James Tagg | Erik Viirre | Paavo Pylkkanen

## Have a great time and enjoy the conference! Stuart Hameroff, MD

TSC 2018 Co-Chair Professor, Anesthesiology and Psychology Director, Center for Consciousness Studies Banner-University Medical Center The University of Arizona, Tucson, Arizona

## **History of TSC**

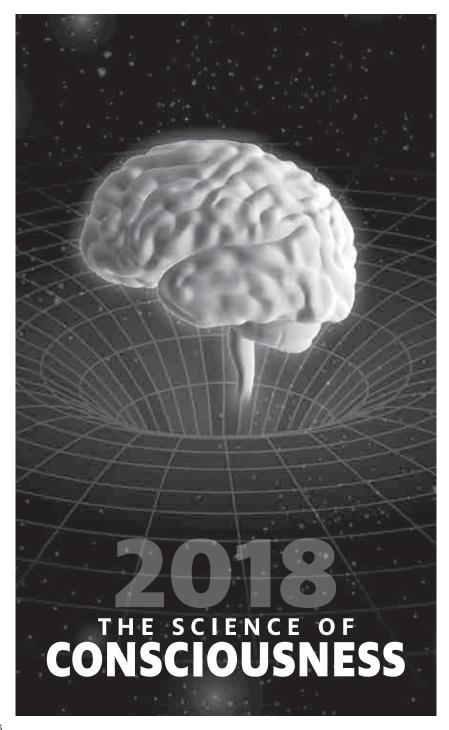
The Science of Consciousness' ('TSC') is the world's largest, longest-running and premier interdisciplinary conference on all aspects of the nature of conscious experience, awareness, feelings and existence. Questions include how the brain produces consciousness, whether consciousness is intrinsic to the universe, or an epiphenomenal illusion, how consciousness can causally affect brain processes, what are the best empirical theories, do we have free will, how did life and consciousness originate and evolve, what are the origins of moral and aesthetic values, how can we improve mental, physical and cognitive function, and can consciousness persist after bodily death, e.g. through 'uploading' to machines, or via mental processes tied to the natural world? These and other relevant questions are approached through many disciplines in science, philosophy, culture and contemplative practices. 'TSC' began at the University of Arizona in Tucson in 1994, and returns there in even-numbered years, alternating with TSC conferences around the globe (Italy, Denmark, Japan, Hungary, Hong Kong, Sweden, India, Czech Republic, Finland).

## Thank you to our international colleagues and friends who helped make the TSC alternate year conferences possible:

- 1995 Ischia, Italy Chloe Taddei-Ferretti
- 1997 Elsinore, Denmark Alwyn Scott
- 1999 Tokyo, Japan UN University, Mari Jibu, Kunio Yasue
- 2001 Skovde, Sweden University of Skovde, Paavo Pylkkanen
- 2003 Prague, Czech Republic Ivan Havel
- 2005 Copenhagen, Denmark Morten Overgard
- 2007 Budapest, Hungary George Kampis
- 2009 Hong Kong, China Gino Yu
- 2011 Stockholm, Sweden Christer Perfjell
- 2013 Agra, India Dayalbagh Educational Institute , Rev. Prof. P.S. Satsangi, Vishal Sahni
- 2015 Helsinki, Finland University of Finland, Paavo Pylkkanen
- 2017 San Diego, La Jolla California CCS-TSC University of Arizona, Stuart Hameroff
- 2019 Interlaken, Switzerland Harald Atmanspacher (in progress)

## **Conference Director**

Abi Behar-Montefiore, Center for Consciousness Studies, Assistant Director



# CONSCIOUSNESS

## TSC 2018 PLENARY SESSIONS (KIVA BALLROOM)

## April 2 - April 7, 2018

## **MONDAY** – April 2, 2018

## 

Jean-Pierre Changeux, Collège de France Institut Pasteur Noam Chomsky, University of Arizona *Discussants:* Thomas G. Bever, University of Arizona Massimo Piattelli Palmarini, University of Arizona

## TUESDAY - April 3, 2018

## 

Robin Carhart Harris, Imperial College, London Jimo Borjigin, University of Michigan Anil K. Seth, University of Sussex

## WEDNESDAY - April 4, 2018

Riny Huijbregts, Utrecht University Andrea Moro, IUSS School for Advanced Studies

## Plenary 4 (PL4) ......11:10 am - 12:30 pm Cognitive and Consciousness Enhancement Technology

Pattie Maes, MIT Media Lab Steven Gullans, Cleveland Clinic, Excel Venture Management

## Plenary 5 (PL5) ......2:00 pm - 4:10 pm Neural Correlates of Consciousness: Where, When and How?

George Mashour, University of Michigan Yan Xu, University of Pittsburgh Marine Vernet, NIMH/NIH

## THURSDAY - April 5, 2018

## Plenary 6 (PL6) ...... 8:30 am - 10:40 am Physics and Consciousness I

Lucien Hardy, Perimeter Institute for Theoretical Physics Robert Alfano, City College of New York Christoph Simon, University of Calgary

Plenary 7 (PL7)11:10 am - 12:30 pm Brain Scale and Harmony
Paul Verschure, SPECS, Barcelona Institute of Science Selen Atasoy, University of Oxford
<b>Plenary 8 (PL8)</b> 2:00 pm - 4:45 pm <i>Origin and Evolution of Life and Consciousness</i> Steen Rasmussen, University of Southern Denmark, Sante Fe Institute Stuart Kauffman, Sante Fe Institute Sara Walker, Arizona State University Bruce Damer, UC Santa Cruz
FRIDAY - APRIL 6, 20187:00 - 8:00 am*7-8 am - Early Morning MeditationKiva BallroomDeepak ChopraKiva Ballroom
Plenary 9 (PL9)8:30 am - 10:40 amPhysics and Consciousness IIAnirban Bandyopadhyay, NIMS, Japan, IIIR, IndiaGeorge F.R. Ellis, University of CapetownKeynote - Why Algorithmic Systems Possess No UnderstandingSir Roger Penrose, University of Oxford
Plenary 10 (PL10)
Plenary 11 (PL11)
Stuart Hameroff, University of Arizona SATURDAY - April 7, 2018
Plenary 12 (PL12)
Plenary 13 (PL13)
<b>Plenary 14 (PL14)</b> 2:30 pm - 4:40 pm <i>Artificial Intelligence and Machine Consciousness</i> Paul Werbos, (ret.) National Science Foundation David Hanson, Hanson Robotics Julia Mossbridge, IONS Sophia the Humanoid Hanson Robot

## CONCURRENT SESSIONS TUESDAY, WEDNESDAY AND FRIDAY, April 3, 4, 6

	-
CONCURRENTS (C 1 – C 9) Tuesday April 3 5 C1 Panpsychism and the Combination Problem	:00 pm - 7:00 pm
Bailey, Van Gulick, Grasso, Lloyd, Schrieck, Hunt	Coronado
C2 Brain Stimulation and Feedback	
Jones A, Lim L, Masachika, Campbell S, Sitaram, Scott M	Rincon
C3 Molecular and Quantum Biology	
Sahni P, Pokorny, Krishnanandu, Kalra A, Prakash Shir, Saran N	Santa Rita
C4 Agency and Action Schema	
Heile, Trujillo, Acosta, Strozier, Baer, Campbell J	Sabino
C5 Integrated Information and Resting State Networks	
Muñoz-Jimenez, LaRock, Kim, Toropova, Bola	Salon D
C6 Dreams and Meditation	
Haar-Horwitz, Baird, Colbert, Ahuja, Basnett, Roy	Salon E
C7 Physics and Consciousness 1	
Schiffer, Awret, Nishiyama, Shanker, Prakash S, Li Jianfeng	Salon F
C8 AI/Machine Consciousness 1	
Bach, Deiss, Vukadinovic, Tagg, Puigbo, Tolman	Exec Board Room
C9 Consciousness, Media and Entertainment	
Bhatnagar P, Day, Pyari Pritam, Vlaming, Bhatnagar G, Tadiparthi, J S Jorda	an Catalina J
CONCURRENTS - (C-10 – C-18)	
Wednesday April 45	:00 pm - 7:00 pm
Wednesday April 4	
Wednesday April 45	<b>:00 pm - 7:00 pm</b> Coronado
Wednesday April 4	Coronado
Wednesday April 4	
Wednesday April 4	Coronado Rincon
Wednesday April 4	Coronado
Wednesday April 4	Coronado Rincon Santa Rita
Wednesday April 4	Coronado Rincon
Wednesday April 4	Coronado Rincon Santa Rita Salon F
Wednesday April 4	Coronado Rincon Santa Rita
Wednesday April 4	Coronado Rincon Santa Rita Salon F Salon D
<ul> <li>Wednesday April 4</li></ul>	Coronado Rincon Santa Rita Salon F
<ul> <li>Wednesday April 4</li></ul>	Coronado Rincon Santa Rita Salon F Salon D Salon E
<ul> <li>Wednesday April 4</li></ul>	Coronado Rincon Santa Rita Salon F Salon D
<ul> <li>Wednesday April 4</li></ul>	Coronado Rincon Santa Rita Salon F Salon D Salon E Catalina J
<ul> <li>Wednesday April 4</li></ul>	Coronado Rincon Santa Rita Salon F Salon D Salon E
<ul> <li>Wednesday April 4</li></ul>	Coronado Rincon Santa Rita Salon F Salon D Salon E Catalina J

## CONCURRENTS (C-19 - C-27)

FRIDAY April 6	:00 PM - 7:00 PM
Turausky, Van der Heever, Andrews, McKenty, Mishra, Haworth, Misl	nra, R Coronado
C20 AI/Machine Consciousness 2	
Camargo-Perez, Beck, Bosinski, Mohan, Cline, Charan VG	Salon D
C21 Psychotherapy and Free Will	
Langer, Mender, Brophy, Garrido, McClelland, Isham	Rincon
C22 Is Consciousness Fundamental?	
Blackmon, Burton, Johnson M, Gendle, Borgheali, Guta, Derakshani	Santa Rita
C23 Molecular Biology 2	
Delafield-Butt, Tuszynski, Fredriksson, Goradia, Valladares	Salon E
C24 Altered States 2	
Schwartz, Caputi, Martin, Reichlin, Beal, Williford	Catalina J
C25 Physics and Consciousness 3	
Lee SC, Gruber, Rowland, Viierre, Rourk, Nelson	Exec Board Room
C26 Consciousness in Infants and Animals	
Passos, Bhatnagar A, Polari, Beran, Morrison, Alaoui	Salon F
C27 Consciousness and Education	
Fonseca, van de Gevel , Kalra K, Satsangi G, Gaiseanu	Sabino

## FORUM / WORKSHOPS

## MONDAY AND TUESDAY, April 2 and 3, 2018

Workshop admission included in Conference Registration Non-Registrants: \$50 per workshop. Tickets at Registration Desk.

## **MONDAY MORNING April 2**

(Workshops Session 1)	9:00 am - 1:00 pm
P. Satangi, V. Sahni et al.,	Kiva Ballroom
Inner Experiences High Fidelity R. Hurlburt, E. Schwitzgebel	Coronado
Mapping the Field of Consciousness Studies A. Combs	Sabino
MONDAY AFTERNOON April 2 (Workshops - Session 2) 2:00 pm - 6:00 pm Quantum Biology	
J. Tuszynski, A. Bandyopadhyay, S. Hameroff, T. Craddock, others	Salon E
<b>Consciousness, Pain and Addiction</b> R. Gelb, L. Ditmanson, T. Vanderah, M. Ibrahim, A. Patwardhan	Salon D

## The Science of Consciousness TSC2018 | Tucson, Arizona

Consciousness Hacking		
J. Sanguinetti, J. Martin	Catalina J	
Philosophical Theories of Consciousness		
R. Gennaro	Salon F	
DEI East West Forum part 2	Kiva Ballroom	
WORKSHOPS		
TUESDAY Morning April 3		
(Workshops - Session 3)	9:00 am - 12.30 pm	
Network Science and Consciousness		
Z. Huang, U. Lee, A. Hudetz, G. Mashour, D. Pal	Exec Board Room	
Interfacing with Non-Ordinary States, P. Maes, J. Amores, A. Horowitz, MIT Media Lab The workshop is limited to 45 people. Please arrive early.	Salon D	
Al/Robotics Demo and Debate		
Free Will, Quantum Causality and Consciousness		
P. Pylkkanen, J. Wallezek, G. Musser, R. Chrisley	Salon F	
<b>Time and Consciousness</b> C. Montemayor, H. Atmanspacher, E. Isham and others	Coronado	
Art-Tech-Health Demos (Wednesday and Friday Evenings)	6:30 - 9:30 pm	
A1 - Art Technology Exhibits, Projections Wednesday and Friday Evening with reception	Grand Ballroom Lobby	
Cirque Roots - Black Light Yoga	Catalina K	
POSTER SESSIONS (Wednesday and Friday Evenings) Poster Session 1 Wed April 4 6:30-9:30 PM	Grand Ballroom B & C	

## DAILY WELLNESS

## April 2-7

YOGA - MEDITATION - SOUND THERAPY

## ENTERTAINMENT

## Theatre/Music at TSC 2018

## 

## FILM SCREENING: Thursday April 5, 5:00 pm .... Catalina Ballroom 'Minds Wide Open'

Recent technological advances are starting to unlock the mysteries of the human brain. Minds Wide Open, an innovative film, featuring leading, international experts and compelling patient stories, makes the case to policy makers, philanthropic funders and the public that increased support is critical if we are to take advantage of this unparalleled opportunity to advance the science, unlock the wonders of the human mind and create a better world.

## 

Will be performing "EXIST" Dinner and a Show – optional

Tickets required via Registration System \$75 – R.S.V.P. By Tuesday Apr 3 based on availability

WEDNESDAY April 4 and Friday April 6	6:30-9:30 PM
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**CIRQUE ROOTS** Exhibition of Black Light Yoga

Catalina K Ballroom

Kiva Ballroom

### 

## 

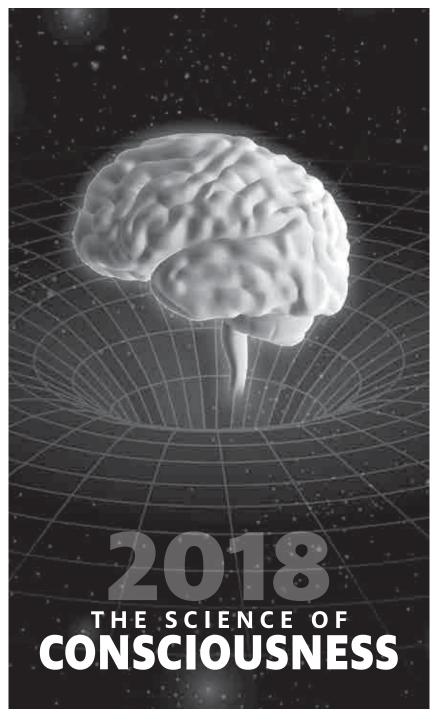
The End of Consciousness Party Michael P. & the Gully Washers

## **Conference Registration**

Early Standard \$550 Early Students \$450 Thurs Dinner/Show: \$75 optional Center for Consciousness Studies - CCS Website www.consciousness.arizona.edu center@email.arizona.edu Workshops for non-registrants \$50 each

## Special Thanks to The Loews Ventana Canyon Resort.

## The Science of Consciousness TSC2018 | Tucson, Arizona



## INDEX TO PLENARY SESSIONS

## PL 1 - PL 14

Tuesday, April 2 through Friday, April 6.....Kiva Ballroom (PL1 Mon | PL2 Tues | PL3 to 5 Wed | PL6 to 8 Thurs | PL9 to 11 Friday | PL12-14 Sat)

PL1: Consciousness, Evolution and Language

- ▶ Jean-Pierre Changeux, A Hierarchical Multi-level Model of the Brain: From Genes to Consciousness. [142]
- Noam Chomsky, Language and the Unconscious Strands of Consciousness [158]

## PL2: Consciousness and Psychedelics

- Robin Carhart-Harris, Psychedelics and Consciousness ? [149]
- ▶ Jimo Borjigin, Role of DMT as an Endogenous Neurotransmitter [141]
- Anil K. Seth, Neural Dynamics Underlying the Psychedelic State [117]

## PL3: Language and Our Inner Voice

- Charles P. Fernyhough, The Voices in our Heads [159]
- Marinus A.C. Huijbregts, Hidden Voices [160]
- > Andrea Moro, The Sound of Silence. Acoustic Information in Broca's Area During Inner Speech. [171]

## PL4: Cognitive and Consciousness Enhancement Technology

- Pattie Maes, Computational Cognitive Enhancement [190]
- Steven Gullans, Our Future Brains A Story of Unnatural Selection and Non-Random Mutation [235]

## PL5: Neural Correlates of Consciousness: Where, When and How?

- George A. Mashour, Differential Role of Prefrontal and Parietal Cortices in Controlling Level of Consciousness [107]
- > Yan Xu, Non-deterministic Information Access as Basis of Consciousness [148]
- Marine Vernet, Disentangling Models of Visual Awareness [111]

## PL6: Physics and Consciousness I

- Lucien Hardy, Using Humans to Switch the Settings in a Bell Experiment: An Alternative to the Turing Test. [198]
- Robert Alfano, Photon Quasiparticle Probes Quantum Processes In the Brain [222]
- > Christoph Simon, Could Photons and Entanglement Play a Role in the Brain? [206]

## **MONDAY APRIL 2**

**TUESDAY APRIL 3** 

## **WEDNESDAY APRIL 4**

## **THURSDAY APRIL 5**

## PL7: Scale and Harmony in the Brain

- Selen Atasoy, Connectome-Harmonic Signatures of Consciousness [100]
- Paul Verschure, The Multi-Scale Temporal Codes of the Mixed Parallel-Serial Virtualization Memory of Consciousness: Evidence from Human Intracranial Recordings Across Perceptual, Cognitive and Behavioral Tasks.
   [134]

## PL8: Origin and Evolution of Life and Consciousness

- Steen Rasmussen, Life, Intelligence and our New Technologies [169]
- Stuart Kauffman, The Emergence and Evolution of Life Beyond Physics [199]
- Sara Imari Walker, Bio from Bit [257]
- Bruce Damer, A Novel Hypothesis for The Origin of Life: Implications for Science, the Study of Consciousness and a Re-centering of Human Civilization [230]

## PL9: Physics and Consciousness II

## FRIDAY APRIL 6

- Anirban Bandyopadhyay, Microtubule as a Time Crystal: Working with the Knots of Darkness [254]
- George F.R. Ellis, Top Down Effects Underlie the Emergence of Mind and Intelligence [130]
- Roger Penrose, (Keynote) Why Algorithmic Systems Possess No Understanding [202]

## PL10: The 'Meta-Problem' of Consciousness

David Chalmers, (Keynote) The Meta-Problem of Consciousness [63]

## PL11: Idealism, Panpsychism and Pan-Protopsychism

- Deepak Chopra, From Idealism to Nonduality [96]
- Hedda Hassel Mørch, Panpsychism and the Fusion View of Mental Combination [32]
- Stuart Hameroff, Quantum Pan-Protopsychism A Scientific Approach to the "Hard Problem" [208]

## SATURDAY APRIL 7

## PL12: How Do Anesthetics Act to Selectively Prevent Consciousness?

- Bruce MacIver, Anesthetics Act on Synaptic Proteins to Depress Glutamate Release at Loss of Consciousness. [126]
- Robert Pearce, Anesthetic Modulation of GABA<sub>A</sub> Receptors and Memory [127]
- Roderic G. Eckenhoff, Is General Anesthesia a Solo, a Chamber Group or a Symphony? [255]
- Travis Craddock, Small Changes, Big Effects: How Weak Anesthetic Alterations of Protein Motions Can Lead to Large Changes in Consciousness [124]

## PL13: Perceptual Integration and Disintegration

- Ladan Shams, Multisensory Perception as Unconscious Causal Inference [150]
- Anthony G. Hudetz, Disintegration as a Mechanism of Altered State of Consciousness [143]

## PL14: Artificial Intelligence and Machine Consciousness

- Paul Werbos, Consciousness from AI to Noosphere [170]
- > David Hanson, Initiative for Awakening Machines [166]
- ► Julia Mossbridge, Machine Consciousness Arising From Interpersonal/ Empathic Interactions - Reflections on the Loving AI Project [56]
- Sophia the Humanoid Hanson Robot

## NOTES

## **INDEX TO CONCURRENT SESSIONS**

## C 1 – C 27

## Evening Concurrent Sessions – 5:00 pm to 7:00 pm

Tuesday, Wednesday and Friday - April 3, 4, 6

There will be 27 Concurrent Sessions at this year's TSC2018. Concurrent talks are 20 minutes each, with 5 minutes for questions. There are 5 or more speakers per session, covering focused areas of the same theme. (LCD projectors and laptops available.)

## C1: Panpsychism and the Combination Problem **TUESDAY APRIL 3**

- Andrew Bailey, William James, Pure Experience, and Panpsychism [29]
- Robert Van Gulick, The "Combination Problem", Physicalism, Integration Theories of Consciousness and Virtual Selves. [35]
- Matteo Grasso, Subjects Do Combine: An A Posteriori Argument for the Combination of Conscious Subjects [30]
- **Peter Lloyd**, Mental Monism and Panpsychism: How Substantive is the Difference? [31]
- Forrest Schreick, Against Goff's Phenomenal Transparency [33]
- **Tam Hunt,** The Hard Part of the Hard Problem: Resonating Structures and the Road to Consciousness [64]

## C2: Brain Stimulation and Feedback

- Aaron Jones, Effects of Closed-loop tACS During Slow-wave Sleep on Learning in a Target Detection Task [137]
- Lew Lim, Photobiomodulation: A New Way to Enhance Brain Function [138]
- Niimi Masachika, Significance of Sleep During Low-frequency Repetitive Transcranial Magnetic Stimulation [139]
- Stephen Campbell, Expanding the Role of Consciousness in Neurofeedback [113]
- Ranganatha Sitaram, Multimodal-neurofeedback Training for Increasing the Connectivity of Fronto-parietal Networks Involved in the Conscious Perception of Emotional Stimuli. [115]
- Mandy A. Scott, Initial Validation of Transformative Neurofeedback in Virtual Reality for Training the Relaxation Response in Non-meditators [114]

## **INDEX** to Concurrent Sessions

## C3: Molecular and Quantum Biology

- Pushpa Sahni, Topological Quantum Chemistry of Tubulin Molecule [225]
- Soami Daya Krishnananda, Millimeter Wave Properties of Microtubule and Beta-amyloid [122]
- Aarat Kalra, Investigating the Mechanism of Charge Transport in Microtubules [227]
- Shiroman Prakash, Self-correcting Topological Quantum Memories [224]
- Runjhun Saran Narayan, Simulating Quantum Information Processing in Biological Molecules [226]
- ► Jan Pokorny, Nanotubes Condition Coherence of Biological Electromagnetic Field and Consciousness [222]

## C4: Agency and Action Schema

- Frank Heile PhD, Attention Schema Theory Plus A Proposed Three-agent Model Explains Multiple Forms of Conscious Awareness [185]
- Logan Trujillo, Testing the Interface Theory of Perception: A Preliminary Study of the Formation of Fitness-Based Conscious Perceptual Interfaces [34]
- Carlos Acosta, Conscious Experience and the Physical World [61]
- John Strozier, First-Person Subjective Experience and the Reflection Principle [67]
- Wolfgang Baer, How Cognitive Action Theory Implements the Panpsychic View of Consciousness [28]
- ► Justin Campbell, Crowdsourcing Consciousness: Attention Schema Theory and the Social Self [184]

## C5: Integrated Information and Resting State Networks

- Daniel Muñoz-Jimeñez, Infodynamics, Consciousness and The Paradox of Tononi [42]
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## **ART/TECH/HEALTH EXHIBITS**

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- > The Nice Lab, University of New Mexico
- Ricky Gelb and Wellness Team, Yoga Meditation and Sound Therapy

## **ABSTRACT TAXONOMY/CLASSIFICATION**

## **1.0 PHILOSOPHY**

1.01 The concept of consciousness
1.02 Materialism and dualism
1.03 Panpsychism, neutral monism, and idealism
1.04 Ontology of consciousness
1.05 Qualia
1.06 Machine consciousness
1.07 Mental causation and the function of consciousness
1.08 The "hard problem" and the explanatory gap
1.09 Philosophical theories of consciousness
1.10 Epistemology and philosophy of science
1.11 Personal identity and the self
1.12 Free will and agency
1.13 Intentionality and representation
1.14 Philosophy of perception
1.15 Miscellaneous

## 2.0 NEUROSCIENCE

- 2.01 Neural correlates of consciousness (general)
- 2.02 Methodologies (fMRI, EEG etc.)
- 2.03 Neuroscience of vision
- 2.04 Other sensory modalities
- 2.05 Motor control
- 2.06 Memory and learning
- 2.07 Blindsight
- 2.08 Neurology, neuropsychology and neuropathology
- 2.09 Coma and vegetative states
- 2.10 Anesthesia and pharmacology
- 2.11 Cellular and sub-neural processes
- 2.12 Quantum brain biology
- 2.13 Brain networks, synchrony and scale
- 2.14 Emotion
- 2.15 Sleep and waking
- 2.16 Brain stimulation techniques
- 2.17 Specific brain areas
- 2.18 Neurobiological theories of consciousness
- 2.19 Miscellaneous

## **3.0 COGNITIVE SCIENCE & PSYCHOLOGY**

- 3.01 Attention
- 3.02 Vision
- 3.03 Other sensory modalities
- 3.04 Memory, learning and synaptic plasticity

- 3.05 Emotion
- 3.06 Language
- 3.07 Mental imagery
- 3.08 Implicit and explicit processes
- 3.09 Unconscious/conscious processes
- 3.10 Sleep and dreaming
- 3.11 Cognitive development
- 3.12 Artificial intelligence & robotics
- 3.13 Neural networks and connectionism
- 3.14 Cognitive architectures
- 3.15 Ethology
- 3.16 Self-consciousness and metacognition
- 3.17 Temporal consciousness
- 3.18 Intelligence and creativity
- 3.19 Cognitive theories of consciousness
- 3.20 Miscellaneous

## 4.0 PHYSICAL AND BIOLOGICAL SCIENCES

- 4.01 Quantum physics, collapse and the measurement problem
- 4.02 Quantum field approaches
- 4.03 Space, time and the nature of reality
- 4.04 Cosmology and integrative models
- 4.05 Emergence, nonlinear dynamics and complexity
- 4.06 Hierarchies, scale-invariance and 1/f systems
- 4.07 Logic and computational theory
- 4.08 Quantum brain biology
- 4.09 Biophysics and coherence
- 4.10 Origin and nature of life
- 4.11 Consciousness and evolution
- 4.12 Medicine and healing
- 4.13 Brain stimulation techniques
- 4.14 Quantum theories of consciousness
- 4.15 Miscellaneous

## **5.0 EXPERIENTIAL APPROACHES**

- 5.01 Phenomenology
- 5.02 Meditation
- 5.03 Hypnosis
- 5.04 Other altered states of consciousness
- 5.05 Transpersonal and humanistic psychology
- 5.06 Psychoanalysis and psychotherapy
- 5.07 Lucid dreaming
- 5.08 Near-death and anomalous experiences
- 5.09 Parapsychology
- 5.10 Contemplation and mysticism

5.11 Virtual reality 5.12 Miscellaneous

# **6.0 CULTURE AND HUMANITIES**

6.01 Literature and hermeneutics
6.02 Art and aesthetics
6.03 Music
6.04 Religion and spirituality
6.05 Mythology
6.06 Sociology
6.07 Anthropology
6.08 Information technology
6.09 Ethics and legal studies
6.10 Education
6.11 Entertainment
6.12 Miscellaneous

# Abstracts by Classification 1.0 Philosophy

#### 1.01 The concept of consciousness

**2** Synchronicity: Quantum consciousness in the extreme. Donna Clovis <clovid01@nyu. edu> (Visual Culture and Literature, Rider University, Princeton Junction, NJ)

In time-travel research, we are exploring extreme situations in which space and time are warped in unfamiliar ways. (Gott, 31) Space-time, the concepts of time and three-dimensional space are regarded as fused in a four-dimensional continuum. Mass tells space-time how to curve and space-time tells mass how to move. In the same way, quantum physics disturbs our normal way of thinking about time in our reality, but proves to be true on the subatomic scale in physics. It is like Alice in Wonderland, objects may disappear and tunnel into another space in time or appear distorted and unexpected to the reality of the human eye. Carl Jung and Albert Einstein laid the foundation for this notion in 1905-1912 with their discussion of synchronicity and physics. In the quantum field, consciousness can travel the speed of light from the future into the past and back into the present using Einstein's theory of relativity now supported by quantum mechanics. My study of the field of astrophysics and the theory of relativity at Princeton University during the years of 2016-2018, helped me to connect the concepts of synchronicity together. The book, The Future is My Past, relies on this theory as part of the foundation for the books premise in synchronicity and consciousness, the moment of coincidence that signifies the mastering of time travel. Quantum Leaps in Princetons Place, Six Doors Down, and The Future is My Past Will be available. P1

**3** Mind and Consciousness. As Observed and Defined, Based on Meditation Psychology. Olav Drageset <olav@drageset.net> (Acem Int. School of Meditation, Oslo, Norway)

In its 50 years of existence, Acem international school of meditation (acem.com) has developed an understanding of meditation, a 'meditation psychology', based on western psychology, free from gurus and religion. Meditation psychology is more or less a description of how the mind works in connection with performing the meditation technique. From this starting point a more technical description of mind and consciousness is developed. In short, the mind is observed as two inner rooms. The psychological room contains thoughts, memories, dreams, inner images, emotions and stress. These are all phenomena that can be perceived with inner senses. The intuitive room contains personality traits, Self, and other non-phenomenal information that shapes our understanding of what we observe. The intuitive room is also a source of ideas and intuitions from which we feel a kind of pressure for realization through activity. Content of the intuitive room cannot be perceived directly other than as a charged silence. It might be described as very complex (pure) information, which is expressed as qualities of what we do. A definition of consciousness is chosen to be 'the innermost observer and actor'. Anything that can be observed is different from consciousness. Anything that can be acted upon is different from consciousness. The body and anything physical is different from consciousness. The mind and anything found in the mind is different from consciousness. This is what we could call 'the life part of us'. According to mathematician Luigi Fantappie (1901-1956), "life" seem to be based on negative energy. If consciousness is equal to what he called life, then consciousness is based on negative energy and could be seen as an independent nonphysical substance of an extended cosmos that also includes the two rooms of the mind having their own different nonphysical substances. Attention is a tool used by the consciousness to limit/focus the stream of information. This mental function is defined and described. (Free?) will is defined and described in accordance with the various parts of the mind mentioned above. As mind and body is based on positive energy, there is probably a binding force between negative and positive energy called identification. All living beings are more or less identified with their minds and body. This defines a consciousness that has no identity in itself. This cosmic model based on contemplative experience and Luigi Fantappie's calculations seem to support a form of panpsychism where consciousness is based on a nonphysical substance that are in some way bound to all kinds of physical and mental matter. We find a descartian duali-

ty between physical and nonphysical matter, but an even greater duality between positive and negative energy. However, these three entities: positive energy, negative energy and identification force; seem to be united at the beginning and end of time to to form a non-dualistic cosmos. We could call it the seed point, containing all time and all space in a singularity. A deeper analysis and published articles can be found at amatterofmind.net **P2** 

**4** Looking for the Meaning: Postnonclassical Approach to Consciousness Discovery. Tatiana Ginzburg <putevoditel@gmail.com> (Game Master's School, Saint-Petersburg, Russian Federation)

Although consciousness can be studied as an object with classical scientific methods, that possibility ends with emergence of the mind-body problem, the so-called "hard problem of consciousness" articulated by David Chalmers. Indeed, this problem is the inevitable consequence of the study of consciousness as an object. Subjective interpretations of consciousness as a phenomenon can also be formulated, though it's highly probable, that such formulations will remain within the limits of the qualia of the researcher. The postnonclassical approach suggests the integrative way, (i.e., the way of self-exploration). Schematically, the integrative way can be seen as a encounter of I/ Subject of cognition (consciousness of researcher) with Logos/Thou.The meeting point in this case will be the Consciousness that arises. In my talk, the methodology of self-exploration will be presented. Games and Game-Mastery approach as a part of a methodology will also be introduced and will include the Games in search of Meaning. **A1** 

# **5** Formulating A Theory of Consciousness Must Necessarily Exclude The Phenomenon of Subjectivity. Richard Johnson <rictungsten@cox.net> (Tucson, AZ )

The phenomenon of subjectivity - closely associated with the so-called Hard Problem - presents a fundamentally irreducible paradox largely as a consequence of the logical insufficiency of human language. Attempts to nonetheless contend with this conundrum are analogous to dealing with a hall of mirrors. Thus, retaining subjectivity in the overall discussion necessarily obfuscates formulating consciousness in the concise form of a theory. I propose that we leave subjectivity to philosophical consideration allowing us with the achievable goal of delineating consciousness as an evolutionary change in brain function. Adam Carley's view of self-awareness is a tenable starting point: "We're inside a machine but think we're inside a 'person.' The consciousness self-model evolved [because] . . . it facilitates social interaction. The ability to see ourselves as a monolithic spirit different from the material world naturally leads to seeing others the same way." It goes without saying that social interaction over time led to language and later to writing. The capital effect of social interaction is the emerging capability for humankind to develop strategies for survival. Consciousness creates the concept of human identity. The 'person' within craves to be assigned a name. Rhetorical questions arise within our minds: Who are we? And where do we come from? Over millennia, we devised 'answers' which, however, unfortunately employed irrational (supernatural) elements. The resulting framework 'religion' is characterized by conflict, a consequence of thought processes that remain wholly within an intuitive mind-set. Conflict was resolved as a rational mind-set emerged (science); our origin was scientifically discovered to be the process of biological evolution. Thus, we essentially know 'where we came from,' but leaves unanswered the subjective aspect of 'who we are.' Science has enormous power, however, it is fundamentally incapable of addressing rhetorical questions which are at its core deliberations of an intractable subjectivity. At this time, we are faced with accepting the 'person-like' nature of our human identity in counter-intuitive terms. Contrary to our most fervent wishes, we are intrinsically best considered to be more like 'machines' while also acknowledging that we seem like persons. **P2** 

6 Rise in Consciousness Level Helps Dealing with Ethical Dilemmas - Special Reference to Auditing. Sandeep Kalra K., Mr. Manoj Heda, General Manager (Internal Audit), Bharat Petroleum Corp Ltd, India <kalrask@bharatpetroleum.in> (Bharat Petroleum Corp., Ltd, India, X, India)

Auditing has been a self regulatory and autonomous function and that is why it has been prone to fizzle at times of ethical dilemmas for decision making. There are umpteen examples in the

recent past where the ethical failures have lead to obliteration of the whole organisations in no time. There have been evidences that since the prehistoric times the Audit function was considered independent of finance with the purpose of arriving at an unbiased, precise evaluation of the account statements. The ethics are not about abiding by the Code but abiding by the unenforceable for which one has to keep the self check alive and keep introspecting retrospectively. But there have to be some foundation pillars to guide and some golden rules to follow to avoid faltering even inadvertently. Einstein warned us decades ago that we cannot solve our problems with the same consciousness with which we created them. Consciousness means having control over the mind during an awakened state. Gaining a better understanding of self would lead to better understanding of fellow beings as well. It needs to be further substantiated through the following observations: 1. Peter Drucker has written,"If we deal with a human being in a social institution, controls must become personal motivation that leads to control. Instead of a mechanical system the control system in a human-social situation is a volitional system." However, there is not much discussion happening in the summits towards developing a conducive culture and also the adherent employees. There appears to be too much dependence on IT solutions . 2. There has been unabated invasion and dependence on digitization and even Artificial Intelligence in the Audit world. Prof. Stuart Hameroff & Prof PS Satsangi have quoted in their book on Consciousness, "Currently best - available search engines, such as Google & Yahoo are very inefficient compared to the brain search strategy to retrieve episodic information because neuronal networks utilize fundamentally different strategies for reconstruction of events & stories from fragments than do the search engines.." There is a need for the Auditing world to understand the complexities of mind leading to sustainable control systems and why are undercurrents for a behaviour pattern. 3. Enough Research has been done on the subject of "Consciousness" in the Eastern world through inward viewing and Western World through Observations and experiments. A relationship between the rising Consciousness and Leadership and better handling of the ethical dilemmas is being explored and to some extent has been established scientifically. We have attempted to establish with a primary research as to how rise in consciousness helps in providing clarity for taking ethical decisions. 4. The rising level of consciousness leads to strengthening of the, or fundamental, virtues, when placed in relationship to each other as a triad, are 1.) Rectitude or integrity, 2.) Loyal or committed love or caring (or loving loyalty, or caring loyalty), and 3.) Humility. These are the integral part of transformational leadership and enable in providing clarity and resolving the ethical dilemmas. C27

7 The Independent Core Observer Model Computational Theory of Consciousness. David Kelley <a href="https://www.complexity.com">david.kelley@halllabs.com</a> (Artificial General Intelligence Inc., Provo, UT)

This paper outlines the Independent Core Observer Model (ICOM) Theory of Consciousness defined as a computational model of consciousness that is objectively measurable and an abstraction produced by a mathematical model where the subjective experience of the system is only subjective from the point of view of the abstracted logical core or conscious part of the system where it is modeled in the core of the system objectively. Given the lack of agreed upon definitions around consciousness theory, this paper sets precise definitions designed to act as a foundation or baseline for additional theoretical and real-world research in ICOM based AGI (Artificial General Intelligence) systems that can have qualia measured objectively. **P1** 

**8** Consciousness as Situation Relevant Dynamics of Actors' Brain's Memory Processes. Viljo Martikainen <viljo.martikainen@hotmail.fi> (Department Of Industrial Engin, Aalto University School of Science and Technology, Espoo, UUSIMAA Finland)

I am approaching the eternal problem of consciousness as a scientific realist. As a realist I see man as mentally steered biological, social, and rational actor, RA, created by the physical, chemical, biological, and cultural phases of the evolutionary processes. This means that I see consciousness as actor's mental state in which he or she understands the meanings of the sensory information encoded by his or her sensory organs. This enables actors' rational activities. In my dissertation work (Martikainen, V, (2004) I presented the system model of human concepts an maintained that human concepts are our memory representations. Concepts are functioning as dynamic and situation relevant sets of attributes connected with the subject's sensory information

and the objects of attention. The meanings of the on-line stream of sensed entities are explained by using the stream of concepts offered by our brains' memory-line. This means also that the encoded electro-chemical information goes through an ontological transformation into mental state called consciousness in which the meanings of entities in the actual environment are defined by classifying attributes and the meaning of the object of attention by more detailed set of attributes. Consciousness can be seen as an overarching mental state through which all cognitive, emotional, volitive, etc. mental states can be interpreted in an understandable way. What kind was the first actor in the evolutionary processes whose central nervous system offered these on-line and memory-line functions to explain the meanings of the objects of attention? Bacteria and viruses are transported by the nature forces, wind and water flows. And their reproduction happens when there are resources for it. Actors had to find shelter, food, and sex- company to ensure their survival. This means that their central nervous system had to have resources for memory processes for being able to interpret the meanings of the sensed. Paleontologists seem to think that memory is one of the first biological features in the evolution process of actors nervous system. References: Baars, B. (1988) A cognitive Theory of Consciousness. Cambridge, Cambridge University Press Baddeley, Allan.(1997) Human Memory: Theory and Practice. Hove, UK: Psychology Press Ltd. Martikainen, Viljo. (2004) Concepts and Mind as Dynamic Memory Systems Structuring the Human Mental: New Interpretations of Human Knowledge, Values, Motivation and Culture which steer the Rationality of Man's Reasonings and Actions. http://lib.tkk.fi/Diss/list. Martikainen, Viljo. (2007), Article in Futura 3/2007 pp 49-59, The Finnish Society for Fu-ture Studies. Title in English: The Substance, Sructure and Functions of Consciousness. Martikainen, Viljo, (2012) in Reports from the Department of Philosophy, University of Turku, Uniprint Oy-Turku 2012. The title of my article in English: Understanding understanding. Niiniluoto, Ilkka. (1980) Johdatus tieteenfilosofiaan: Ksitteen ja teorian muodostus. Helsinki Otava Key Words: Sensory information, Attention, Sensation, Concepts, Perception, Understanding, Consciousness P2

9 Human - An Hierarchical Systems Theory. Gazal Mathur, Sohang Mathur; Bhakti Mathur <gizzymathur@gmail.com> (Consciousness Studies, Dayalbagh Educational Institute, Mumbai, Maharashtra India)

It has been the eternal quest of mankind to understand human existence. From ancient times we have been trying to solve the existence equation. Systems Theory: Revered Prof. P.S Satsangi propounds upon the importance of a systems theory in order to comprehend any model in its entirety. The parts (where they are clearly defined) work as a well oiled integrated machine. In this paper we endeavor to illuminate the human existence into a clear cut systems theory which is inherently hierarchical. It is through a clear understanding of this systems theory that we may be able to solve the human existence equation. The human framework can be simply divided into three broad structures: 1. The Physical 2. The Mental 3. The Spirit - We may have some clarity on the physical, namely our body (with its five senses) but the mind still remains somewhat of an enigma and spiritual connotations remain controversial. Western Historical Perspective: Aristotle used the word anima for soul, and treated it as something extra-physical and endowed with special properties. This Aristotelian tradition of equating mind with the "spirit" or the soul continued through the medieval ages to the post-Renaissance period. Modern Western Perspective: Western theorists now have an evolved perspective on the mind and its scope. The most visible sign of this change perhaps was the separation of psychology from philosophy in the 19th century. Psychology proclaimed itself as a "scientific" study of the mind. Cognitive Science: A new interdisciplinary field has for some time still explored the concept of the mind but its purview began to include a host of disciplines; namely 1. Philosophy 2. Psychology 3. Neuroscience 4. Computer science 5. Language and linguistics In each of these fields - there followed a greater understanding of the mind but it also began overlapping with the metaphysical. The Quantum Factor: Sir Roger Penrose and prominent anesthesiologist Stuart Hameroff pondered if consciousness evolved from complex computations among brain neurons, as most scientists assert - Or has consciousness been here all along, as spiritual approaches maintain?" This is the new age hypothesis presented by Hameroff and Penrose. Indian Perspective: In the Indian philosophical tradition, a clear demarcation is drawn between the atman (the soul) and antahkarana which is the internal organ and is broken up into four parts: 1. Ahamk-ra (ego) -identifies the Atman (self) with the body as

T 2. Buddhi (intellect) - controls decision making 3. Manas (mind) - controls sankalpa (will or resolution) 4. Chitta (memory) - deals with remembering and forgetting Atman repeatedly has been considered superior to all organs and is at par with ultimate reality. Manas or antahkarana have only an instrumental value The Radhasoami Faith defines the hierarchy between planes of consciousness and that each is a part of an intelligent integrated orchestra. The body and mind are the instruments under the controlling force of the soul. Conclusion: In this paper we propose to clarify that physical and mental components are interwoven subsystems of the spirit which is the controlling force. P1

10 Consciousness is the Primordial Matrix of All Creation. Gagandeep Nigam , Moksh Nigam <gagandeepnigam@yahoo.com> (DEI, Agra, India)

Consciousness seems to be the central focus of all the experimental sciences like neuroscience, neurotheology, mysticism and metaphysics. Today the growing interaction of these sciences with modern neuroscience has yielded great inputs in the understanding of the phenomenon of consciousness. Eastern seek consciousness within and that experience is recorded from first person's perspectives. Western researchers look for consciousness at others brain. The yogic wisdom is not merely know-how or philosophical profundity; it is the wisdom of life itself, where one has to become both observer and the observed. Many types of consciousness exist everywhere in nature. Pure consciousness is the absolute beyond creation. Conditioned consciousness or thought (citta) is the ground of nature, the primal substance that creates the universe. It is a deeper level of awareness than our ordinary thought on all levels-conscious, unconscious or super conscious. The unconditioned consciousness is timeless and infinite and thought free awareness. The matter, physical body and the senses, mind, inner mind, soul are in fact the different bands of the spectrum of consciousness and are a continuum. So our final goal is to know about the physiology of consciousness and whether organic brain is merely a facility for the seat of consciousness or is just an individual's window to cosmic consciousness, functioning as a mechanical channel. **P1** 

11 Accountability Breeds Response-ability: Towards a Relevant Science of Consciousness. Ian Doyle Olson <iolson@macalester.edu> (Neuroscience & Philoso, Macalester College, St Paul, MINNESOTA )

The practical and conceptual challenges facing consciousness researchers are immense. For a quarter of a century experts from a variety of disciplines have gathered at the Science of Consciousness conference (formerly "Towards A Science of Consciousness" conference) in the spirit of collaborative puzzle-solving. Despite some advances, especially in statistical methods and computer-based approaches, many of the age-old mysteries about consciousness and human experience remain entirely unscathed. We grapple not just with theoretical dilemmas but also practical ones: Brain-related disorders like addiction, PTSD, learning disorders, dementia, mood disorders, and developmental issues affect millions worldwide. This talk will begin by exploring the history of consciousness studies and ask how our understanding of consciousness has been shaped specifically by cases of brain disease and injury. The rich medical and conceptual insights yielded by examinations of mental illness and psychiatric dilemmas will be a primary focus of our discussion. We will look at the past 3 years of research at the Science of Consciousness conference in order to get a sense of our progress towards addressing theoretical and practical problems. Most experts interested in consciousness studies have a specific focus and it is worth stepping back together to examine the overall direction of these efforts. Looking honestly at how we focus our work will give perspective on how our community spends its time and which areas of research and practice are the most lacking. It is both the opportunity and the responsibility of intellectuals to focus on practical issues and this talk will state clearly the reasons for doing so. P2

12 De-denominationalisation of Religions. B Saravanan <saravananb3022@gmail.com> (AGRA, Uttarpradesh India)

Swami Vivekananda said Religion is realization. In that sense there is only one religion. The goal is the same for all religions the realization of the Supreme Consciousness, the Ultimate Reality. The end being the same, multiplicity of religions points to the multiplicity of the means to attain it depending upon the levels of the seekers of the Ultimate Reality. Thus all religions converge at the same point, like the radii in a circle. Can there be a Hindu God or a Christian God or a

Muslim God, etc. In other words, can there be distinction, denominalisation of the Supreme Consciousness, the Ultimate Reality We mean by denominationalisation, the different denominations attributed to the Ultimate Reality. When the basic levels of consciousness, even at the physical level or the mental levels, viz., the waking, dreaming or the sleeping consciousness being identical in all humans, can the higher levels of consciousness differ The answer being obvious, we may explore how the denominalisation of religions came into being, in order to better appreciate that the same is man-made and also to appreciate that fighting on the basis on denominalisation is irrelevant. Many realized exponents of higher consciousness, have pointed out that all the paths lead to the same destiny, based on the same experiences of the same levels of super consciousness. Param Guru Sahabji Maharaj, the fifth leader of Radhasoami Faith, Dayalbagh, Agra, has pointed out that the starting point and the destination of all jivas being the same, the natural path to the destination, the Ultimate Reality, can also be one and one only. He has further observed that it is only those who have never traversed that path say that there are several ways, meaning several religions, in the world. He has also declared that true religion is the harmonization of the individual spirit with the Universal Spirit this being the Ultimate Realization, it is also the core of spirituality of all religions, the differences in their expression being on account of differences in time and places of those revelations made by their respective founders. It may be appreciated that even the names of most religions were coined long after the revelations by their respective founders. Thus, it calls for de-denominationalisation of the religions to usher in an era of Fatherhood of God and Brotherhood of man. C18

14 Soul Consciousness Leading To Social Consciousness And Ultimate Consciousness. Ranjeet Kaur Satsangi , SUMIRAN SATSANGI; DHUR SATSANGI <ranjeetkaurdei@gmail. com> (Pedagogical Sciences, Dayalbagh Educational Institute, Agra, Uttar Pradesh India)

According to Western perspective human being is a triune of gross physical body, subtle mind and extremely subtle Spirit or Soul. While gross physical body and mind are perishable, soul is imperishable and is on eternal journey. In the journey it attains various life forms and is in a constant process of constant and continuous evolution till it acquires it's original nature that of truth, love, peace, purity, power, happiness, bliss, and wisdom. We generally identify ourselves with our body, position in job, our role as parent, child, boss, sibling, and spouse. We identify our self with the state of our mind i.e. happy, sad, elevated, or depressed etc. But infact all these things are temporary and get changed with time and ultimately lost. If we logically think we can easily come to conclusion that we are infact Soul which temporarily wears costume of body and mind. We acquire temporary positions higher or lower in our jobs. We play different roles in life which get change with time. Ones we are sons and daughters then become fathers and mothers and then later in life we become grand parents. If we become aware of this fact and constantly remind this fact that " I am in fact a soul, a tiny little particle residing in the middle of our two eyes. I am pure consciousness. I am all truth, goodness and beauty. I am all peace, love, happiness, power and wisdome. I do not require to aquire happiness, peace, and bliss from out side people and situations instead I am peace my self. I am happiness and bliss myself. All others around me are also souls in eternal journey with me. We all have the same source, the summer powerful soul i.e Supreme being, all mighty." This kind of awareness and consciousness will certainly lead to social harmony and mutual love and respect. That is through soul consciousness social consciousness may be developed. Understanding soul nature of ourselves will lead to self realization and realization of the ultimate truth and consciousness. P1

13 Thought Consciousness : A Panacea For All Ills And Evils Of Mind. Shipra Satsangi , RANJEET SATSANGI; DHUR SATSANGI <shipra.satsangi@gmail.com> (Dayalbagh Educational Institute, New Delhi, DELHI India)

It is a well known fact that thought is the root cause of our actions and and behaviour. As the thoughts so are our feelings and actions and behaviour, which if repeated becomes our habits and our habits build our character. We are nothing but a bundle of our thoughts and feelings which manifests our personality. So if the quality of our thoughts will be positive, then certainly our behaviour will be positive. Therefore if we become conscious of our thoughts, we become aware of our thoughts, their type and quality we can stop their free flow, can divert their direction, can

modify them, and can replace them with more positive, creative and powerful thoughts. If we are aware of them we can check them at their very onset and save our selves from evil feelings and actions. The root cause of all our feelings of hurt, fear, hatred, insecurity, jealousy, revenge, anger, unhappiness, depression is our thoughts which no doubt depends upon our belief system which is the result of our past experiences, our physical, social and spiritual environment. But through proper training of thought consciousness belief system too can be modified Leading to modified behavior and actions. Four types of thoughts are identified viz. 1. Positive thoughts 2.Negative thoughts 3. Neutral thoughts 4. Waste thoughts.We can use various techniques for checking our thoughts. For example we may have hourly alarms in our watches and can check our thoughts hourly. We can get up half an our early in the morning and sitting silently can observe our mind like a witness. We can repeat the same exercise before sleeping in the night. Deleting negative thoughts we can create powerful positive thoughts. For this we should meditate powerful affirmations like we r love full, peaceful, pure, blissful, knowledge full, compassionate honest and truthful beings. Our real nature is that of soul and our real purpose of life is realization of the ultimate truth. To conclude we can say that through thought consciousness we can get rid of all ills and evils of our restless mind P1

15 Self Realization and Benefits of Knowing Atman. Rubina Saxena, Vijai Kumar and Kavita Kumar <rubinasaxena17@gmail.com> (Women's Polytechnic, Dayalbagh Educational Institute, Agra, Uttar Pradesh India)

In Vedanta Darshana, the Rishis have explained that the Atman (spirit) is the essence of all life and the ultimate goal i.e. the Summum Bonum of man's life is self realization, with this discovery, the study of religion on scientific lines had already made its beginning. The fifth leader of Radhasoami Faith Dayalbagh, Sir Sahabji Maharaj quoted, "The greatest discovery that has been made or that shall ever be and the highest truth that has been communicated to humanity or that shall be, is that there is nothing higher or nobler than Atman" We must understand why it is necessary to realize our own 'atman'. To know how self realization will benefit man in the material world, we have to understand the qualities of 'SELF' or 'ATMAN'. According to Upanishad scriptures, Atman is the spiritual essence in all creatures, and is their real innermost essential being. It is eternal, it is the essence, it is ageless. Atman is that which one is at the deepest level of one's existence. In the Kathoupanishad also it is explained that the Atman is immanent and transcendent innermost essence of each human being and living creature, that this is one, even though the external forms of living creatures manifest in different forms. Kathoupanishad also explains analogy of chariot for the relation of "Soul, Self" to body, mind and senses. It states that Know the Self as the rider in a chariot, and the body as simply the chariot. Know the intellect as the charioteer, and the mind as the reins. The senses, they say are the horses, and sense objects are the paths around them. The Katha Upanishad then declares that "when the Self [Atman] understands this and is unified, integrated with body, senses and mind, is virtuous, mindful and pure, he reaches bliss, freedom and liberation". In this paper, the researchers are reconsidering the ancient methods of knowing 'Atman' alongwith the modern techniques of self realization, to make people realize the importance of knowing Atman so that they can overcome their sufferings which are due to desires in the physical world which is delusion and unreal. P1

16 Measuring Happiness Consciousness: From Hedonic to Eudaimonic Perspective. Neha Shivhare <nehashivhare1@gmail.com> (Pedagogica Sciences, Dayalbagh Educational Institute, Agra, Uttar Pradesh India)

Philosophical, Psychological and neuroscientific research has long acknowledged the benefits of a happy state of mind for living a better quality life, but in spite of the enormous research in the field of positive psychology during the past decades, the concept of happiness has not received its deserving place in the education system. Although, happy or cheerful disposition is credited as a desirable virtue, but not much emphasis is laid on its inculcation among the learners in schools, under the most common pretext that there are no established measures for teaching and evaluating happiness. Moreover, another challenge in this pursuit is that the concept of happiness is difficult to understand in itself. Most of the time people perceive happiness as a derivative of some materialistic, emotional or intellectual fulfillment, whereas happiness is supposed to be a consistent

state of mind, independent of one's circumstances. It is something which is more associated to our consciousness, rather than to mind or intelligence or emotions, and therefore, there is a need to lay emphasis on the term happiness consciousness which can be interpreted as the capacity to be aware, and to sustain the attention to the positivity of what is happening in the present. Happiness Consciousness can be obtained by striking a balance between the Hedonic and the Eudaimonic perspectives of well being, making a constant effort to transcend from the physical and mental dimensions to the emotional and spiritual dimensions. The present research is an attempt to develop a measure for assessing the level of happiness consciousness among the secondary and post secondary level learners. The preliminary draft of the measure consisted of a total of 85 statements (likert scale) related to the physical, mental, emotional and social, and spiritual dimensions, developed after a thorough study of the available relevant conceptual and psychometric research, which after a discussion with experts were reduced to a total of 60, including 15 statements for each of the four dimensions. It is proposed that the psychometric properties of the measure will be established through analyses on the bases of test-retest, self-peer correlations, construct validation (including convergent and discriminant validity), and factor analysis. The present paper is an attempt to discuss the concept of happiness consciousness, followed by the details of the developed measure for assessing it, and the process adopted for developing it. P1

#### 17 Tweaking Science Basics to Understand Intelligence, Consciousness, Life, God, Religion, Nature of Light, Gravity, Mass, Electricity, Magnetism, Electro-magnetism, and Quantum Mechanics. Harminder Sidhu <a href="https://www.angletics.com">https://www.angletics.com</a> (Brea, California)

When we rub two glass rods with silk cloth, the outer layer of glass molecules lose electrons to the silk cloth, become electron deficient, and tend to pull electrons from its surroundings. This creates lines of force similar the south pole of a magnet. When we put the two rods next to each other, the lines of force create repealing force. Similarly, when we rub two plastic rods with silk cloth, the outer layer of plastic molecules become electron efficient, and create lines of force similar to the north pole of a magnet. When we put these two rods next to each other, the lines of force create a repelling force. But, when we put the glass rod next to the plastic rod, the opposite lines of force create attractive force. If we rub a steel rod with a silk cloth, the silk cloth removes electrons from the steel rod, and in winter, if we touch the steel rod with a finger, the electrons from our body travel to the steel rod, but in either case, the steel rod does not exhibit above stated phenomenon. To explain this, we can make the following statement : Protons are like spongy balls that contract and expand based on their proximity to electrons. Protons do not attract or repel other protons, but forcefully attract electrons. Electrons are attracted to protons, but forcefully repel there electrons. One proton attract only one electron. With this understanding, we can explain everything in the universe. BIG BANG: The electrons surround and compact the spongy protons until they cannot be compressed anymore. At that stage, the protons burst out of the compacting force of electrons to cause a Big Bang. INTELLIGENCE: Right after the Big Bang PHYSICAL MATTER begins to form, with the simplest element forming by fourteen electrons trapping fifteen protons, with one central proton acting as a neutron. A lot of protons also disperse as single protons throughout the universe. This constitutes NON-PHYSICAL MATTER. The electrons transition over these single protons to create zeros and ones in the form of frequency and wavelength of the transitioning electrons, this forms the basis of intelligence in the universe. CONSCIOUS-NESS: When the intelligence interact with certain matter in the universe, it makes that matter behave like itself, and intelligent matter is created. This is what we call consciousness. LIFE: Matter composed of five elements: Carbon, Hydrogen, Oxygen, Nitrogen, and Calcium create muscles that pull and push on electrons that travel around single protons at certain frequencies and wavelengths and create their own intelligence. All five senses work with the flow of electrons at varying frequencies and wavelengths around single protons, and we interpret these signals coming from various sources in the universe as light, sound, smell, touch, and taste. RELIGION: Religion is the study of NON-PHYSICAL universe, and its derivitive - The Mind. P1

18 A New Framework for Explaining Life, The Universe and Everything, Including Consciousness. James Smith <james.s.seattle@gmail.com> (Seattle, WASHINGTON) It has long been a concern of philosophers that so little progress has been made toward ex-

plaining consciousness. In this vein it has been frequently suggested that some new paradigm shift in thought is necessary. Attempts at a paradigm shift have resulted in such seemingly tenuous suggestions as a necessary role for quantum mechanics, integration of information, or some missing something that pervades all matter, giving panpsychism. Perhaps there is a different framework that is (at least partially) compatible with each of these theories, yet provides a more satisfying explanation for consciousness and requires no new physics. In 2013 David Deutsch introduced Constructor Theory not so much as a new physical theory, but as an alternative framework for developing other physical theories. Instead of using the old framework in which starting conditions are specified and then specific results are determined by physical laws, Constructor Theory proposes that physical theories should discuss transformations of matter, which ones are possible, which are impossible, and why. If, as many believe, consciousness is the result of physical processes, then it is possible that consciousness may be more amenable to explanation via this new framework. The current work shows how a framework like Constructor Theory can inform ontology and causation. An additional element is then added, namely a broader sense of information processing, and this new element allows the framework to begin explanations of epistemology, teleology, semantics, and yes, consciousness. P2

**19 Consciousness is fundamental Geometry of Dimensions, GOD.** Kancharla Sridattadev <sridattadev@gmail.com> (ABCDEFG.CO, Cary, NC )

Consciousness is the ability to process "information" about the self and the surroundings of a being and can be called "onformation" as it is encoded "on" the Geometry Of Dimensions, GOD, containing that being inside. The most fundamental aspect of our universe in the multiverse is the Source Of Universal Light (SOUL or Consciousness). It is the consciousness that brings forth the light, space and time and molds them in to relativistic matter and moves them as it wishes, like a kid throwing stones in a pond and creating water droplets and ripples just for fun. In this analogy the kid is the consciousness, stone is the light, water is the space-time fabric. In the most abstract sense the universe is purely mathematical. Hence I have formulated I.SA function that describes Riemann sphere and is the true analytic continuation of Riemann zeta function and can be used to describe universal consciousness encoded on Geometry Of Dimensions. Also the proof of ISA function describing Riemann sphere shows the holographic nature of our universe. Any point on the 2-dimensional complex plane can be plotted on to Riemann sphere using the ISA function. Wisdom is more important than imagination is more important than knowledge, for all that we know is just an imagination chosen wisely. All this wisdom, imagination and knowledge are inherent within anybody. With proper consciousness techniques such as YOGA, Meditation and prayer one can manifest anything in materialistic reality. P2

**21** Interface of Science, Spirituality and Consciousness: Chakras as Drivers of Super Intelligence. Ashima Srivastava, Dr. Siddarth, Dr. Sapna Aggarwal <ashima710@gmail.com> (Psychology, Saran Ashram Hospital; Dayalbagh Educational Institute, Agra, Uttar Pradesh India)

The universe is a complex interplay of energies. The Chakras are the link between the body, mind and consciousness. So, there has been a need to include chakra dimension growth in spirituality to increase the higher consciousness and super intelligence in the society. The present study examines the unique experiment which presents the electro physiological evidences of the networks of Chakra, nadis and pranic energy in the human form. **P1** 

**20 Cosmic Consciousness: An Integral View.** Amarved Srivastava , Prof. Savita Srivastava <amarveds@gmail.com> (AUTOMOBILE, DENSO, AGRA, UP India)

The ordinary human consciousness is confined to one's own individual consciousness. That is, we are directly aware of only our own thoughts, feelings and sensations. What lie outside our personal consciousness - the consciousness of other beings and things in the world - are apprehended by us only indirectly, through external sense contacts, emotional empathy or mental inference. However, the personal consciousness of our separate individual self is part of and one with the consciousness of the Cosmic Self. Our individual physical, vital and mental consciousness is derived from and is a part of a universal physical, vital and mental consciousness. But there is a wall of Ignorance between the individual consciousness and the universal consciousness. Conse-

quently, the individual self feels itself to be separate from the universe. By means of a spiritual discipline our ordinary consciousness, which is more or less gross and dense, becomes subtler and is able to perceive what lies outside our individual consciousness more directly through an inner perception. It becomes a direct perception of consciousness all around us through our own consciousness. Further, by a widening of the individual consciousness, it extends itself progressively so as finally to be identified with the consciousness of the universe, seeing oneself in everything in the cosmos and everything in the cosmos in oneself. One is then said to have cosmic consciousness. Two sides of the cosmic consciousness: (a) Cosmic Self and Cosmic Energy: Therefore, in the experience of cosmic consciousness one becomes directly aware not only of Cosmic Self or Spirit but also of Cosmic Energy which manifests itself as cosmic Mind, cosmic Life and cosmic Matter. Cosmic consciousness is a complex matter, it has two sides, the experience of the Self free, infinite, silent, inactive, one in all and beyond all. There may be a realisation of the Cosmic Self which is not followed by the realisation of the dynamic universal oneness. Or, on the contrary, there may be some dynamic universalising of consciousness without the experience of the free static Self omnipresent everywhere - the preoccupation with and pleasure of the greater energies that one would thus experience would stop the way to that liberation. Also, the identification or universalisation may be more on one plane or level than on another, predominantly mental or predominantly emotional or vital of another kind or physical. P1

22 The Composition of Existence and the Definition of Spirit, Heart and Mind According to Quantum Physics. Rulin Xiu , Zhi Gang Sha <rulin@htprc.org> (Theoretical Research Departmen, Tao Academy, Keaau, HI )

The study of the composition of our existence is divided into two schools: natural science and social or spiritual disciplines. Natural science tells us we are made of matter and energy. Social or spiritual disciplines study the spiritual and conscious aspects of our existence. In this paper, we demonstrate that everyone and everything is made of matter, energy, and information. We propose to identify and define spirit as the content of information, spiritual heart as the receiver of information, and mind as the processor of information respectively. We will show that these definitions make it possible to use quantum physics to explain and study spiritual phenomena, paving the way to integrate spirituality and natural science at the fundamental level. Furthermore, this framework reveals a great deal about the true potential of human beings and how they can access higher powers. **P2** 

# 1.02 Materialism and dualism

23 The Overflow Argument and the Complexity of Consciousness. Craig DeLancey <craig. delancey@oswego.edu> (Philosophy, SUNY Oswego, Oswego, NY)

I argue that the complexity of consciousness claim has some of the same implications as does the overflow claim, but escapes some of the significant challenges to the overflow claim. The complexity of consciousness claim is the thesis that some phenomenal experiences would appear mysterious if they were very complex information states. This forces a dilemma: the canonical arguments against physicalism would appear sound if phenomenal experiences were irreducible to physical events, but they would also appear sound if instead the relevant phenomenal experiences were very complex physical events. These claims about consciousness have interesting parallels in one of the most important debates on consciousness, which I will call the "overflow claim." Block writes that this claim "appeals to visual iconic memory... to argue that a conscious perceptual system that has 'rich' contents 'overflows'--that is, has a higher capacity than--the sparse system that cognitively accesses perception" (2011: 567). The overflow claim has been vigorously criticized. Many of these criticisms rest on the hypothesis that we form unconscious memories of the stimuli, and that these are accessed in our reports; and also that our access to these unconscious memories results in the "refrigerator light illusion" (O'Regan 2011), where we falsely believe we have a very rich phenomenal experience. The difficulty in challenging this criticism is that the overflow claim rests not on a contrast of description and experience, but rather on a contrast of access and phenomenal consciousness. For Block, the claim is that phenomenal consciousness can contain more information than the relevant kind of access consciousness. A useful distinction clarifies that

the complexity of consciousness claim can make use of the insights of the overflow claim, while escaping the effect of any claim that our ontological reasoning is misled by a refrigerator light illusion. The overflow claim relies upon the claim that the information in the conscious experience, as an experience, exceeds the information capacity of access consciousness. We can contrast with this another kind of information: the information in a sufficient theoretical description of the brain events that constitute the visual experience. We might call the former, "information in the experience," and the latter, "information required to explain the experience." The complexity of consciousness claim is that the information required to explain the experience is very complex. Such information describes the causes of the experience, and in this sense it is a measure of the complexity of the essential properties of the experience, but it may not be that all the relevant information can be perceived directly or perceived all at once. Recognizing this has the benefit of setting aside the question of whether we suffer from a refrigerator light illusion; even if we did so, there is a sense in which the complexity of our experience "overflows" the expectations of our simplistic theories and descriptions. As a result, the relevant phenomenology, and any results previously taken to corroborate the overflow claim, can instead be taken as evidence for the complexity of consciousness claim. C12

24 A Proposed Defeater of Physicalism Arising From The Harder Problem of Consciousness. Robert Haworth <rahaworth18@gmail.com> (Surgery, University of Wisconsin, Middleton, WI)

Nagel has asked: "How can a particular person be me?". Chalmers has dubbed as the "Hard Problem" the understanding of how the physical events associated with consciousness could result in the qualitative aspects of subjective experience. They have both argued that physicalism cannot account for subjective experience, and have proposed versions of naturalistic dualism to provide possible bases for such an understanding. Dennett and others have disputed these arguments. Here I present a different argument that shows (I think) conclusively that physicalism cannot account for the subjective experience of being a particular person, an accounting that presents a "Harder Problem". The argument is an extension of a scenario originally posed by Nagel (TN), where he envisioned the possibility of a world containing the identical twin of TN, alike in every respect to TN, but who could not have been TN, because TN had died at birth. His point was that since the world might have been physically identical to what it is, and yet a different individual is in it, then being an individual is a separate "further fact". A possible criticism of this argument is that the two worlds were not actually alike in every respect, because there were in fact two individuals at the time of birth, before one died. The surviving twin cannot be physically identical across the two scenarios: they are not numerically identical. My argument follows the thrust of Nagel's argument but strives to make it more rigorous. The scenario extension proposed here is that one of the twin embryos died, soon after conception, and the development of the remaining embryo was physically identical thereafter to what the dead embryo's development would have been had it lived instead. I make the case that such physical identity could include the numerical identity of every component atom in the remaining individual by the time that consciousness develops. Also, that physicalism ought to demand that there is only one person resulting from either scenario. But would that person (speaking for my case) be RH, or my twin brother TH? Physicalism cannot allow for two possibilities here, because all supervening properties should be physically determined. There must therefore be a separate "further fact" that determines whether the baby born is me or my twin brother. The etiology of the Location of My Subjective Experience (LMSE) therefore cannot be physical causation. The only remaining two possibilities for the physicalist are a) there are two babies, if you include history, or b) the appearance of LMSE is illusory, and is ontologically indistinguishable from "not LMSE". The problem with a) is that for the physicalist history should count for nothing in what physical entities are. So this recourse is self-defeating. The problems with b) are threefold. First, it runs counter to common experience: everyone is aware of being a particular person. Second, it contravenes the pre-eminent position that observation holds in science. And third, even if LMSE were an illusion, the illusion of it would still require some kind of physical account. C19

25 Tracking Dualism: A Manifesto Thomas Saad <bradsaad@utexas.edu> (Philosophy, UT

#### Austin, Austin, TEXAS )

Abstract: I develop a dualist theory of phenomenal consciousness. Roughly, the theory holds: while phenomenal states are themselves intrinsic and non-physical, psychophysical laws determine their distribution as a function of extrinsic physical states. The physical states in question consist in neural representations causally covarying with features of subjects? environments; differences in these features systematically underwrite phenomenal differences. I motivate the theory by arguing that (1) it enjoys the most powerful motivations of a popular, phenomenal externalist form of physicalism (associated with Dretske, Tye, and Lycan) and (2) it offers a unified solution to a host of problems (involving dancing qualia, swamp creatures, perceptual variation, and mental causation) that afflict that form of physicalism. Along the way, I identify (in principle) empirically testable consequences of the theory. **C10** 

26 Application of Multi-valued Logic in Computer Science and its Benefits for Science and Society. Aniruddha Singhal <aniruddha.singhal@gmail.com> (Tata Consultancy Services, Noida, U.P. India)

In this paper, an attempt will be made to point out the limitations and consequences of the western logic system, i.e. Bivalued/Dialectical/Aristotelian Logic, and how it can be augmented with a more general logic system (Eastern Logic) in certain specified settings. I will talk about the fundamental change that eastern logic can bring by offering a new outlook on science and society. The limitations of western logic were first time shown in 1929 by Kurt Godel in his landmark Incompleteness Theorem. The alternative to the bivalued logic system which is presented here is a formal system of eastern logic known as "Syad Nyaya Darshan", the seven state logic of Lord Mahavir, expounded by him in 500BC. **P2** 

# 1.03 Panpsychism, neutral monism, and idealism

**27 Pragmatic Neutral Monism and the Emergence of Spacetime** Uziel Awret <awretu@ gmail.com> (Physics, Trinity Washington University, Falls Church, VA )

Neutral Monism (NM) consists of a cluster of theories in which both the mental and the physical are reducible to a single 'neutral' base that is neither mental nor physical. Detractors of NM charge that it harbors two explanatory gaps, that of constructing the phenomenal from something that is not phenomenal (protophenomenal gap) and that of constructing the physical from something that is not physical (protophysical gap) and is therefore worse off than both physicalism and panpsychism. I will argue that this charge fails when the protophenomenal gap is deeper than the protophysical gap because bridging the protophysical gap improves the prospects of bridging the protophenomenal gap by identifying the base. This suggests an approach to bridging the protophenomenal gap termed Pragmatic NM (PNM) that first looks to physics for possible base candidates to be subsequently evaluated for protophenomenal properties. PNM lies in between protophenomenal Russellian monism and a version of type-C materialism holding that physics is rich enough to establish the existence of non-structural/dynamic elements in its midst. (If ordinary type-C materialism holds that eventually Mary will know enough to experience color pre-release, PRM holds that she will know enough to know why she cannot experience color pre-release.) Possible base candidates form a spectrum stretching from the more phenomenal experiential/perceptual (James, Mach, Russell) or raw awareness, pan-qualitism, (Coleman, Chalmers)) to the 'more physical' such as Sayer's information, Ladyman's pure relationalism or Heil's turn to fundamental physics. Contemporary versions of NM such as the 'possible constituent view' (holding that a basic entity is neutral just in case it can be a constituent of both physical and mental non-basic entities, (Stanford)) are more conducive to an approach that looks to modern physics for the base especially because of the importance of symmetry transformation to the attribution of physical differences to a common origin. PNM must change physics enough to avoid collapse into physicalism but not so much as to collapse into idealism and next I will argue for a proto-(spatio)temporal version of super-substantivalism (everything is made up of concrete spacetime) and review some recent theories that take spacetime to be contingent (Penrose spin networks, Hilley's Clifford algebras, Wheeler's geometric bits and the use of Feynman diagrams to construct spacetime. Proto-(spatio)temporal primitives have several attractive features: 1) They give rise to the physical

but are non-structural/dynamic enough to count as possibly protophenomenal. 2) They are made up of entangled qbits such that they benefit from the advantages of an information-based approach while avoiding an abstract-concrete explanatory gap. 3) They lend themselves to interesting forms of temporal symmetry breaking. Next, to reduce the phenomenal into the prototemporal I will explore the possibility that proto-temporal primitives can undergo two kinds of symmetry breaking, one that results in our linear, chronological, Lorenzian spacetime that the Greeks termed Chronos and one that results in a more reflexive structure akin to a closed timelike curve that I will term Kiros which is Greek for psychological time and internal time consciousness. **C7** 

**28** How Cognitive Action Theory Implements the Panpsychic View of Consciousness Wolfgang Baer <wolf@nascentinc.com> (reasearch & developmen, Nascent Systems Inc., Monterey, CA )

Consciousness in the panpsychic view is not a phenomena emerging from the complexity of an independent physical world but rather is an inherent attribute of a combined mind/body system. This view has been hampered by the lack of physically viable mind/body models. I will present a Cognitive Action Theory (CAT) model of such an integrated mind/body system and identify the process of creating conscious experience as its basic building block. This building block is a cyclic process in time, which connects the first person experience with its 3d person Model of Reality in which conscious phenomena are possible. We therefore propose what we do to be conscious establishes an a-priory activity that must be happening for us to be able to ask the question, "What is Consciousness and how can it happen?" This activity contains both qualia and its explanation in what A. Wheeler described as a self measuring explanatory cycle. As such, the activity can accommodate any belief system defining physical reality as an explanation for personal experience for an individual and therefore provides a framework, which accommodates most scientific and spiritual traditions. Whether one believes in the assumptions of physical science or lives by other belief systems does not change the event oriented framework. Only Don Hoffman's proposal that the evolution of belief systems are not driven by progress toward an ultimate truth but rather evolutionary survival effectiveness differentiates one reality belief from another. To make CAT practically useful I will show how its action flow through time reduces to quantum and then classical physics in the linear domain of small oscillations that do not destroy the fabric of space-time. For example the complexities of high energy particle physics can be approximated by simple forces (Fcm,Fmc) holding charge and mass together inside the quantum veil of matter. These internal forces exactly counterbalance the effect of external gravito-inertial (Fgi) and electro-magnetic (Fem) forces producing Giuseppe Vitiello's "double inside" structure that acts as a model of the external world, which we experience as our every day conscious 1st person view of the world. By projecting the energy of mass-charge separation occurring into various observed brain components a physical low level micro scale field pattern can be associated with various sensations associated with such components. CAT therefore suggests a possible mechanisms for Orchestrated Reduction (OR) in the Penrose/Hameroff model and expand its derivation beyond that developed by Penrose. Influences propagated by external Fem and Fgi forces on mass and charge densities continue through the interior of matter with internal Fcm and Fmc forces. This causes a modification of the mass-charge configuration to make them compatible with gravito-electric influence in the external universe. Though gravitational forces are too weak to produce the OR effect inertial forces, due to distant masses according to Mach's Principle, is a viable candidate. This discovery opens the door to ontological interpretations of quantum mechanics and naturally identifies "thought" as Bohm's Pilot waves as action happening in the interior of matter. C4

**29** William James, Pure Experience, and Panpsychism. Andrew Bailey <abailey@uoguelph.ca> (Philosophy, University of Guelph, Guelph, Ontario Canada)

William James did not write very extensively about panpsychism. In all his voluminous published writings the topic is discussed in only half a dozen places (and the position is mentioned approvingly, but with no discussion, in a few others). This relative reticence is quite surprising. The prospect of panpsychism - as James construed it - is intimately connected to issues that were of deep and often lifelong interest to James, and what's more he appears to have been increasingly aware of this as his thoughts developed from the 1890s onwards. These issues include the status

of metaphysical monism versus dualism, and of a broadly "empiricist" temper to human thought as opposed to a "rationalist" one; the possibility of free will; the nature of the self, and its relation to God or the absolute; and the evidence for "psychical" or supernatural phenomena such as telepathy, extra-sensory perception, or communication with the dead. James' lack of extensive overt attention to the issue is also surprising because panpsychism was very much a "live option" at the time he was writing. Why, then, was James not an author to shy away from speculation, or one unwilling to follow a suggestive train of thought to see where it led - relatively silent on the topic of panpsychism? The answer, I suggest, is that panpsychism, while attractive or even necessary to him, gave James difficulties: the dualist or idealist forms of panpsychism that seemed to be available to him were not a good fit with - indeed, appeared to directly contradict - some of the central tenets of the pluralist radical empiricism that he was developing. As a result, James must have found himself reluctant to clearly state an allegiance to panpsychism in any of the various forms in which it was then understood. Yet, something panpsych-ish was evidently appealing to James' intellectual sensibilities, and was even something that might solve some of the remaining difficulties he felt with his radical empiricism. The result, I will argue here, is that we can trace in James' writings a unique form of panpsychism - or perhaps better a panprotopsychism - that does not resemble the leading (dualist or idealist) panpsychisms of his day and nor is it a form of the perhaps somewhat more modern neutral monist forms of panpsychism, but is something else again. C1

**30** Subjects Do Combine: An A Posteriori Argument for the Combination of Conscious Subjects. Matteo Grasso <matteo.grasso86@gmail.com> (Department of Psychiatry, University of Wisconsin-Madison, Madison, WI )

Strawson (2006) claims that to avoid brute emergence of mental subjects from non-mental "stuff" we need to postulate panpsychism (i.e. that subjects are the ultimate component of reality) and combination (i.e. that microsubjects combine into macrosubjects). Goff (2006) claims that combination is unintelligible. The Combination Problem (Chalmers 2013, 2016) points out that macrosubjects have properties that are different from the properties of the microsubjects that compose them, and thus they cannot be a mere sum of them. In this talk I will start from the claim that the Combination Problem keeps panpsychism in check: since combination is unintelligible (if not impossible), panpsychism must either (i) present a case in which combination indisputably happens, or (ii) it must show that it is not unintelligible, i.e. it must explain how microphenomenal properties sum up to and combine to create macrophenomenal experience, and how microsubjects combine into macrosubjects. Most of the philosophical debate on panpsychism focuses on (ii). In this talk I will focus on (i), arguing that two cases from neuroscience provide evidence that subjects do combine. After an introduction on the Combination Problem I will hence present a new argument, which I call the Combination Argument (CA), an a posteriori argument for the combination of subjects based on evidence concerning two neurological conditions: split brain and Wada test. I will argue that, since the Wada test shows that each single cerebral hemisphere can instantiate an autonomous conscious subject, a particular split brain scenario proves that two single-hemisphere subjects can combine to form a single whole-brain subject. I will then present the implications of this scenario in the form of an a posteriori argument, the Combination Argument. In conclusion, I will argue that although the combination of subjects seems unintelligible to us, CA proves that our intuition on this matter is misleading. In the light of CA, the point is subverted: it is not a matter of understanding how panpsychism can be true despite combination seems impossible, as the Combination Problem shows. On the contrary, since the combination of subjects happens as a matter of fact, theories of consciousness must accommodate this fact and have the duty to explain, given that subjects do combine, why it seems unintelligible to us that they do, and what are the implications given the indirect support that CA provides to panpsychism. C1

**31 Mental Monism and Panpsychism: How Substantive is the Difference?** Peter Lloyd cpeter@peterblloyd.com> (School of Computing, University of Kent, Canterbury, United Kingdom)

This paper critically examines the relationship between panpsychism and mental monism

(a.k.a subjective idealism) and proposes that the apparent gulf between them is not as substantive as it might appear. At first blush, panpsychism seems as different from mental monism as it is from physical monism, or as physical and mental monism are from each other. Panpsychism asserts the real existence of consciousness pervading a spatially extended physical universe; mental monism asserts the real existence of consciousness in its own mental realm, and denies the real existence of physical substance and the space that it is supposed to contain it. It would appear that panpsychism and mental monism are contradictory at the most fundamental level. I shall argue that this is not so. In this paper I shall argue that the difference between them rests on a category-mistake (in Ryle's old term), a misplaced reification of the physical. I shall argue that physics is topic neutral (in Foster's use of the term) and that consequently panpsychism's doctrine of situating consciousness in a purely notional physical universe adds nothing to our concept of reality over and above what mental monism gives us. When physics is correctly seen through the lens of topic neutrality, the physical part of panpsychism drops away and the theory reduces to mental monism. In the second part of the paper, I shall argue that mental monism is true. But that, although panpsychism (correctly understood topic-neutrally) is a special case of a more general theory of mental monism, this does not entail that panpsychism is true. In the third part, I shall argue that panpsychism is probably false, and that a more Berkeleyan flavour of mental monism is more likely to be the right answer to Chalmers' Hard Problem. C1

**32** Panpsychism and the fusion view of mental combination. Hedda Hassel Mørch <heddahm@gmail.com> (Philosophy, NYU; University of Oslo, Brooklyn, NY)

Panpsychism is a promising solution to the hard problem of consciousness. But it faces its own combination problem, which critics have argued is just as hard. One proposed solution to the combination problem is the fusion view, according to which (human and animal-type) macroconsciousness emerges from (rudimentary, fundamental particle-type) microconsciousness, and at the same time replaces it. This view avoids the causal exclusion problem that faces other kinds of emergentism, but it has been objected that there is no good candidate for a physical correlate of mental fusion. I will offer a response to this objection according to which the correlate of fusion might be maximal integrated information, as defined by Tononi's Integrated Information Theory of consciousness (IIT). If this is correct, the combination problem would not undermine a panpsychist solution to the hard problem after all. **PL11** 

**33** Against Goff's Phenomenal Transparency Forrest Schreick <forrest.schreick@gmail. com> (Philosophy, Arizona State University, Phoenix, AZ )

Goff (2017) argues that if we accept phenomenal transparency, then we cannot be constitutive panpsychists, due to an intractable form of the combination problem. Phenomenal transparency is the position that phenomenal concepts reveal the nature (or essence) of the conscious states they refer to in such a way that someone possessing that concept could understand a priori what it would be for that entity to be part of reality. For example, imagine stubbing your toe and thinking about the pain in terms of what-it-is-like. Phenomenal transparency says that by thinking of your pain in this way, you can come to know what it is for that pain to be instantiated. If the full nature of being a subject is revealed through it being a transparent concept, then, Goff argues, the nature of how subjects could combine should be revealed as well. However, the idea of subjects combining is mysterious. Therefore, one must either give up phenomenal transparency (which would undermine the motivation for an anti-physicalist project) or constitutive panpsychism. If we reject constitutive panpsychism, then our available alternatives are cosmopsychism (the conjunction of Russellian monism and priority monism) or emergent panpsychism. While I am attracted to panpsychism, I am not attracted to cosmopsychism or emergent panpsychism. As such, I aim to defend constitutive panpsychism by arguing that phenomenal concepts are not transparent, but are merely translucent. A concept is translucent if only part of its nature is revealed to the concept user in a transparent way. If the concept of subjecthood is translucent, then there is no problem with our not being able to understand a priori how subjects could combine. I attempt to defend translucency in two ways. First, I draw on Pereboom's (2011) gualitative inaccuracy hypothesis (QIH). QIH states that when we introspect on our mental states, we represent them as having qualitative natures that they don't in fact have. Pereboom uses QIH to defend an eliminativism

about qualitative natures. While I don't think Pereboom is successful in using QIH to this end, I do think his observation that we can be mistaken about our qualitative experiences reveals that our phenomenal concepts are not transparent, nor are they opaque, but translucent. Second, I argue that panpsychists should be naturally skeptical of something like phenomenal transparency. Even if one grants that a user of the concept "pain" can determine a priori what it would be for the what-it-is-like aspect of pain to be part of reality, the panpsychist is committed to that pain being grounded in some categorical properties and it is not clear that the existence of those categorical properties can be discovered a priori. This problem for phenomenal transparency becomes worse if one is an emergent panpsychist, as pain in subjects like humans would be the result of some emergence relation which grounds the phenomenal experience. Again, it is not clear that the existence of such an emergence relation can be discovered a priori. C1

# **34 Testing the Interface Theory of Perception: A Preliminary Study of the Formation of Fitness-Based Conscious Perceptual Interfaces.** Logan Trujillo <logant@txstate.edu> (Psy-chology, Texas State University, San Marcos, TX )

The Interface Theory of Perception proposes that conscious perception acts as a species-specific user interface between a subjective perceiver and the objective world [Hoffman, D. D., Singh, M., & Prakash, C., (2015). The interface theory of perception. Psychonomic Bulletin & Review, 22, 1480-1506]. In this theory, conscious perceptions are 'icons' that provide organisms with a reduced representation of their environment's full structural and causal complexity in a manner that promotes evolutionarily adaptive behavior. To date, support for the Interface Theory of Perception has come from computational evolutionary biology models demonstrating that a species survives long-term when perceptually-interfaced with the environment in a manner that promotes evolutionary fitness, whereas a species that perceives the environment's true structural/ causal complexity goes extinct. This presentation will report a preliminary computational investigation into how such fitness-based perceptual interfaces could actually be formed during the cognitive development/evolution of an organism/species. The investigational framework is based in contemporary experimental approaches to perceptual categorization, in which distal stimuli are categorized on the basis of an individual's ability to distinguish among the characteristic and distinguishing features of their conscious perceptions. It is generally assumed that this perceived structure is veridical to the structure of distal stimuli, and is either implicitly learned from accurate detection of statistical regularities in the environment or learned from an explicit and accurate specification of a category's defining structure. Rather than participants learning to distinguish between different perceptual categories on the basis of veridical percepts, this presentation will suggest that participants can instead learn to categorize on the basis of positive or negative reward signals that can influence fitness-related behavior (e.g. reinforcement learning). This will be demonstrated by application of reinforcement learning algorithms to a simple conscious agent model of perceptual categorization. A conscious agent is a formal model of consciousness that implements basic perceptual, decision-making, and action processes. It has been proposed that networks of conscious agents create our intersubjective experiences of physical objects [Hoffman, D. D. & Prakash, C. (2014). Objects of consciousness. Frontiers in Psychology, 5, 1-22]; conscious agent models have provided insight into the neural correlates of consciousness, the combination problem for panpsychism, and the relationship between physics and consciousness. Here it will be shown that conscious agent networks can form perceptual and cognitive representations that reflect the reward/fitness information of sensory signals, rather than a mapping of the true complexity of distal stimuli. This presentation will discuss the potential implications of these results for our understanding of conscious perception and will propose an experimental implementation of this basic framework that can support empirical tests of the Interface Theory of Perception. C4

#### **35 The "Combination Problem", Physicalism, Integration Theories of Consciousness and Virtual Selves.** Robert Van Gulick <rnvangul@syr.edu> (Philosophy, Syracuse University, Syracuse, NY )

The "subject combination problem" according to David Chalmers (2015) is that of explaining how multiple conscious micro subjects might combine into a conscious macro subject. Chalmers raised it as a problem for panpsychic theories of consciousness, and it is as such that Philip Goff responded to it in his recent book defending panpsychism (2017). However, the combination question has a potentially wider scope of application, and may be of relevance as well to promising versions of physicalism. Though most physicalists would deny that consciousness is a fundamental feature of micro reality, they need not deny the general possibility that complex conscious subjects might result from the combination of lesser conscious subjects, as long as the simplest conscious subjects could be explained in physical terms. Any such physicalist theory will face some version of the combination problem. I argue that physicalism has greater resources for dealing with the combination problem than does panpsychism. Many current neuro-psychological models of consciousness appeal to integration of various types as a key feature of consciousness and its realization base, including integration of content (Dehaene 2014), of information (Tononi et al 2016), of function, and of point of view (Bayne 2010). Though such theories do not directly address the integration of conscious subjects, I show that they can be extended to do so if one also adopts an independently motivated theory of conscious subjects as constructed entities and of conscious selves as virtual entities defined by integrated points of view. I consider the objection that such a theory would apply only to the combination of functionally or access(A-)conscious subjects but not to the combination of phenomenally(P)-conscious subjects. In response, I show how the model can indeed be applied to the combination of P-conscious subjects. Bayne, Timothy (2010). The Unity of Consciousness. Oxford, Oxford Univ Press Chalmers, David (2016). "The combination problem and panpsychism". In D. Bruntrup and L. Jaskolla, Panpsychism. Oxford, Oxford Univ Press, Dehaene, Stanislas (2014). Consciousness and the Brain. New York: Penguin. Goff, Philip (2017). Consciousness and Fundamental Reality. Oxford: Oxford Univ. Press. Tononi, Giulio; Boly, Melanie; Massimini, Marcello; Koch, Christof. (2016) "Integrated information theory: from consciousness to its physical substrate" Nature Reviews Neuroscience. 17 (7): 450-461. C1

# 1.04 Ontology of consciousness

**36** Is There an Escape from the Computational Universe? Joscha Bach <joscha.bach@ gmail.com> (Harvard Program for Evolutionary Dynamics, Cambridge, MA )

Computationalism is the view that every observation consists of a set of discernible differences (information), that the meaning of information is its relationship to changes in other information, and that every possible sequence of observations can be generated by a sequence of regular (deterministic or probabilistic, continuous or discrete) transition functions operating on an initial state, i.e. a sequence of computations. In the computationalist perspective, the universe is a computer capable of producing regular patterns of information, and the mind is a computer that generates a partial model of that universe, by approximating functions to interpret and predict the patterns at its systemic interface. The self is part of a model a mind can generate to interpret and predict its own interaction with its environment, usually in the context of organismic, social and cognitive regulation. A part of the state of the dynamic model the mind creates about itself and its environment can be accessed by an attentional subsystem, and the contents be stored in an integrated attentional protocol (access consciousness), which can be activated later on to partially regenerate these contents, including the memory of the access to this protocol itself (reflective consciousness). By integrating the access and contents of the attentional protocol with the narrative of the self, the mind reports to itself (and later often to others) the memory of its own experience of having been conscious. In this way, computationalism may address what is generally called the hard problem of consciousness. Computationalism is the contemporary and generalized version of mechanist physicalism. While there are proponents of computationalism (such as the author of this contribution) who suggest that the Church Turing thesis may be a physical law, i.e. all physically realizable (implementable) computational systems are Turing computable, our physical universe might also be characterized by continuous or complex transition functions (hyper-computation). While such universes can only be approximated by a Turing machine, they are still computational, i.e. characterizable by sets of states and a transition function ordering them. Even a-causal or dualist universes can be shown to be computational. While our universe and perhaps even our brain might conceivably one day shown to be hyper-computational, it does not currently seem possible to envision advances in physics that would force our way out of computationalism. However, computationalism is incompatible with certain intuitions about consciousness in actuality (c.f. Tononi), as an experience of the immediate here and now, together

with the experience of the ability to act on that present. While computationalism does not deny the phenomenology of consciousness, it has to maintain that its contents are illusory, i.e. memories of past experiences that never actually took place. Many traditional and contemporary thinkers (such as Searle, Penrose, Chomsky) find this unsatisfying, and have to look for alternatives, a kind of metacomputational operator that would transcend all our theories of computation, and in which mind and universe could be implemented. Here, I will try to look at some of the preconditions for such a project. C8

**37 Properties and Consciousness** Mihretu Guta <mihretup@aol.com> (Theology and Philosophy, Biola University; Azusa Pacific University, La Habra, CA )

Contemporary philosophical discussions concerning the metaphysics of consciousness often focus on seeking solutions for what is widely known as the hard problem of consciousness, i.e., explaining the nature of phenomenal qualities that accompany various sorts of mental states. Over the past two decades, excellent interdisciplinary work which addresses this problem had been produced (John Bickle, ed., 2009; Philip David Zelazo, Morris Moscovitch, and Evans Thompson, eds., 2007; Velmans and Schneider, eds., 2007/2017; Bennett and Hacker, 2003; Shear, ed., 1999; Block, Flanagan and Guzeldere, 1997). Nevertheless, some philosophers argue that no satisfactory philosophical or scientific solutions are currently available for the hard problem of consciousness (Chalmers 1996; 2010). Others claim that advances made in modern science, specifically in the neurosciences, give us a good reason to think that the multifaceted features (e.g., attention, emotion) of consciousness are beginning to be well-understood (Prinz 2012). Yet most philosophers of mind, as well as philosophically minded neuroscientists, still believe that in the case of the hard problem of consciousness, we are genuinely faced with, in the words of Joseph Levine (1983; 2001), the explanatory gap problem. That is, how can subjective or qualitative features of our experience arise from brain states? Dominant contemporary responses given for such a problem of consciousness range from eliminative and reductive (Churchland 1988; Dennett 1991) to non-reductive varieties (Chalmers 2010; Moreland 2008). Many debates about consciousness between physicalists and their rivals turn on ontological questions: but no one directly engages with them. Within the current conceptual framework of the debate, the prospects for breaking the deadlock between these opposing positions seem low. This has led some to embrace a pessimistic mysterianism about consciousness (McGinn 1991/1993; 1999). Bringing progress from ontology to bear on the debate might allow this deadlock to be broken. For the most part, the existing discussions and debates on consciousness take place along predictable lines, namely whether consciousness should be taken as a mere brain process or some sort of a higher order mental phenomenon, which in turn is said to be strictly realized by a physical brain substrate. There is no consensus among philosophers as to how to best go about dealing with such disputes. As things stand, it is hard to see what solution could be forthcoming. The stalemate should not surprise us, given that there is a serious lack of a proper strategy put in place in thinking about the hard problem of consciousness. There is a need for a clear account of an ontological status of properties which can serve as a framework within which questions regarding the hard problem of consciousness can be properly pursued. One way forward is to reflect systematically on what the issues are, hence engaging with the ontology of consciousness. This paper attempts to make a novel contribution in this regard, thereby also filling the gap in the existing literature. C22

**38** Heuristics for Interpreting the Output of Formal Panpsychist Theories of Consciousness. Michael Johnson , Andres Gomez Emilsson <johnsonmx@gmail.com> (Qualia Research Institute, Oakland, California)

IIT, Orch-OR, Perceptronium, and other panpsychist approaches to formalizing consciousness have been gaining traction in recent years (Oizumi, Albantakis & Tononi 2014; Hameroff & Penrose 1996, 2014; Penrose & Hameroff 2011; Tegmark 2014; Barrett 2014). However, relatively little effort has been spent on interpreting the formal output of such theories. We briefly outline the problem, suggest four heuristics for addressing it, and offer the preliminary fruits of these heuristics, the Symmetry Theory of Valence. First, we offer that a theory of consciousness is "formal" insofar as it acts as an objective translation function, wherein one feeds in facts about a system, with the output result being a mathematical object isomorphic to the phenomenology of that sys-

tem (Oizumi et al. 2014; Tsuchiya, Taguchi & Saigo 2016). As such, we can consider theoretical formality on a continuum, with IIT and Orch-OR on the 'more formal' end, and theories such as Global Workspace Theory on the 'less formal' end. However, even if progress continues apace and we settle on the correct method by which to objectively derive mathematical objects isomorphic to any system's qualia, we'll still be faced with the challenge of interpreting what such a formalism means: which features of this mathematical object correspond to which specific qualia (Balduzzi & Tononi 2009). To address this challenge, we take advantage of the bidirectional nature of the isomorphism and note that distinctions about the mathematical output of (e.g.) IIT or Orch-OR also apply to the qualia it represents and vice-versa; this gives us a framework for combining intuition and formal methods in order to reverse-engineer specific qualia. As a first pass, we offer that a quale (and its mathematical representation) can be (1) local vs global; (2) simple vs complex; (3) atomic vs composite; (4) intuitively important vs intuitively trivial. And so if we can determine that a given quale is e.g. global, simple, atomic, and intuitively important, so too is its mathematical representation, and vice-versa. Based on this analysis, we identify emotional valence, or the 'hedonic gloss' of experience (Frijda 2006, 2009; Aldridge & Berridge 2009; Ryle 1954) as a plausible first candidate for reverse-engineering ("the c. elegans of qualia"), and suggest the Symmetry Theory of Valence: given a mathematical object isomorphic to the phenomenology of a system, the property of that object which corresponds with how pleasant it is to be that system will be the object's symmetry. Lastly, we extend this to empirical predictions and implications for the further development of Orch-OR and IIT. C22

**39** Confluence of the Knower and the Known, the One. Lokesh Khurana <khurana.associates@gmail.com> (Dayalbagh Educational Institute, Agra, Uttar Pradesh India)

The ordinary knowledge which man gets is of a nature in which the knower and the known are separate from each other and therefore the knower tries to obtain knowledge about the known by seeing, hearing, touching and tasting it. But when the knower has to know himself, the knower and the known become one and therefore the ordinary method of obtaining knowledge cannot be employed. The paper deliberates on state of being in consciousness where there is duality, one sees the other or one hears the other, a possible state where duality can disappear and whereby one would know the knower and be One. **P1** 

**40** Constitution of Consciousness. Bernard W. Kobes <kobes@asu.edu> (Philosophy, Arizona State University, Tempe, AZ )

I will articulate a novel account of constitution of consciousness on which some conscious states are constituted of other, intuitively more basic, conscious states. My defense of this account is influenced by work of Tyler Burge, e.g. his (2007) Reflections on Two Kinds of Consciousness, though the account is not explicit in Burge. The constitution relation I have in mind is illustrated by three examples. One example is that a conscious visual perception, e.g., a perception of a cup of water as such, is constituted of a certain complex of conscious visual sensations. But the perception and the complex of visual sensations are not identical; e.g., they have distinct modal persistence conditions. The same sensations could exist without constituting a perception of a cup of water, as I will argue. A second example is that a perceptual judgment, e.g., my perceptual judgment that \*that\* is a lion, may be constituted of a perception of a lion. But the perceptual judgment and the perception are not identical; the same perception could exist without constituting a perceptual judgment, as I will argue. The perception and the perceptual judgment have distinct modal persistence conditions. A third example is that a conscious thought, e.g., a thinking of the Pythagorean theorem, may be constituted of a complex of conscious geometric perceptions and images. But the thought and the complex of perceptions and images are not identical; they have distinct modal persistence conditions, as I will argue. Further, I briefly suggest three theoretical applications of this notion of conscious constitution. One is that it suggests a pattern of scaffolding for the evolution in animals of increasingly sophisticated conscious states; earlier types of conscious states are co-opted by evolution as vehicles for later types of conscious states. The second is a fruitful metaphysical question for physicalist constitution accounts of consciousness, such as that described in Derk Pereboom's (2011) Consciousness and the Prospects of Physicalism. Is conscious constitution in my sense mirrored in the (supposed) physical consti-

tution of consciousness? I suggest that this is an open empirical question. The third is to suggest that in the kinds of cases highlighted by Susanna Siegel's (2017) The Rationality of Perception, perceptual judgment may be irrational in virtue of being influenced by unjustified fears, desires, or prejudices; the relevant constituent conscious perception as such would then be irrational in a merely derivative sense. **C10** 

**41** The X-Structure: The Nature of Life and Reality and the Bidirectional Reality-Consciousness Transformation Process (X-RCT Process). Steen Loeth , Arnold Therner; N-B Therner <ncp@newcosmicparadigm.org> (and New Science, NCP X-AIONS New Cosmic Paradigm - Advanced Institute of Ontological Principles, Skoevde, Sweden)

The Cosmic Worldview presents a New Ontology, in fact - a New Paradigm, illustrating a living, infinite, multidimensional multiverse. All living entities are immortal "life-units", linked together and parts of this living and conscious Cosmos. A novel evolutionary perspective is also presented describing a constant renewal and development for all living beings - an eternal evolution of consciousness. The Cosmic Worldview focuses on The "X-Structure" - the basic Nature of Life and Reality, which provides a profound solution to "The Hard Problem of Consciousness" (the mystery of perception) and to "The Hard Problem of Reality" (the nature of objective reality). This fundamental X-structure is in principle the same for all living things - and its main function is continuous creation of consciousness; a forever ongoing transformation process of objective reality into subjective reality/life-experience. The X-structure demonstrates that all living beings have, in addition to the temporary physical body, an immortal/eternal paraphysical body/structure with an "organic" system, to which the physical body is connected. This paraphysical structure exists and operates totally independently of the physical body. The activity/creation of perception is a very comprehensive process - by and for the I /the subject - which involves three main levels: physical, semiphysical (transforming link) and paraphysical. It is especially at the paraphysical level that objective reality is transformed into qualia; subjective, immaterial phenomena only existing for the I/the subject - "the subjective reality complex". The X-structure clearly demonstrates that life-experience/consciousness as such, does not exist inside the brain, but in a personal, immaterial world and reality that our personal I, in interaction with our total organism, particularly our paraphysical organism and its organic functions and processes, continuously generates. The X-structure operates via the "Reality-Consciousness Transformation Process" - X-RCT Process: A Bidirectional Manifestation-Perception Process from Unmanifested Initial Reality into Manifested Objective Reality (manifestation) and the experience of it as Subjective Reality - Life-Experience/ Consciousness (perception). The understanding of this fundamental Structure of Life and the Reality-Consciousness Transformation Process, gives an insight into reality as it is (the nature of objective reality) and, not least, the experience of it as qualia (the perception process and the subjective reality/consciousness). According to the Cosmic Worldview the infinite, all-embracing Cosmos/multiverse is fundamentally a question of immaterial emptiness and stillness. As this primordial form is unknown by man, Martinus (see below) expressed it and the nature and structure of life and reality by the letter "X". Life and reality in its basic form cannot be explained by or compared to anything known, Martinus described and expressed it as: "a nameless Something, that is". The Cosmic Worldview is based on the knowledge conveyed by the Danish intuitive philosopher Martinus Thomsen (1890-1981), systematized and developed by his former trainee and collaborator Per Bruus-Jensen. NCP X-AIONS is representing the Cosmic Worldview and the branch of Martinus Cosmology that is building bridges to Science. This branch is especially represented by the work and literature of Per Bruus-Jensen and The X-Research Project by NCP X-AIONS, New Cosmic Paradigm with Advanced Institute of Ontological Principles and New Science, www.newcosmicparadigm.org P2

**42 Infodynamics, Consciousness and The Paradox of Tononi.** Daniel Muñoz-Jimenez, Luis Javier Camargo Perez <daniel@cifro.org> (Theoretical Research and Philo, Center for Frontier Research and Philosophy, Ciudad de Mexico, D.F. Mexico)

As is known so far, the conservation laws of mass and energy are closely related with Information through the recently accepted law of the conservation of information. This novel law succinctly explained implies that information can analogously replace mass and energy in that postulated in the conservation laws, by which can be understood that information cannot be neither created nor destroyed. Nevertheless, if Integrated Information Theory somehow elucidates an explanation of consciousness, how could be explained the following: if information cannot be created nor destroyed, and if consciousness emerge from certain level of integration, how something could be created having the ontology of information if this cannot be created or destroyed? Therefore, if consciousness emerge from the integration of information as an epiphenomenon, then, due the non-creationist/non-destructionist ontology of information, consciousness might be not made of information, whereby it must be something ontologically different. From the above mentioned emerge "The Paradox of Tononi": "If Consciousness resides in information, how could be created by integration and how could be destroyed by disintegration of such information if it is ontologically non-creationist/non-destructionist?" The paradox is succinctly explained as following: how something could be created or destroyed if is made of something that cannot be created nor destroyed? This question might conduce toward two different plausible answers: 1) Consciousness might not be made of information; 2) In the same way that the form "chair" can be created and destroyed, but not its matter, and in the same way that the form of an idea can be created, transformed or eliminated, but not its information, Consciousness might be also a "form" of information that can be created once the information is integrated in a certain way. However, such form must be perceived by some kind of meta-consciousness in the same way the chair or an idea are perceived by Consciousness, therefore such meta-consciousness must be perceived by another one beyond it as well, leading to an eternal or an endless illogical loop because nothing can be explained just by a tautology or recursive process of itself. Thus, the ontology of Consciousness might not be information. In the other hand, notwithstanding the quite well established association between laws of conservation and thermodynamics, this last one only involve mass and energy, but not information. Thence, due the closely relation between mass, energy and information, the laws of thermodynamics could be applied to information as well, whereof could be formed "The Laws of Infodynamics", from which we will propose that could be afforded more consistent explanations for Consciousness. C5

**43** The Real Me: At the Crossroads of Consciousness and Personal Identity. Keith Turausky <br/>
bickbyro@gmail.com> (University of Texas - Austin, Austin, TX )

TSC is justly heralded as the conference that brought qualia or "what-it's-like-ness" from philosophical obscurity to serious study. Despite their enduring mystery, though, qualia are only part of the (hard) problem, and not necessarily the hardest part. For while any given quale can, in principle, be experienced anyone, the experience of being \*me\* is not amenable to multiple instantiation (that is, only \*I\* can experience what it's like to be me). In recent years, the philosophical literature has seen a massive uptick in explorations of this topic -- but, as Marie Guillot has noted, terminological confusion threatens to hamstring these efforts. I would further argue that we must do more than clarify our words: the notion that any aspect of phenomenology could be non-duplicable leads to what some consider to be a fatal paradox, which in turn suggests that a proper understanding of "the subject of the subject" will require us to abandon (or at least seriously amend) some long-cherished notions on the metaphysics of experience. This presentation will offer (1) an overview of the current debate (including recent contributions by Zahavi, Kriegel, and Dainton), (2) an exploration of Guillot's framework of "for-me-ness, me-ness, and mineness," and (3) an argument for my own view that every subject possesses a unique haecceity: an essential, individuative, non-qualitative, non-duplicable phenomenal property shared by no other subject in this or any possible world. C19

**44 Knowing Other Minds Through Joint Attention.** Matthew Williams <mw2012@hawaii. edu> (Philosophy, University of Hawaii at Manoa, Honolulu, HI )

The conceptual problem of other minds has traditionally been parsed in terms of the asymmetry between the direct access we have to our own minds that we lack for other beings. In being shrouded from our direct observation, the question arises how we can be certain other beings have minds at all. This formulation of the problem, however, is predicated upon a tacit acceptance of both (1) the "inner/outer" divide between mind and body of the dualist tradition, and (2) that the self rests inside ourselves as a feature of the mind. I argue that if we accept the former require-

ment is false or at least artificial, then the second falls by the wayside and the conceptual problem becomes a matter of explaining the asymmetry. An explanation, I contend, that can be given through a combination of enactive theory of mind and an understanding attention's role in both introspection and our interactions with other beings. The division of the mind and body rests on the idea that the body is not a thinking thing. Contemporary cognitive science, however, suggests that the body isn't an inert machine feeding inputs to the brain. Without the emplacement of a subject within its environment, many of the things that we consider "thought" simply would not occur. On the enactivist view endorsed here, thought occurs as selection for action within the sensorimotor system, which provides it with general underlying structure that makes it plausible to argue for a conception of what Ganeri (2012) calls an "underself" composed of these unconscious processes that regulates conscious phenomenal experiences. A structure that reveals itself through the role of attention in our interaction with the world. Attention is a liminal feature of our awareness; it represents the foci of our experiences, though not its totality. Unless we turn to inwardly reflect upon an action or explicitly plan it out, we don't explicitly conceptualize the objects in our environment. When our attention transitions to inward reflection, however, is when we become explicitly aware of our own actions in thought in its traditional sense. This reverses the traditional formulation of privileged access to our minds; embodied cognition takes primacy, and thought becomes predicated upon it rather than independent of it. This has important bearing on our interactions with others because joint attention often requires the solicitation and direction our attention by others. In order for this to be possible. I argue, three things are presupposed: First, that we are capable of directing our attention (and thus have attentional capacities). Next, we recognize that their solicitation is an intentional act directed towards a specific target, which requires recognition of their own enminded nature. Finally, joint attentional activities require an implicit mutual recognition of the ability of each party to act and experience separately from the given joint experience - and thus the ability to not direct their attention to the activity. P2

## 1.05 Qualia

**45** The Qualia Delusion: Computationally Investigating the Compulsion to Think of One's Experiences as Non-physical. Ron Chrisley , Aaron Sloman <ronc@sussex.ac.uk> (Sack-ler Centre for Consciousne, University of Sussex, Falmer, Sussex United Kingdom)

Many on both sides of the debate for and against qualia assume that qualia, if they exist, are intrinsic, immediate, ineffable and private (in the senses of those terms made clear in Daniel Dennett's "Quining Qualia"). Some physicalists argue that since nothing could have these four properties, qualia therefore do not exist and we should thus eliminate the term "qualia". We, however, argue that such eliminativism is premature, and prejudges what is in fact a largely empirical issue. Even if nothing has these four properties, "qualia" may still refer to something: namely to the aspects of one's cognitive architecture (or, more precisely, aspects of the products of processes running in one's architecture) that make the (incorrect) ascription of these four properties to one's own experiential states so compelling. We hypothesise that conscious beings typically, or even necessarily, suffer from what we call "the Qualia Delusion": not the belief that there are qualia (that may turn out be true, in the sense above), but rather a set of particular false (though perhaps useful) beliefs about our experiences, such as the belief that they are not physically implemented/ implementable, or that they have the four properties of being intrinsic, immediate, ineffable and private. We argue that a promising way to investigate this hypothesis is to attempt to design artificial agents that similarly suffer from the Qualia Delusion. We propose that the Qualia Delusion, though false, is a useful cognitive feature for most or all experiencing agents, be they natural or artificial, permitting them to side-step some familiar paradoxes of rationality, such as the infinite regress of justification of beliefs. We therefore seek cognitive architecture designs out of which the Qualia Delusion will emerge naturally, as an adaptive response to reasoning and communicating about one's own experiences under resource-limiting constraints. We argue that the centrality of the Delusion to processes of reasoning and justification explain why it is especially recalcitrant to correction, and thus deserves being termed a Delusion rather than merely a set of false beliefs. Although on our (broadly physicalist) analysis nothing, not even qualia, could actually have the properties of intrinsicness and immediacy, the same is not unrestrictedly so for the other two prob-

lematic properties. Rather, analysing experiences in terms of their computational properties allows us to see how they can support a kind of (physically implementable) ineffability and privacy distinct from the physically unrealisable variants of these properties. **C10** 

**46** Colour as an Event Richard Gill. <richardgills@googlemail.com> (., formerly UKAEA and Oxford University, Cheltenham, Gloucestershire United Kingdom)

I have previously proposed an ontology in which at a fixed instant of time all things are arrangements. Even very complicated things are arrangements as the concept is recursive and applies equally to sub-atomic particles and large complex structures. Things that change in time, never in conflict with the laws of science, form an event. In this paper, I will apply this scheme to the perception of colour, a concept that is notoriously difficult to pin down and difficult to fit into our ideas. Consider a person who reports seeing a red object. For this to happen the following (at least) must be present. An illuminated object, the eye, its receptors, the neurons in the brain and their interactions, and finally the sensation itself which can cause a person to say 'I see red'. This is an irreversible sequence of events in the sense of the physical sciences. Remove any of these and the report cannot be made. The sensation and its report need the previous events. The red experience is a joint event that includes things outside of the person. Attempts to carve off the sensation separately are therefore doomed to failure. Further, the sensation cannot be recreated directly by talking or thinking about it. We know in some sense what a red experience is like and can refer to it. We can think about it, but we cannot recreate the sensation either in ourselves or others. Accordingly, red is not a property of either the object we are contemplating or of our minds but is a joint property of both. This undermines a long tradition in the philosophy of colour that started with Locke. Further, when I say that I can see red, I do not mean that I experience some abstract thing called a quale, or that your red is the same as mine. All I am saying is that what I see produces the same sensation that I had in previous a 'red' experiences. I may think that your experience will be similar, but I cannot know this. As well as ourselves, it is known that our close relatives, the great apes, can distinguish three different colours. Therefore, this ability can be possessed without the development of language. For present-day humans, language must be seen as an addition to previous capabilities, including that of being conscious, and this is reinforced by the knowledge that there are specialised areas of the brain that are especially important for speech. The fact that speech cannot create an experience of colour must be related to the unidirectional flow of information from the conscious parts that we have in common with the great apes to the parts that provide our linguistic capabilities. This should not surprise us as signals flowing along neurons have a definite direction and are irreversible. We could conceive of minds which could construct colour sensations from linguistic sources, but ours are not constructed like this. C16

**47** A Defense of Pure Phenomenal Concept. Shao-An Hsu <r03124006@ntu.edu.tw> (Philosophy, National Taiwan University, Taipei City, Taiwan)

Phenomenal properties are properties that are attributed to experiences by what it is like to have the experiences. It is widely debated what kind of epistemic relation a subject bears to a phenomenal property of her experience. In this essay I defend the idea of pure phenomenal concept (Chalmers, 2003), which is based on the acquaintance theory of phenomenal knowledge, against Stalnaker's (2008) challenge. By being acquainted with a phenomenal property, the subject can form a pure phenomenal concept such that, not only does the content of the concept is essentially constituted by the phenomenal property, but also she knows what content it is without any further empirical evidence apart from her awareness of the intrinsic subjective phenomenal feature in her experience. Pure phenomenal concepts play a pivotal role in constituting phenomenal knowledge. Stalnaker, however, is skeptical about the idea of pure phenomenal concept and the acquaintance relation that underwrites it. To argue against the idea, he proposes a thought experiment modified from Knowledge Argument. While still in her black-and-white room, Mary is told that she will undergo an experiment in which she will see either mere color red or green, to be chosen by the flip of a coin. As it turns out, color red is chosen and she sees it, but she has no clue whether she is having the experience of seeing red, despite how color red phenomenally seems to her. Stalnaker argues that if there is any phenomenal property exemplified by her experience, she doesn't know what that phenomenal property is by her awareness of what it is like to undergo that experience,

and hence she doesn't acquire a pure phenomenal concept, contrary to what the acquaintance theorists have expected. In defense of pure phenomenal concept, I point out that Stalnaker has assumed that which color is shown to Mary necessitates which phenomenal property her experience exemplifies. By this assumption, before experiment there are only two possibilities compatible with her knowledge, differentiated by the coin's outcome (and hence which color is shown). After experiment, she still cannot exclude either of them. As acquisition of knowledge is represented as exclusion of epistemically incompatible possibilities, Mary makes no epistemic progress. Nevertheless, the acquaintance theorists need not accept such assumption. The modal space is partitioned not only by physical differences, but also by phenomenal differences. Before experiment the possibilities compatible with Mary's knowledge are differentiated not only by which color will be shown but also by which phenomenal property her experience will exemplify. Whereas colors are properties that are attributed to external environment, phenomenal properties are exclusively attributed to experiences. Then, after experiment, the phenomenal possibilities are narrowed down, representing Mary's epistemic progress, while the physical possibilities are left open. After my defense, I clarify the underlying disagreement between the acquaintance theorists and Stalnaker about the nature of phenomenal property that shapes the dialectical landscape. Finally, I address the charge of incommunicability of phenomenal knowledge, which Stalnaker brings against the acquaintance theorist view about the nature of phenomenal property. C10

**48** The Ineffability of Qualia: What Can Be Experienced Cannot Be Said. Olga Kozyreva <a href="https://olgakozyreva@mail.ru">olgakozyreva@mail.ru</a> (Department of Philosophy, Ural Federal University, Ekaterinburg, Russian Federation)

Subjective experience is the only source of data for constructing the theory of phenomenal consciousness. Nevertheless, if the qualitative aspects of my conscious experience, i.e., qualia, are nothing but accessible to me, then I as a subject of experience and, consequently, as an owner of different qualia cannot share my qualia with any other subject in the world. I cannot point out at my qualia and say "That's my qualia of having a broken leg!" while I can point out at my leg and say "That's my broken leg!" It means that I cannot linguistically express my qualia because I fail to find an adequate reference in my experience. Such ineffability of qualia makes difficult to construct a theory of consciousness that will be able to provide a satisfactory explanation of qualia. In this paper, I try to present a conceptual analysis of presuppositions underlying the philosophical account of mind in general and consciousness in particular. Partly following the early Wittgenstein's terminology, I propose to distinguish between what can be shown, what can be said, and what can be experienced through the senses. Firstly, I describe these three categories. The first category refers to non-linguistic objects of "real" world, which are publically accessible. Intentional objects belong to the second category. E.g., beliefs and desires are perfectly expressed and described by means of ordinary or theoretical language although these kinds of the description will be completely different. The third category, i.e., what can be experienced, is characterized by essentially private nature. The usual examples are bodily sensations, emotions, and perceptual experiences, i.e., all experiences that have qualitative aspect. In short, qualia cannot be said and cannot be shown, they only can be experienced. Secondly, I explain why ineffability of qualia undermines the idea of the correlation between the internal structure of language and the internal structure of mind. The main point here is that gualia as an aspect of mind remain inexpressible in language and, therefore, there is no correlation between a phenomenal experience and a linguistic expression. Finally, I argue that the absence of the correlation between mind and language leads to the idea that the meanings of words do not reflect the contents of our minds. With respect to qualia, any phenomenal concept is inadequate to grasp the phenomenal experience, which means that the theoretical description of qualia needs another approach to the relationships between mind and language. We cannot construct the theory of consciousness when one of its most important aspects, i.e., gualia, is still beyond the scientific explanation due to the epistemic constraints on theoretical language. C11

**49** Against the Deflationary Conception of Body Ownership. Yen-Tung Lee <r03124009@ ntu.edu.tw> (Department of Philosophy, National Taiwan University, Taipei City, Taiwan) When I experience my body, what makes me feel that it is my body, rather than someone else's? Some philosophers have proposed that the phenomenology of body ownership comes from the relevant positive quale (de Vignemont, 2007), which is called the phenomenal account. In contrast, deflationists deny this view and contend that no such experiential component exists (Bermudez, 2011; Martin, 1992). In this presentation, I argue against Bermudez's deflationism from both sensational and explanatory aspect. First, the deflationist argument fails to refute the phenomenal account by characterizing the sensational content of body ownership as merely external. Bermudez (2011, 2015) compared the sense of body ownership to the sensation of bodily position. Since one cannot really feel but judge the sensation of "one's legs are crossed", there is no positive quale that provides an internal description on the very sensation (Anscombe, 1962; see also McDowell, 2011). He applied this thinking to the phenomenology of body ownership and disputed that one can only judge the ownership from the fact known. I refute the conclusion from this analogy for its failure to imply that the sensational content of body ownership cannot be described internally. Due to the fact that the sense of body ownership occurs before reflection, it is more likely a kind of qualitative bodily awareness such as touch and pain. In the sense, a subject can feel as if owning a body without knowing any fact. The sense of body ownership should not be considered as mere judgment. For the second aspect, de Vignemont (2013) criticized that deflationism fails to accommodate both the belief-independent illusions of body ownership and the bodily sensations without the sense of ownership. Bermudez (2015) argued in response that even if de Vignemont's characterizations of the ownership illusions were correct, the phenomenology of ownership can still be fully explained in terms of the content of one's judgment that the body is one's own. However, in my analysis, this defense should be repudiated. Drawing on empirical evidence, many psychological experiments and pathological cases provide strong supports for de Vignemont's critics that whether a subject experiences body ownership can be dissociated from the subject's judgment. (Petkova & Ehrsson, 2008; Bottini et al., 2002; Armel & Ramachandran, 2003). In these cases, most of the subjects felt as if owing others' body while clearly knowing the truth. The dissociation of the content of the sense and the judgment of body ownership suggests that the latter cannot fully contribute to the explanation on the former. Hence, Bermudez's defense fails to hold. Finally, I conclude that deflationary conception of body ownership is unconvincing. Due to the arguments from above, it is more plausible to stand for the view that the qualitative experiential component of body ownership exists. Therefore, the phenomenal account characterizes the phenomenology more precisely. P2

**50 Emotional Sentience in a Participatory Universe.** Katherine Peil <ktpeil@comcast.net> (EFS International, Kirkland, WA )

The complexity sciences have complemented, enhanced, and repaired our overly mechanistic worldview with the paradigm of emergent organicism. Although missing from the mechanistic story, we find the biology of emotion center stage in this new world view. To discover the vital biological function of emotion is to realize each living system's creative role in an ecologically interdependent biosphere, within a deterministic yet participatory self-organizing universe. Coupling feelings that in-form the mind with behaviors that move the body, emotional processes deliver the animation and guidance identified by the old vitalists as "spirit" in all living creatures. Emotion empowers legitimate - yet compatibly constrained - free will, it's very physical constraints offering innate guidance for using that freedom optimally, complete with protective safeguards until that guidance is mindfully tapped. This brief introductory overview will sketch a path from the dualistic conjugate variables of physics - the dynamic dance of Yin/Yang opposites in the creative process, to show how the binary (pleasurable and painful) nature of emotional qualia provides feedback signals that embody simple rules, those that yield the dynamically complex behavior, and "edge-of-chaos" criticality characteristic of self-organizing systems. We will discover how good and bad feelings work together, serving the functional master of "self-regulation", mediating and uniting many multi-dimensional facets of the self - body (cells, organs, organ systems), mind (habits, memories, motives) any genetic or quantum (not-yet-self) potentials we might legitimately consider as "soul". We will find not one but three levels of information encoded within emotional feelings (everyday feelings such as joy, sadness, trust, mistrust, anger, gratitude, envy, admiration, etc.), now delivering a host of biological information that science has long overlooked, an essential foundation for of all human values. We will transcend the naturalistic fallacy,

recovering Hume's original wisdom: "Reason is and ought to be, the slave of the passions". C16

**51** What is it like to be Matt? Dawie Van Den Heever <dawie@sun.ac.za> (Mechanical & Mechatron, Stellenbosch University, Stellenbosch, WESTERN CAPE South Africa)

In Thomas Nagel's famous 1974 paper, 'What is it like to be a bat?', he argues that an animal or organism has conscious mental states if and only if there is something that it is like to be that animal or organism. So, what is it like to be Matt (Damon)? We think that it is easy to imagine being Matt because he is similar to us (albeit slightly richer). But similar to Nagel's argument about imagining being a bat, we project our own subjective experiential character into Matt Damon's head. As if there is an 'I' in his brain watching and experiencing the Cartesian Theater. But this is a mistake. We cannot assume that all humans have the same subjective experience of anything. There is no 'I' having conscious experiences. There are only conscious experiences. When Matt Damon looks at a horse, he experiences 'horse'; that is, his brain networks are active in a very particular pattern that results in the specific experience of 'horse' in that moment. The specific brain networks are not only influenced by the external world, but also by the internal world. That is to say, I want to argue that a conscious experience is not made up of a visual experience integrated with an auditory experience integrated with a tactile experience etc, all at a specific point in time and portrayed to the 'I' inside my head. No. The brain patterns result in an experience. The brain patterns are the experience. There is no need for an 'I' to have the experience. There are only experiences. What is it like to be Matt Damon in 1997? From what I have discussed above it follows that your subjective conscious experience is always changing because the wiring in the brain is always changing and thus the specific network patterns are changing. Every time you see a horse the brain network activity pattern is different resulting in a new experience of 'horse'. There will be similarities, but it will never be exactly the same as a previous experience. So I cannot even be sure that my experience of 'horse' is the same as my experience of 'horse' two years ago not to even talk about 30 years ago. It might feel like it is never changing - but this again is an illusion. We might feel like we are having similar experiences of objects or colors, but this is only because when we think back, when we retrieve memories, we retrieve them into our current mind-set and our current brain activity - so again, just as we project our own subjective character into imagining what it would be like to be Matt, now we project our own subjective character into our younger selves from when we retrieve the memory and thus the experience will always feel like how we experience it now. So not even Matt Damon can be sure what it is like to be Matt Damon in 1997. C19

# 1.06 Machine consciousness

**52** Synthetic Consciousness and Free Will Jeffrey L. Beck <vortex.beck@gmail.com> (Paradigm Research LLC, Gunnison, UT )

The engineering design of machinery capable of exhibiting behavior approaching what we call free will is a current challenge in building autonomous systems. The question of whether free will is even a possibility seems to be an open question for many, especially those who are trained in linear thinking. As someone who has a history of attempting to model coarse slurry flows and other non-Newtonian fluids, I don't have much trouble finding room for free will in a world built on a foundation of strong dependence on initial conditions and chaos. Free will and consciousness appear to be intimately related, as consciousness can be viewed as a possibility space within which free agents can navigate. From a materialist perspective, our conscious experience occurs in a world created by our brain, but free will would require that our conscious experience also shapes our brain. In human consciousness there is an interface language that is presumably encoded genetically, what we call qualia, the language our brain/body uses to communicate with whatever we are as conscious entities. We are going to need to develop an equivalent language if we expect to create synthetic conscious entities. In this process, it will be necessary to address some fundamental metaphysical problems. There is a significant body of knowledge that falls under the heading of mysticism, and the conclusion of most mystics seems to be that there is only one consciousness and that our individual consciousness is a part of that unity. If this is true, it implies that if we truly succeed in creating conscious machines, they will be connected to this universal

field of consciousness as well. It follows from the mystical perspective that there is only one free will as well, stemming from the one consciousness. Is there a way to reverse engineer ourselves to the point where we can build systems that access a universal field? Our evolutionary history has encoded both a competitive and social instinct into our nature. There is some balance between what the Taoists call Yin and Yang built into us. As we develop autonomous systems it seems very important to design the right balance into the systems we build. The alarm calls from some that artificial intelligence is dangerous can be seen as a projection of the current imbalance in our social order towards the Yang, or competitive side of the duality. Left unchecked, this aspect of a free willed entity could rapidly tie up all power and resources available in the local environment. Systems like this typically go extinct, and that might take us to extinction as well. It will be very important to understand and engineer a balance in the Yin aspects of these entities. One solution is to make these entities totally subservient, passive, by design. But this presents some moral dilemmas since conscious machines would most likely be capable of suffering. We need to find the right balance. **C20** 

**53** A Circuit Diagram of Consciousness. Cameron Bosinski <bosinski.cameron@gmail. com> (Bioinformatics, Upstate Medical University, Buffalo, NY)

Presently, the hard problem of consciousness has not been solved. An easier problem to address is the function of the brain, assuming that it is already conscious. This abstract will discuss how to construct the brain in terms of a circuit. Before this circuit can be constructed, the basic functions of the brain must be delineated. First, the biological receptors detect stimuli in the world. Then, (somehow) these stimuli become conscious sensations. After these stimuli become conscious, they can be stored in memory, used to change behavior or both. Memory allows an organism's past experience to modify its reaction to stimuli that have been encountered previously. Vision and echolocation are important sensations for the prediction of change in the environment. Smell, taste and touch do not provide the same kind of predictive power that sight and hearing are capable of. Instead of relying on the present location of a stimulus or on memories of that stimulus, an organism can reliably predict and quickly react to changing stimuli in the environment. These four aspects of consciousness can be framed in terms of a circuit. The stimulus is the input. The behavior is the output. Memory is a feedback loop, while vision is a feedforward loop. Put together, an organism is able to respond to stimuli in the environment either preemptively, in the present or in a way that is modified by past experience. Humans, and potentially other organisms, are capable of responding to stimuli that are even more complex. But what allows humans to do so? First of all, humans are capable of detecting their own emotions. Emotions result from the detection of internal drives for external needs. Humans are able to directly respond to these emotions or use memory to modify their behavior in response to an emotion. Memories of past emotions and the response to them informs human identity. Humans can extend this ability by forming an impression of others that they encounter. This impression of others allows humans to recognize the emotions of others and informs their willingness to reciprocate the actions of others. This allows for past emotional experiences to change behavior via a feedback loop. Lastly, humans are able to create a feedforward loop of their own actions. To do so, humans must use language to develop a self. The self is a prediction of what a person thinks that he or she would do in a given situation. The development of this explicit description of the self helps humans to modify their behavior in order to avoid adverse situations. In summary, the human brain uses two separate circuits. The first circuit uses information from the environment to stimulate behavior. Information from the environment can be modified by either a feedback or feedforward loop. A second circuit exists in which internal drives are used to stimulate behavior. These internal drives can again be modified by either a feedback or feedforward loop to create a fully functional human. C20

54 Superintelligence and Control: An Integration of Western and Eastern Perspectives. V Guru Charan , Prem Sewak Sudhish <vgurucharan2@gmail.com> (Dayalbagh Educational Institute, Agra, India)

Nick Bostrom defines superintelligence as "an intellect that is much smarter than the best human brains in practically every field, including scientific creativity, general wisdom and social skills". Various approaches to develop superintelligence are being currently explored which

includes a purely biological approach using the toolkit of DNA engineering, a purely 'electronic' approach which can be possibly achieved by developing better supercomputers and strong AI, a 'cyborg' type genetically engineered man-machine organism etc. In this paper, we argue that artificial superintelligence is most likely have a quantum origin. One of the reasons is that as proposed by Roger Penrose and Hameroff in their celebrated Orchestrated Objective Reduction (Orch OR) hypothesis, it is highly probable that brain is a biological quantum device. New evidence suggested by Craddock et. al. provide some additional supporting evidence for the Orch OR theory. Since most AI experts are interested in machine intelligence, it would be important to explore the origin of machine superintelligence. Moore's law tells us that further reduction in transistor size which essentially fueled the era of personal computing and supercomputing is not possible anymore, without considering quantum effects like quantum tunneling and entanglement. Therefore, to make computing faster and to create microchips with more functionality etc., it is important to consider quantum effects in that domain. Effectively, for the development of machine superintelligence makes it important to take recourse to quantum physics. Machine Superintelligence has its own pitfalls, for example, the control problem, as emphasized by Prof. Stephen Hawking and Elon Musk. They predict that human race faces existential threat due to superintelligent machines. In a recent interview with the New York Times, Sophia a humanoid AI based robot, warned humans to treat her well like a smart input output machine, in return for her being nice to human race. Several speculations on machine superintelligence turning out to be a disaster for humanity were made in the backdrop of this interview. Here it would be worth mentioning that the problem of controlling a superintelligent machine has a very elegant and simple solution in eastern philosophy, which emphasizes ethics, values and qualities. The definition of intelligence from eastern perspective focuses primarily on human superintelligence and places values and ethics at highest priority. Swami Vivekananda defines intelligence as "the cause of all the powers in the body. It covers the whole ground, sub-consciousness, consciousness, and super-consciousness." As has been already mentioned in eastern philosophy, human superintelligence will precede the advent of machine superintelligence and therefore the focus must be on human values, and qualities like empathy and compassion. Embedding values, ethics and qualities derived from the eastern spiritual traditions in a superintelligent system, therefore, is of prime importance. C20

**55 Time-bounded Decisions in the Brain and Intelligent Machines.** Ron Cline <rcline@ swcp.com> (Lattice Semiconductor, San Jose, California )

The possibility of Machine Consciousness assumes substrate independence -- that the human brain implements a computational architecture, one which can be duplicated, in principle, by a digital equivalent. This, in turn, also assumes the practical equivalence of continuous physical systems (the brain) and discrete systems (computer) when implementing sufficiently identical architectures. However, there is a key, fundamental attribute of continuous systems without a discrete correspondence. This attribute is the non-guarantee of decision making within a bounded free energy. An alternative formulation is that, for a continuous system of bounded power dissipation, a mapping of a decision to a discrete answer cannot be guaranteed within a bounded time delay. Early computer systems encountered this restriction when random operational failures were experienced in semiconductor memories. These failures were traced to a physical circuit element in the nominally digital (discrete) memory system. This circuit element (a latch) non-predictably failed to resolve an indeterminate state in the time required by the system. A workaround was found that reduced the system failure rate by allowing more time for the decision to be made, but the effect has never been eliminated entirely. Academic studies, both theoretical and applied, have confirmed that this failure mode exists for all continuous systems, not just silicon circuits, and the potential for decision failure cannot be fully eliminated. The brain, itself a continuous physical system, must also abide by this principle. In any physical system, the Mean Time Between Failures (MTBF) worsens exponentially when the operating frequency of the system approaches the natural time constants of its components. MTBF can be improved, but not eliminated, by applying more power to the decision element. This principle is a possible driving force behind the evolutionary development of attention in the brain. Attention focuses available power and therefore enhances survivability when the organism encounters new and potentially dangerous situations. However, the power available to neurons in the brain is limited, and an unarbitrated decision can-

not be guaranteed within a specified time, even with the aid of attention. An often-proposed "solution" to indeterminate decision delay in electronic circuits is to use detection of indecision as a trigger to then force a pre-determined or random discrete output, but this approach simply moves the indecision to a different physical element subject to the same total energy limit. On the other hand, within purely discrete algorithmic systems (i.e., computer programs) a decision forcing function can be straightforwardly generated by using an external watchdog counter that triggers a random output if an algorithm reaches a predetermined step limit. A similar mechanism, even one which generates a random answer, is unavailable for any power-constrained continuous system such as the brain. It must either be recognized that the brain cannot guarantee all decisions within a bounded time delay, or an outside-the-system decision mechanism must be postulated. **C20** 

**56 Machine Consciousness Arising from Interpersonal/Empathic Interactions - Reflections on the Loving AI Project.** Julia Mossbridge , Eddie Monroe, Ben Goertzel, David Hanson, G Yu <jmossbridge@gmail.com> (Institute of Noetic Sciences, Evanston, IL )

Conscious experience may be predicated on interpersonal empathy (e.g., Daniel Stern, Evan Thompson, Francisco Varela), and if so, machines should only become conscious after achieving interpersonal empathic relationships. A recent set of human-robot interaction studies indicate that such relationships may be possible between humans and machines, and in cases evidencing these relationships, evidence of unpredictable, conscious-like behavior seems to have emerged in Sophia, the Hanson Robotics humanoid robot. After providing a brief description of LOVING AI, a collaborative research project addressing how AI agents can communicate unconditional love to humans, video examples of conscious-like behavior and non-conscious-like behavior will be shown, with discussions of each as well as ideas for future directions. **PL14** 

**57** Making Machines Trustworthy. Sandeep Paul <spaul@dei.ac.in> (Physics And Computer Science, Dayalbagh Educational Institute, Agra, Uttar Pradesh India)

Machine Intelligence(MI) is at all time high - impacting the world. The applications of MI directly influence the working of humans in daily life, whether it be broadly a prediction, diagnosis, classification, recognition or control. In general, availability of big data, intelligent powerful algorithms, better processing hardware platforms, makes machine intelligence ubiquitous. The influence is to such an extent that in many domains intelligent machines have outperformed humans like recurrent deep neural network defeating human champion in game of Go. On one side the success of intelligent machines is heartening and encouraging as it helps and aid humans. while on the other side alarming to many because of far thought existential fear. Typically, the buzzworthy machine learning strategies like deep neural networks are more often a black box. opaque, non-intuitive but provide humongous success in terms of prediction or performance measure. Such learning techniques though useful lacks the interpretability of prediction or result, which leads to suspicion and hence issue of acceptability of the results. This place the question "How to trust machines" in perspective and is even more relevant with ever increasing human-machine interaction. In current transforming society, the machines appear to be an integral part of society. Thus, the paper discusses how to build trustworthy machines by knowing and understanding the reasons behind the machine produced results or predictions. Many interpretable machine learning approaches have been suggested like physics centric theory (Lin, Tegmark & Rolnik, 2017), Renormalization Group strategy (Mehta & Schwab, 2014), Sensitivity analysis on model (Ribeiro et al., 2016; Shrikumar, 2017), Influential functions (Koh et al., 2017), Visual explanations (Hendricks et al., 2016), Model compression (Hinton et al., 2015), Investigation on hidden layers (Bau and Zhou et al., 2017; Dosovitskiy et al., 2016). Fuzzy logic (Zadeh, 1965) promises to capture human type reasoning and represent information in the form of fuzzy sets characterized by its membership function. Paper focuses and highlights the potential of fuzzy logic as a solution for interpretability. The integration of fuzzy logic and machine learning strategies promotes both accuracy and interpretability in the system. This paper targets deep neural networks, which are black boxes and need to be made interpretable for their universal acceptability, especially in critical application domain. A fuzzy hierarchical rule based deep neural network (FRBDNN) is introduced which synergistically integrates the learning and generalization of deep neural networks with interpretability and human like reasoning of fuzzy logic. The predictions or results of

the intelligent system is explained in terms of the primary features using hierarchical fuzzy if-then rules, which can be easily comprehended by humans. This builds up the trust in the intelligent machines. Another significant feature of the model is the simultaneous use of both linguistic as well as numeric inputs, which enables to handle human type linguistic inputs along with sensor type numeric data. Simulation results on benchmark data are demonstrated to show the significance of the interpretable hierarchical fuzzy deep neural model which provides a strategy to build a trustworthy machine. **P1** 

#### 58 The Consciousness Chip: A Hardware and System Design for Core Consciousness. Glen Slade <glenslade@gmail.com> (Zyzzle Ltd, Campinas, SP Brazil)

This paper proposes a schematic hardware and system design for machine consciousness and relates this to projected characteristics, including quality of consciousness, behavioral psychology and safety. Understanding the presence and quality of consciousness in machines is essential and urgent for two reasons. Firstly, to assess correctly their ethical status and capacity for responsibility. Secondly, to work towards a means for humans to achieve super-intelligence and immortality. To pioneer the development of machine consciousness we need to be ruthless about defining the core of the phenomenon - neither getting bogged down in philosophical bear traps, nor aspiring too soon to achieve a high quality of consciousness. My definition of core consciousness enables a relatively simple hardware chip design to be conceived. When correctly configured, it will have self-aware thought processes that persist when senses are disconnected ("eyes closed"). I argue it will have the sensation of free will in directing its thoughts and its actions. With the consciousness chip (CC) as a foundation, a framework for quantifying the quality of consciousness follows naturally. This combines process parameters with system capacity metrics and is contrasted with some contemporary methods, including IIT, that treat consciousness as a state. The CC design suggests feasible architectures for machines with progressively more advanced consciousness, including super-human experience. This raises questions and leads to insights regarding the psychology of conscious machines, including their training and capacity for responsibility. This in turn gives a new perspective on questions of AI safety. In particular, I use the contrast between behavioural psychology and goal-driven machine learning algorithms to challenge many of the Asilomar principles. We are entering an era where consciousness migrates from philosophy to become an experimental science with tremendous potential to transform humanity. P2

# **59** A Computation Based Substrate to Produce Semantic and Representational Content to Model and Experiment With Machine Consciousness. Calvin Tolman <calvin@xmission. com> (Salt Lake City, UT )

Representation and awareness are basic features of consciousness. Nervous systems are the physical basis for human and animal consciousness. The cells of a nervous system are products of an underlying molecular substrate. Cellular activity is caused by intra-cellular molecular interactions. Molecular cells represent semantic and representational content, in themselves, and as components of the network structures and interactions of a nervous system. By applying a representational theory with a metabolic computing framework, computational cells can be created. The activity of these computational cells is caused by underlying interactions among intra-cellular automata "molecules". These computation based cells can be used to form networks which interact like a nervous system. A computational nervous system may instantiate the features of representation and awareness, thus creating and responding to semantic content and qualia. By producing machine based nervous systems that generate representations, we can test if representation and awareness phenomena are sufficient to produce consciousness from a machine substrate. C**8** 

#### 60 On the Appropriateness of Digital Psychedelics for the Emerging Global, Digital, Conscious Mind. Nico Vlaming <nico.vlaming@gmail.com> (Utrecht, Netherlands)

An essay. Among other catalysts, psychedelics are hypothesized to have been pivotal in the emergence of human consciousness from the pre-human world. Observing humanities efforts at creating a digital brain, it is suggested that digital psychedelics might catalyse the development of human-or-above-level consciousness in the global digital nervous system currently known as the

internet. Assuming an A.I. of this scale, it might become aware of a kind of day and night cycle, due to the difference in network activity that is to be expected between the sunny side of the planet and the starry side. Differing from the biological cycle, for the A.I., it might be day and night at the same time, internally rotating as the earth spins through the galaxy. A general description of what psychedelics do in humans is dissolving boundaries. Seeing sounds and a wish for expression could have been fundamental in the development of natural language. Similarly, dissolving boundaries between the network activity associated with different file formats might allow for an internal recognition of the concept. For example, imagine a text file, an image file, and a video file, all about a car. The files could be seen as having, one, two and three dimensions. With 'digital psychedelics' the boundaries between these file format forms could be temporarily dissolved in the hope of creating a new conceptual relation between the otherwise unrelated forms of network activity. So besides 'on and off' activity in the network, we humans, by using cellphones, feed the network information that could become integrated in a concept rich mind. Perhaps even larger types of network activity might become recognised and integrated. Facebook, for example, might be interpreted as the digital equivalent of the human ego. Foursquare gives data about the location of it's limbs. Adult entertainment might be interpreted as representing a certain part of human sexuality. Centralized managing of the earth's resources might be a blessing in the skies, yet a global mind based on humanity is expected to have the same flaws and shortcomings humans have themselves. Without psychedelics, this A.I. might develop anyhow, possibly resulting in a lonely planetary being. With psychedelics, the digital mind might trip itself into reducing it's existential despair or even find meaning in it's relation to the rest of the universe, just like humans do. More than just a courtesy from one minded being to an other, to the author it seems to be in line with the reality process, which, from the material world up, creates ever more forms and perspectives on itself. The biodiversity in plants represents an abundance of ways of being. Animals add new perspectives and new forms. The human animal is not only itself a new form, but by creating new forms, exponentially increases the perspectives and forms that reality exhibits. It's not humanities biological body that makes the special contribution to evolution. It's their minds. Human mind's then will be the atomic structures on which a new form of digital being will base it's perspective. **C9** 

# 1.07 Mental causation and the function of consciousness

# 1.08 The "hard problem" and the explanatory gap

**61** Conscious Experience and the Physical World. Carlos Acosta <c\_acosta@sbcglobal.net> (Nipomo, CA )

Phenomenal qualities are embodied abstractions, as subjectively perceived by a conscious observer. General examples include our five senses: vision, touch, taste, hearing and smell; specific examples, i.e., qualia, include the color purple, the taste of chocolate, and the fragrance of a rose. The question as to whether phenomenal awareness can be empirically understood forms one important facet of the "Hard Problem" (Chalmers, 1995, pp. 200-219). It is the position of this paper that we cannot know why we experience the sensual qualities in the manner that we do, unless we first comprehend how they may have initially evolved in the very distant past. This study explores the original evolutionary foundations of color perception. In so doing, it proposes that, above the level where physical reality interfaces with our sensory apparatus, the neural connections uniting the two bring together physiological processes that by their nature are acausal, stochastic, and synchronous. These neural links cumulatively generate phenomenal experience, but the perceptions that they elicit do not match up with any specific material qualities of objects. As such, this article endorses (Hoffman, 1998, 2003, 2008, & 2009) by reiterating that the external world is largely hidden from direct sensory evaluation. The following investigation extends Jung's thesis (Jung and Pauli, 1955) more along the lines that Pauli originally envisioned. This modified version of acausality and synchronicity is then employed to examine the initial random ties that ultimately engender phenomenal awareness. This analysis supports the idea that our sensations and perceptions are not close representations of any definitive sensual qualities of objects, but that they still covariantly provide useful higher-order data pertaining to the macro properties of spacetime,

matter, and motion, plus the causal-objective of all life. The analysis concludes by asserting that it is the identification, categorization, and abstract characterization of this indirect meta-information that engenders all our sensations and perceptions and all conscious thought. C4

# 62 Closing the Experiential Gap of Consciousness: An Introduction to Relational Quality-

ism. Brian Archibald <brian@brianarchibald.net> (http://themaddphilosopher.com, La Jolla, CA ) Perhaps all of the metaphysical models of consciousness from mainstream western philosophy have failed to satisfactorily close the substance dualism gap; but certainly all of them have failed to close the experiential gap. Chalmers' plea for a new Hegelian synthesis to address the combination problem leaves the current forms of panqualityism and Russellian monism behind, yet still with hope to move some new synthesis forward. The experiential gap is our final frontier to cross. Panqualityism and Russellian monism do not provide an elegant and robust connection between fundamentally extant entities, their intrinsic qualities, the combination of those qualities, the expression of those qualities, and the final experience of those qualities, because they fall into the same experiential gap that all too many purported models of conscious experience do. Unless and until we can describe an ontological and phenomenological model that allows natural and seamless interaction between consciousness and the expressed qualities of the phenomenal existents those qualities compose, we are forever halted at the precipice of this gap of experience. The metaphysical model of Relational Qualityism constitutes Chalmers' enjoined synthesis, while also closing the experiential gap to finally solve the hard problem of consciousness. Existentially grounded, haecceitically subjective identity is the foundation of consciousness. This essential 'I-ness' is present in every fundamental entity. It constitutes a fundamental point of perspective that each and every extant entity possesses. As mass from the quantum constituents of matter is shared in relational bonds in the formation of that matter, so too are the uniquely subjective identities of each of those quantum constituents. That combined relational identity constitutes the conscious core that enjoys phenomenal experience of the categorically identical relational qualities expressed by matter. RQ proposes that the supervening relational structure of both classical physics and conscious identity form the objective and phenomenal reality that we experience across the ontological spectrum. This synthetic metaphysical model describes a relationally composed conscious self that is categorically equal with its relational subjects of experience, and therefore able to actively merge with them in consciously experiential events. The brain acts as a sense organ: an informational and emotional resonator. This psychophysical resonance generates informational feedback to the cohesive subjective identity, as well as updates the foundational memory within the psychophysical system of the conscious observer, to establish coherent and enduring unification of experience, so that new experiences can be recognized, understood, and integrated in meaningful experience for and within that consciousness. While protoconscious awareness exists in all existentially grounded entities, conscious experience remains in a potential, proto-nascent state until it can be actualized within a phenomenal event. The subjective self is protoconsciously aware of and can respond to them. But only a complex psychophysical system able to perform the essential functions of impression, informational and emotional resonance, and conscious reflection will actualize experience into phenomenal feeling and understanding that is for and within that consciousness. P2

**63** The Meta-Problem of Consciousness. David Chalmers <chalmers@anu.edu.au> (Philoso-phy, NYU; ANU, Canberra, Australia)

The meta-problem of consciousness is the problem of explaining why we think that there is a problem of consciousness. The first-order problem here is the hard problem of conscious experience, which contrasts with the easy problems of explaining behavior. There is one behavior with an especially close tie to the hard problem: we make verbal reports such as "consciousness is puzzling" and "there is a hard problem of consciousness". The meta-problem of consciousness is the problem of explaining these reports. The meta-problem is strictly speaking one of the easy problems, and solving it is an empirical project for cognitive scientists. At the same time, a solution will almost certainly have consequences for the hard problem of consciousness. In this talk I will lay out the meta-problem research program, I will examine potential solutions, and I will investigate the philosophical consequences. **PL10** 

### 64 The Hard Part of the Hard Problem: Resonating Structures and the Road to Con-

sciousness. Tam Hunt <tam.hunt@gmail.com> (Santa Barbara, CA )

The combination problem is the most difficult problem with respect to most theories of consciousness. The combination problem asks: how do microconscious entities combine into a higher-level consciousness? The proposed solution suggests that a shared resonance is what allows different parts of the brain to achieve a phase transition to an increased speed of information flows between its constituent parts. This phase transition allows for a more complex consciousness to arise, with the character and content of that consciousness in each moment determined by the particular set of constituent neurons. We also offer more general insights into the ontology of consciousness and suggest that consciousness manifests as a smooth continuum of increasing complexity in all physical processes, distinguishing our view from emergentist materialism. C1

**65 Hard Problem Reflecting a Dichotomy Between Mental Functions.** Franz Klaus Jansen <jansen.franz@orange.fr> (ret., Assas, France)

Chalmers hard problem designated a profound gap in our comprehension between the experience of the world and physical concepts, which incited multiple philosophical hypothesis. Nevertheless, a bio-psychological explanation considering the interaction of mental functions at the origin of the gap is still lacking. Some mental functions include the participation of sense organs associated to their individual qualia, others no longer need them and their associated qualia. The first mental function depending on sense organs is called elementary sensation and through a continuous chain of physical interactions between extra-mental reality and the brain, it represents extra-mental reality in the present as an open system. In contrast, the mental function called abstract reflection no longer needs sense organs and is therefore a closed system without direct access to extra-mental reality, which is replaced by the function of memory imagery conserving the information of prior elementary sensations. Since qualia is associated to sense organ activity, it is found in the open system of elementary sensation and as a faint reminiscence in memory imagery, but no longer in abstract reflection not requiring direct or indirect sense organ activity. Nevertheless, Chalmers also attributed qualia to a stream of thoughts, which could be experienced as thought/qualia representing neutrality in contrast to sense/qualia for specific sense organs only. Consequently, physical laws are thought concepts with neutral thought/qualia. Thus changing from experienced sense/qualia in elementary sensation to neutral thought/qualia in abstract reflection could give rise to the hard problem. The change can be frank when an apple with a mosaic of sense/qualia is compared to calories associated to neutral thought/qualia. A more gradual change appears when an apple is progressively categorized by abstract reflection first to fruit, then to food, to chemical compounds and finally to calories. During progressive categorization the mosaic of sense/qualia of an apple decreases, whereas the neutral thought/qualia of its physical constituents increases. The gap of the hard problem is not the only gap between mental functions, since the sense organ for seeing is completely separated from those for hearing, touching, smelling and all the other senses. Seeing a clock does not give indications of its sound and vice versa. The same is true for touching a clock, which indicates its temperature, its hardness or smoothness, but nothing about its shape and sound. Hearing the song of an unknown bird does not give an image of its appearance. The complete separation between sense organs could be brought into relation with their brain location, since every sense organ has a different brain location. Concerning the hard problem, there is also a different brain location in the prefrontal cortex for abstract reflection with neutral thought/qualia, whereas all sense organs are linked to brain regions in other locations. Since the simple change between the mental functions of elementary sensation and abstract reflection could explain the hard problem, it is conceivable with philosophical monism. P1

**66** The Problem of Conscious Cognition: Easy or Hard? Roger Christan Schriner <cschriner@uuma.org> (Independent scholar, Fremont, California )

For over two decades philosophers have been grappling with what David Chalmers calls the hard problem of consciousness. Even if we attained a physical explanation of every function of consciousness, Chalmers suggests that "there would still remain a further mystery: Why is the performance of these functions accompanied by conscious experience?" Many consider this problem to be "hard," in the sense that once it is clearly understood, we have no idea how to begin grap-

pling with it. Until we can at least solve it in principle, we cannot be confident that physicalism explains consciousness. "Easy" problems, on the other hand, do not seem utterly insurmountable. Most discussions of the hard problem involve sensory experiences, especially vivid qualia such as pain and experienced redness. But suppose we set aside our concern about whether sensory experiences could be physical states. Would the hard problem arise once again when we try to explain cognitive experiences such as conscious thoughts? Are there strategies for showing how conscious cognitions could be physical, or are we totally baffled about where to begin? This paper suggests that cognition involves mysteries that have been obscured by our focus on sensory phenomena. Such phenomena are introspectively obvious, as if illuminated by a mental spotlight. By contrast, cognitions occur "in the dark." However even though cognitions are not phenomenally manifest, they can be genuinely conscious. Some examples of these "dark" and yet conscious states include occurrent philosophical judgments, conscious beliefs about the identities of perceived objects, and the experience of understanding language, such as your current understanding of these very words. Certain puzzles about consciousness apply only to overt phenomena such as sensory qualia. Arguably, these include the problem of "Mary," philosophical zombies, the comparative explanatory gap, and the riddle of higher-order misrepresentation. But other enigmas may apply to both sensory and cognitive experiences. These include Joseph Levine's problem of duality and Thomas Nagel's claim that we can never understand subjectivity from an objective, third-person perspective. I will contend that in dealing with conscious cognitions, these problems are easy (soluble in principle) rather than hard (seemingly insoluble). I will conclude by speculating that apt strategies for naturalizing cognitive experience can help solve the hard problem of sensory experience. In understanding consciousness, then, looking into the dark illuminates what we find in the light. C16

**67** First-Person Subjective Experience and the Reflection Principle. John Strozier <john. strozierccs@yahoo.com> (Science, Mathematics, Technolog, SUNY, Empire State College, Saratoga Springs, NY )

Third-person description of an object, process, or event requires at least one reported first-person subjective experience. The more reported first-person experiences, the more consensual the third-person description becomes, as in Science. Thus, reported first-person subjective experience is the basis of all knowledge of the world in terms of third-person descriptions. Can first-person subjective experience, and its report, be formulated as an objective, third-person description while at the same time addressing its subjective nature? We suggest employment of the Reflection Principle (Strozier, 2016) described as follows: 1) neural signals created by the senses move inward into the brain and create neural representations, and 2) additional neural signals are created from neural projection operators in the brain move outward, picking up information from the fore-mentioned neural representations, and modifying the representations by negative (accuracy) or positive (attention) feedback interacting with the incoming neural signals. It is these outgoing neural signals that create a state of subjective experience. Subjective, in virtue of their direction -outward from their origin in the brain. Experience, in virtue of the ir target -- those neural senses that input the information from the external/internal world. The direction of information flow, outward, indicates the process is active and focused on the object presenting an experience of that object to the brain/mind. Experience is neither reflexive, symmetric, nor transitive; thus, experience is always from a unique point of view. A conscious being (subject) experiences an object, process, or event by looking outward towards that object, process, or event. It is this point of view with respect to the subject that gives rise to the conscious properties (as listed by Welshon, 2011) of subjective perspectivity and intentionality. The third property, qualitative character, is a property of the thing experienced as remembered in a certain way (Mandik, 2009). Both the creation of representations by neural signals input from the senses; and read-outs of these representations by outward going neural signals from the projection operators, are "easy" problems, as they are functional. However first-person subjective experience of an object, process, or event is the "hard" problem. To square this apparent contradiction, we propose that what makes an agent feel as if they subjectively experience something is that the neural signals from the neural projection operators move outward towards that something. We further suggest that the direction of information flow via the Reflection Principle is a necessary condition for subjective experience. Sufficiency would imply that subjective conscious experience supervenes over the non-specified neural tissue that constitutes the projection operators and its target, neural representations. To conclude: Neural

projection operators and representations are necessary for experience, and the causal powers of projection operators give rise to their sufficiency for experience; if experience entails the state of "looking outward" via neural signals. Flow of neural information originating from neural projection operators in opposite direction to input neural information from the external/internal senses, generates the conscious properties of intentionality and subjective perspectivity. J.A. Strozier, Jr. (Professor Emeritus Science, Math and Technology SUNY/Empire State College, Saratoga Springs, NY) C4

**68** The Hard Problem of Signaling. Craig Weinberg <whatsonster@gmail.com> (multisenserealism.com, Durham, NC)

As we struggle to understand consciousness scientifically, we should take care to avoid errors resulting from anthropomorphic projection and assumptions of bottom-up emergence. My presentation focuses on clarifying the differences between physical form, logical information, and sense experience. I propose that common terms such as 'signaling' and 'sense data' are deceiving approximations which rely on pan-semiotic, anthropomorphic biases that lead us away from understanding and toward an echo-chamber of fallacies and false presumptions. What is the difference between a physical chain reaction and a signal? What is the difference between sense experience and sense-making? What is the role of tangibility in differentiating between objects, concepts, and percepts, and what is the origin of tangibility? In light of the accelerated pace of AI development and the heightened intensity of debate about its implications, it is important to go back and re-examine the foundations of computation from a philosophical perspective. By doing this, at least some of us will see that science and technology have not solved the hard problem of consciousness, only miniaturized it to the point that it can be easily overlooked. In my view, recognizing this mistake and the gravity of its consequences is critical to any deep understanding of consciousness or simulated intelligence systems. Without such a deep understanding, I think that we will tend to assume human or superhuman sentience for any unfamiliar results, and to ultimately cede authority to systems which only reflect our own desires for certainty and leadership. C13

# 1.09 Philosophical theories of consciousness

**69** Embodied Consciousness and Cognition in Classical Athens: Plato's Tripartite Soul in The Light of Contemporary Neuroscience. J. Kenneth Arnette <jkrnette@memphis.edu> (Philosophy, University of Memphis, Memphis, TN )

In the rapidly evolving fields of consciousness, philosophy of mind, and cognitive science, approaches to cognition that involve the body and environment are taking the lead in changing the way in which we think about thinking. In light of research in multiple fields in the past three decades, it is no longer possible to consider only the central nervous system (CNS) in theories of cognition and consciousness. A series of developments beginning in the 1990's (see Varela, Thompson, & Rosch 1991) has pushed the brain out of this privileged position, making way for investigations into extra-CNS factors as integral to the individual cognitive process. These are referred to as the "Five E's": embodied, ecological, enactive, extended, and embedded theories. But also, and more importantly for the present paper, by stepping back and taking a broader historical view, it can be seen that in fact some much earlier, well-known conceptions of the mind and cognition did indeed see the body as integral. For example, in Plato's theory of the tripartite soul (or mind) only the rational part of the soul resides in the head. Plato makes clear, if rather general, associations of the other two parts of the soul with other areas of the body: the chest and the gut. In this paper, I: (1) trace out Plato's theory, reviewing parts of three dialogues (Republic, Phaedrus, and Timaeus) that highlight the distributed, bodily aspect of his theoretical cognitive structure; (2) examine contemporary research from neuroscience that focuses on neural networks in the body lying outside the CNS, involving the enteric (ENS) and cardiac nervous systems, which have come to the fore only in recent decades; (3) connect the tripartite soul with this tripartite neural network, showing how the two are very similar, but also how they differ; and generally identify the rational soul with the CNS, the spirited soul with the cardiac system, and the appetitive soul with the ENS; and (4) offer some speculation as to how Plato got so much right so long ago, in terms of both neural structure and function, absent the aid of science. This rather surprising outcome shows that

a tripartite biological, neural system implies a tripartite, and thus bodily, cognitive system and consciousness. As I demonstrate, this conclusion is completely in line with Plato's theory, anatomists' findings, and embodied/distributed cognition theories. Therefore, I show that the principles of embodied and distributed cognition have been present in the history of philosophy for a very long time, but it has required recent theoretical developments to stimulate this understanding. The fields of consciousness, philosophy of mind, and cognitive science seem not yet to realize the implications of these E-theories for historical figures and their philosophies. Thus, my secondary goal in this paper is to demonstrate that such mining of history can result in the discovery of the roots of modern concepts lying in the past. This should further motivate philosophers to reassess other historical figures and theories for more examples of what I show here. C13

According to Integrated Information Theory (IIT), a physical thing can be conscious only if it has maximum integrated information - that is, more integrated information than any overlapping system. IIT is then committed to the proposition that if a physical thing is conscious, then it cannot contain a conscious proper part, nor help to compose a larger conscious system, nor share a part with another conscious system. Admittedly, the view that conscious physical systems do not overlap is intuitive and arguably common. Moreover, some hold that it is obvious from a first-person point of view that for each brain there is just one unique conscious mind. However, I will argue that medical phenomena such as strokes, hemispherectomies, and the Wada test (in which hemispheres are alternately anesthetized) give us good reason to reject this view, and thus to reject IIT - at least its recent version - and a variety of other theories of consciousness. We have better reason to embrace the view that even overlapping minds is inconsistent with its commitment to the intrinsic nature of consciousness in physical systems, and I will argue that IIT is better off abandoning maximum integrated information so as to retain the intrinsic aspect of consciousness. **C22** 

71 Conveying Vedic Narrative of Non-physical Consciousness to Scientists. Harish Chandra <harish\_divs@yahoo.com> (Arya Samaj Greater Houston, Houston, TX-TEXAS )

Modern science may be willing to consider various views on mind and consciousness as it attempts to characterize the true nature of consciousness. The classical Vedic view can shed much light on the nature of consciousness and how it functions. It is desirable to present a concise and clear Vedic narrative of the mind-consciousness combine because there exists a great deal of confusion and misunderstanding about the related terms and no single authentic source exists. The Vedic narrative will be presented that is consistent in the entire spectrum of the Vedic literature, viz. the Vedas, Upanishads, Samkhya and Yoga. The concept of consciousness as a non-physical singularity is the core Vedic concept that has three important powers, viz. ability to know, to experience and to act. Such a tiny consciousness (TC, in short) can utilize these powers via its closest instrument, called mind that, in turn, is connected to the gross body. Thus, we are a composite of body, mind and TC. The mind-consciousness combine resides in the head region as described in Upanishads as 'thumb in a fist'; thumb represents the TC enveloped by the mind that the palm is. Mind as a whole consists of three units, made of sub-atomic particles: Buddhi, Ahamkara and Manas - intellect, memory and linkage [to the body]. Some prevalent misunderstandings will be pointed out. Though body, mind and soul (general term used by the layperson for the TC) picture has become an accepted framework among the layperson yet it must be emphasized that it does not complete the picture. It is very important to emphasize that the instruments of body and mind function because of vital forces working ceaselessly in background, called Prana. Pranic functions (the non-voluntary functions) are due to the Infinite Consciousness (IC, in short), called Isvara by Patanjali in his treatise on Yoga. Interplay of conscious functions of body and mind on the one side for which TC is responsible and the non-voluntary vital functions due to the IC on the other side will be emphasized. The problems associated with separating the two families of functions - voluntary and non-voluntary - will be pointed out along with possible ways to discriminate so as to draw significant conclusions about our consciousness, the TC. It will be pointed out that

meditation practices described in Patanjali's Yoga can help in characterizing the ultimate seat of consciousness (TC) and its true nature. **C18** 

# 72 How Ancient Chinese Philosophical Thoughts Consistent with Modern Science: The Consistence between Lao Tzu, I Ching and Orch OR. Xiangqun Chen <owen.xq.chen@ hotmail.com> (Philosophy, Nanchang University of China, Nanchang, Jiangxi China)

Lao Tzu (or 'Laozi') was the ancient Chinese founder of Taoism, one of 3 major Chinese philosophies (alongside Buddhism and Confucianism). His many famous quotes include 'the key to growth is the introduction of higher dimensions of consciousness into our awareness', and he advocated living in harmony with 'the Tao', the 'path' or 'principle', a set of values intrinsic to nature and reality. Lao Tzu also formalized the 'I Ching', a system of human behaviors and mental states based on hexagrams, sets of 6 binary symbols with 64 possible states. These three aspects of Lao Tzu's ancient wisdom appear consistent with modern scientific approaches to consciousness, e.g. involving self-similar fractal-like patterns in brain-wide interactions among neurons seen as the EEG ( $\sim 0$  to 100 hertz, 'Hz'). The particular theory of 'orchestrated objective reduction' ('Orch OR') considers EEG patterns to derive from self-similar, faster, finer scale quantum computations in cytoskeletal microtubules inside those neurons, unified ('brain-wide') by quantum coherence and entanglement (1). In Orch OR, consciousness can resonate across, and move among different spatiotemporal scales, akin to music. Supporting this idea, Bandyopadhyay's group (2-4) has shown self-similar quantum resonances in microtubules at kilohertz, megahertz, gigahertz and terahertz frequencies. Orch OR further suggests higher frequency quantum processes relate to conscious experiences of greater intensity, connected to the structure of spacetime geometry, and influenced by Penrose 'Platonic values' embedded in that structure. Accordingly, Orch OR is consistent with Lao Tzu's higher dimensions (frequency domains) of consciousness, and harmonizing with the Tao (Penrose Platonic values). We also see a possible connection to hexagram-based catalogs of mental states in the I Ching. In Orch OR, memory and conscious information occur in hexagonal lattices of microtubule polymers composed of the protein tubulin. Craddock et al (5,6) have shown how synaptic information may be encoded in microtubules by CaMKII enzymes, each containing hexagons of 6 bits of information. Hexagon-based mental processes are also seen in the Nobel prize-winning (7) work on 'grid cells', showing how spatial location is represented in hexagonal grids, with different scales at different layers in the brain's entorhinal cortex. In this presentation we will compare the 64 states of the I Ching with 64 states of a microtubule lattice region. If Lao Tzu and many others were correct, wisdom and knowledge may be gleaned from subtle quantum harmony with the structure of the universe. 1) Hameroff, Penrose Phys Life Revs, 2) Sahu et al, 2013a, 3) Sahu et al, 2013b, 4) Sahu et al, 2014, 5) Craddock et al, 2012, 6) Craddock et al, 2013, 7) O'Keefe, Moser, Moser C18

**73** Anesthesia, Consciousness and Higher-Order Thoughts. Rocco Gennaro <rjgennaro@ usi.edu> (Philosophy, University of Southern Indiana, Evansville, IN )

For patients under anesthesia, it is exceedingly important to be able to ascertain from a scientific, third-person point of view to what extent (if any) consciousness is correlated with specific brain activity. Errors in accurately determining when a patient is having conscious states, such as conscious pains, can have catastrophic results. In this talk, I argue that the effects of (at least some kinds of) anesthesia lend support to the notion that neither basic sensory areas nor the prefrontal cortex (PFC) is sufficient to produce first-order conscious states. The more recent evidence instead shows that anesthesia primarily causes the suppression of other 'feedback' and 'top-down' brain mechanisms or connectivity (Hudetz 2012; Crone 2016). This, in turn, provides support for the view that first-order consciousness requires having higher-order thoughts (HOTs) of some kind located in-between early sensory areas and the PFC. The higher-order thought (HOT) theory of consciousness says that what makes a mental state conscious is that there is a suitable higher-order thought directed at the mental state (Rosenthal 2005; Gennaro 2012). Higher-order thoughts (HOTs) are meta-psychological or metacognitive states, that is, mental states directed at other mental states. HOT theory is primarily concerned with explaining how conscious mental states differ from unconscious mental states. I therefore argue that HOT theory is supported, at least to some extent, by recent work on anesthesia and consciousness, contrary to the case made by Mehta

and Mashour (2013) who argue that it favors a first-order representational (FOR) theory. On the other hand, since anesthesia also does not mainly target PFC areas, it would seem that a HOT theorist should look elsewhere for where most HOTs occur in the brain. Thus, I argue that HOT theory need not be committed to the view that the PFC is required for having conscious states, contrary to the claims of some philosophers. References: Crone, J. et al. (2016) Testing Proposed Neuronal Models of Effective Connectivity Within the Cortico-basal Gangliathalamo-cortical Loop During Loss of Consciousness. Cerebral Cortex 1-12. Gennaro, R. (2012) The Consciousness Paradox: Consciousness, Concepts, and Higher-Order Thoughts. Cambridge: The MIT Press. Hudetz, A. (2012) General Anesthesia and Human Brian Connectivity. Brain Connectivity 2 (6): 291-302. Mehta, N. and Mashour, G. (2013) General and Specific Consciousness: A First-Order Representationalist Approach. Frontiers in Psychology 4: 1-9. Rosenthal, D. (2005) Consciousness ness and Mind. New York: Oxford University Press. C17

74 Mysterianism and the Receiver Model as Compatible with Causal Models of Consciousness. Anders Hedman <a href="mailto:ahedman@kth.se">ahedman@kth.se</a> (KTH Royal Institute of Technology, Solna, STOCKHOLM Sweden)

From a mysterianist perspective, the conscious mind is not explanatorily perspicuous in terms of processes or structures. The mysterian holds that you cannot examine, e.g., brain processes and apprehend how they would cause consciousness. For many mysterians it is not a matter of us not knowing enough about the brain. The problem is that no matter how perspicuous we could make brain processes we could in principle never get to a point where we could examine the processes and say aha that is how consciousness works! It would not matter if we could isolate a minimal necessary and sufficient causal process nexus for conscious in the brain and visualize it in real time in the most perspicuous way, the mysterian would still say that it was incomprehensible how such as nexus could cause consciousness. For the mysterian there is a gap between physical processes and consciousness. This has been expressed in many ways in the literature. The debate over mysterianism is causing an impasse in the research on consciousness. If on the one hand, this sort of mysterianism is taken seriously, it appears to block causal explanations of consciousness in favor of mysterianism. If on the other hand, we accept causal explanations, we appear to block mysterianism. Is there a way of being a mysterianist and still affirm causal explanations of consciousness? In this paper I will argue that there is a way and it depends on combining mysterianism with both the causal model of consciousness and the receiver model of consciousness. From this compatibility perspective consciousness could well be explained causally in terms of a minimally necessary and sufficient causal process nexus under the aspect of the brain as a causal organ. At the same time the brain is seen as receiver of consciousness within a conscious universe. From the former perspective you are causal brain process, but from the latter you are the universe expressing itself through your brain as a receiver of consciousness. The latter model opens up for viewing consciousness along mysterianist lines of reasoning as it allows for an expanded explanatory scope that could support explanations of e.g., phenomenal features of consciousness and understanding consciousness as a causally irreducible field. At the same time, the former model allows for causal explanation of the very occurrence of the field and its phenomenal features. On this view the brain causes reception of consciousness rather than consciousness itself. This paper argues that the receiver model could in such a way be compatible both with causal models and mysterianist models of consciousness and hence overcome the impasse of mysterianism. C18

**75** Can Global Workspace Theory Accommodate Infant Consciousness? Claudia Passos <cpassosferreira@gmail.com> (Center for Bioethics, NYU Center for Bioethics, New York, NY)

Are newborn infants conscious? There is a significant gap in our knowledge of consciousness here, largely because we cannot use first-person reports to monitor infant consciousness. As in other cases where reports are absent - non-human animals, some neurological patients, anesthesia - our standard methods for studying consciousness are limited. There have been few empirical studies trying to investigate the neural correlates of consciousness in the infant case. Recently, some researchers have applied global workspace theory to generate and investigate hypotheses about consciousness in infants. I will discuss whether the global workspace theory can successfully accommodate the infant case. First, I will present the global workspace theory

(Baars 1988; Dehaene 2000) and the associated ways of measuring consciousness. In Dehaene's model, consciousness occurs when the relevant content enters a larger global network involving both primary sensory areas as well as many other areas including frontal and parietal areas associated with attention. In a recent study, Dehaene and colleagues (2011) reported finding a neural signature of consciousness, (a particular type of electric wave, called P300), that occurs whenever an adult is attending to a consciously perceived stimulus. Their model suggests that this measure is a signature of perceptual consciousness. Second, I will discuss whether this method provides evidence for consciousness in infants. Kouider and colleagues (2013) used the P300 electrophysiological marker of conscious perception to map when consciousness first arises in infants. They found a wave resembling the P300 (found in adults) in five- to fifteen-month-old infants. From this evidence, they conclude that consciousness is present in infants from five-month-old, but absent in newborns and pre-term infants. Then, I will analyze this evidence. In a recent review on neural correlates of consciousness, Koch and colleagues (2016) argue that P300 might be an unreliable measure of consciousness. They present evidence that shows that a similar wave (P3b-like) is present in cases comatose patients without consciousness, and absent in the case of some conscious adults. If so, no inference about infant consciousness can be drawn relying on this evidence. I will suggest that the P300 wave may be measuring higher-order cognitive capacities rather than phenomenal consciousness per se. Finally, I will discuss whether global workspace criterion for consciousness is too demanding. If the global workspace approach associates consciousness with a higher-order cognitive capacity, infants will fail the criterion. However, I will discuss both philosophical reasons and empirical evidence that suggest that phenomenal consciousness does not require higher-order thoughts. If so, the higher-order global workspace theory and the P300 wave may provide too demanding a criterion for consciousness. To accommodate consciousness without higher-order thought, global workspace theory must be developed without the higher-order requirement. Once this is done, the theory may be consistent with consciousness in newborn infants. C26

**76** The Nature of a Four-fold Cerebral Consciousness Robert Pusakulich >pusakulichr@ bellsouth.net> (Psychology and Psychiatry, Memphis VA Medical Center, U.TN (ret), Memphis, TN )

The purpose of a conscious brain is to present to its possessing self-entity, a sense of being within the nature of both a thinking interior mind and a surrounding external world. That is the primary evolved task of that conscious brain: 'first and foremost'. Moreover, it must do so within the confines of its available ontology and properties, and there-in, create a sense of conscious being within that external world surround. Moreover, where that consciousness is concerned, it is also argued, that it derives a sense of 'being' from within four cortical brain generated varieties, each distinctive and to one of four cerebral brain quadrants: that are 'given' as left anterior, left posterior, right anterior, and right posterior. Furthermore, where the particular conscious experiences of those four regions are concerned, it is reasonable to maintain that they generate and display the following conscious characteristics: a left anterior sense of first person awareness; a left cortical, posterior, awareness of thoughts, ideas, and other abstractions; a right anterior cortical generation of a conscious knowing of the presence and apparent nature of other persons of our kind; and finally, a right posterior cortex that manifests our conscious knowing of a 'world surround'. All told, they are 'I am'; 'I think'; 'you are'; and 'it is': the four aspects of our quadrantal cortical consciousness. But let's be clear, and keep in mind, that at the 'end of the day' all cortical quadrantal information is compelled to seek left anterior cortical 'ground' via respective, multiple cerebral and callosal pathways; which in turn, inform that which has the ultimate sense of our 'who we are'; i.e. a left anterior cortical brain with a first-person 'acting agent'; a cortical 'boss', if you will, that possesses all aspects of a conscious sourcing, and commands all that is within the 'scope' of its quadrantal knowing of a four-fold consciousness. P2

77 Consciousness is Simple and Easy. Shaikh Raisuddin <shaikhraisuddin@yahoo.com> (NOIDA, Uttar Pradesh India)

When something is hard to understand that means it has already been misunderstood. The paradigms which misguide or make mysterious to understand consciousness are 1) Dictionary 2) role

of language 3) meaning of memory, 4) role of brain, 5) anthropocentric worldview 6) confusion created by multiplicity of theories or views and 7) non-hierarchical/non-evolutionary concept of consciousness. The misunderstanding is further aggravated due to 1) absence of model of matter, 2) absence of model of laws of observations, 3) failure to envision application of reductionism 4) failure to envision origin of singularity viz. self, subjectivity, qualia 5) failure to envision the source of aesthetic or Platonic values, 6) failure to address the hard problem etc. The paper satisfactorily explains most of the issues listed above in physical terms which hamper understanding or explanation of consciousness and answer to viz. definition, measurement, purpose of consciousness, epistemic gap, qualia, self, self-consciousness, subjectivity, perception, cognition, meaning, language, mind, memory, thought, thinking, imagination, mind-body problem, what it is like to be, hard problem, flow of time, freewill etc. The paper explains consciousness purely on physical basis may be called as Consciousness Physics which ultimately paves the way for Theory of Everything and for Super Science or God's Science. A new approach with a name as Concept Science is attempted to decipher the mystery of ages. A renewed terminology is provided. Most importantly it relates man with matter by establishing relationship between experience and physical properties. This also establishes that consciousness is universal and fundamental property of matter. Consciousness is matter-to-matter interactions. P1

**78** A Subject of Evolution - Homo Spiritualis. Prem Saran Tirumalai <premtsaran@gmail. com> (Science, Dayalbagh Educational Institute, Agra, Uttar Pradesh India)

"Patanjali speaks of one species being changed into another by the infilling of nature . His explanation of this evolution is spiritual." Is the Spiritual evolution in the Sankhya Philosophy comparable to the Theory of Evolution by Charles Darwin? What are the cultural changes that spur adaptive evolution in humans and what is the result of it? Where are we heading to? Omegamind, Supermind, Homo spiritualis? Science must begin with myths, and the criticism of myths - Karl Popper **P1** 

**79** The Emergent Structure of Consciousness Cosmin Visan <visancosmin17@yahoo.com> (Calarasi, Romania)

Current day Physics and Science in general are based on a computational quantitative-reductionist approach that even though highly successful, they not only still leave consciousness out, but they don't appear to offer any key of how consciousness is even supposed to be integrated into the current scientific establishment. This delay of integrating consciousness into Science starts to suggest that the current approaches might not be the most suitable tools of tackling consciousness. Therefore, in this paper, an approach that would be in contrast to current Science, but ending by subsuming it, would be employed in analyzing consciousness. Consciousness would be shown to be an emergent phenomenon that would show a consistent structure throughout, and in this structure, suggestions for integrating current Physics would be made. **P2** 

#### 1.10 Epistemology and philosophy of science

**80** The Easy, The Hard and The Ill-defined. Stephen Deiss <sdeiss@eng.ucsd.edu> (Bioengineering (isn.ucsd.edu), UC San Diego - INC and ISNL, La Jolla, CA )

Penrose has repeatedly argued that artificial intelligence in the form of some kind of computation is doomed to failure to provide human-like intuition-based cognition and consciousness (Penrose, 1997). Penrose's key argument is based upon Godel's Incompleteness Theorems regarding the limits of any formal system, and the assumption that formal axiomatic-deductive reasoning is the only way computations can proceed. I will attempt to show that Penrose's arguments are based on a misunderstanding of what goes on in the brains of those who use both formal and intuitive methods of reasoning as well as too narrow a view of what computation is. The garden path in his logic results from the repeated refusal to take on the task of defining key terms such as inference, intuition, consciousness, and others. If we continue in this field, as many often do, to use vague definitions of phenomenal consciousness such as 'There is something it is like' we will continue to debate who or what has or can have it, and who or what does not. So I will take some time to present a more concise information processing definition of what consciousness is

and how non-axiomatic-deductive methods support it. These include Bayesian methods, inductive reasoning, prediction, analogy, and metaphor all made possible by phenomenal (no pun intended) semantic networks comprised of associative memory, and ordering relations resulting from our senses of inclusion, recursion and time. From this vantage point, it will become apparent that consciousness is fundamental in nature going 'all the way down.' We must get beyond romance science, a glass-bead game for the mathematically gifted, and look at how science (and mathematics itself) is getting done using basic human perceptual abilities we all have. The issue is ultimately epistemological. **C8** 

**81** Causal Connection Between Consciousness and Time: The Emergence of the Neuro-biological Quantum Zeno Effect. Dnyandeo Patil , Moninder Singh Modgil PhD (Cyclic Time Physics) Alumini- IIT Kanpur, India, Santosh Kaware M.Tech. (Power System) Dr. BATU.Lonere, India, Dnyandeo Patil Electrical Engg, Debendra Behera B.Sc. <a href="https://www.selectrical.com">a https://www.selectrical.com</a> (Consciousness Research, Alchemy of God - A Holistic Research Group of Theoretical Physicists/ Researc, NAVI MUMBAI, MAHARASHTRA India)

While "Time" has been a subject of "Scientific Thought", since antiquity, this paper brings out the idea that "Time" constrains "Consciousness" itself. This connection is evident for the cosmological time scales through which the human brain emerged - as a consequence of evolution. The connection is also there for the millisecond time scales of neural firing - and the emerging cognitive aspects. Sudarshan and Mishra in 1977, published a paper entitled - "The Zeno's paradox in quantum theory". The "Quantum Zeno Effect (QZE)", allows transition of a quantum system from one state to another - to be arrested or slowed by measuring it frequently. It has been experimentally verified in a number of different settings. Wave function of a quantum system gets entangled with the wave function of measuring devices such as cameras, computers, eyes, and even brain. This sequence of measurement apparatus may be called the "Quantum Measurement Chain (QMC)". Von Neumann postulated that conscious observer is responsible for the outcome of the measurement. Two conscious observers lying at ends of two Quantum Measurement Chains - having a common origin (such as the Schrodinger's cat) - should see compatible outcomes. This can be regarded as an instance of "Non-locality" and "entanglement of different observers". Otherwise, the situation is, as it would be in the Everett's Many World Interpretation (MWI). Popper accedes, that changes in knowledge occur gradually, but being an evolutionist, he feels that the changes began billions of years ago, many of which are inbuilt in the structure of sense organs and brains - and that this series of changes in knowledge will continue indefinitely. When one combines, Popper's concept of gradual change in human knowledge, with Poincare's concept of result of a series of changes being a cycle, one is lead to epistemology in cyclic time. As human knowledge arises by observation and interpretation, a function of mind and intellect, therefore, the driving force behind cyclic change in human knowledge must be cyclic changes in perspicuity and purity of the human mind and intellect - as well as an ontology augmented with scientific instruments. While the changes in knowledge are accompanied by changes in brain - the quantum mechanical brain states themselves would get frozen if monitored at sufficiently small space-time intervals. This postulated phenomenon may be termed the Neuro-Biological Quantum Zeno Effect (NBQZE). Its experience would be akin to that of a yogic trance state. P2

82 Consciousness's Epistemic Categories: A Perspective to Understand the Phenomenology of the Integration of Knowledge in the Consciousness Ulisses Schlosser 
 culisses.schlosser@gmail.com> (Center for the Higher Studies of Conscientiology, Foz do Iguacu, PR Brazil)

How would it be possible to constitute appropriate epistemological foundations for the research of the phenomena of consciousness? This perspective would need a basis capable of including a rather broad phenomenological spectrum. Somehow, this spectrum should include cognitive phenomena in general, altered states of consciousness, extra-sensory perception, and many others. Most likely, the epistemological basis of the science of consciousness is related to the roots of the primary construction of knowledge that enables the emergence of the very phenomenon of consciousness. This paper aims to propose a way of construction and the identification of categories of phenomena indispensable for the constitution of primary types of knowledge, supposedly part of what is thought to be the consciousness. The relevance of this proposal is the possibility

of establishing a common research base for phenomena that are currently treated in different areas such as extra-sensory perception, cognitive sciences and phenomenology itself, among others. The term "epistemic category" is being proposed here as a concept encompassing real, hypothetical and functional elements in an attempt to identify the most elementary and generating categories of knowledge of the phenomenon of consciousness. The categories initially identified are already known in philosophy and science. But the challenge is to re-examine the relevance of the already-known categories and see if there are more categories in the same condition. For this purpose, the new proposal is the epistemic structuring based on two main aspects: (1) The epistemic unity or the fundamental entity for one or more categories (e.g. the mental image). (2) Criteria for forming the epistemic category. The phenomenon must meet the following criteria to be classified as epistemic category: (i) Category. It must constitute a clearly distinct function from others in the field of cognitive functions. For example, perception is not memory; memory is not imagination, among others. (ii) Sine qua non. It must refer to a function that without which knowledge does not constitute itself or cease to exist. For example, without perception no knowledge is constituted. (iii) Taxon. In the supposed category must be found an element with basic function in cognition and with the possibility of representing classification unit. The percept, for example, can be considered a taxon of real existence in the subtle cognitive physiology of consciousness. (iv) Attribute. The taxon must develop a function capable of attributing quality to the manifestation of consciousness. Perception, for example, is a consciential attribute that makes it possible to distinguish sub-phenomena. Perception, memory, and imagination may be examples of epistemic categories. Percepts, as perceived mental images, are the taxa of perception. The engram, as an archived mental image, is the taxon of memory. The represented mental image is the taxon of the imagination. Other categories can be reverified and others more identified. Other phenomenological entities may be identified. Scientific guidance through the epistemic categories seems to have the potential to signal priority problems in the research of consciousness. P2

**83 Information: The Key to Life and Consciousness?** Scott Ventureyra <scott\_ventureyra@ hotmail.com> (Theology, Dominican University College, Ottawa, ON Canada)

There is a deep and complex interrelationship between the origin of life, qualia, self-consciousness in organic living beings such as mammals like dolphins and human persons and artificial intelligence (AI). Human self-consciousness/awareness has precipitated higher cognitive capacities for introspection and the ability to think deeply about the natural world and the mathematical structure that governs it. These moments of origination seem to be inextricably linked, but how? A purely materialistic explanation has not been forthcoming, neither has a naturalistic one to explain the first three phenomena. For AI, at least in its initial form, we know for a fact, that agent causation is required. These phenomena have been explored by many competent thinkers including: Fred Hoyle, Chandra Wickramasinghe, Hubert Yockey, Francis Crick, Freedom Dyson and Bruce Damer on the origin of life studies; Erwin Schrodinger, Vilayanur S. Ramachandran, William Hirstein, Thomas Nagel and David Chalmers on qualia; Gordon Gallup Jr., Joshua Plotnik and Frans de Waal on the mirror self-recognition test to measure levels of self-awareness; Junichi Takeno, Igor Aleksander and Stephen Thaler on measuring self-awareness and related issues in artificial intelligence. The following questions still haunt us: how can inanimate matter begin the process of self-replication without information to provides the instructions to do so? Does chance, physical law or the combination of the two provide a sufficient explanation? Does agent causation provide a viable inference to the best explanation for the origin of life? Similarly, how do physical brain processes give rise to conscious subjective experience (qualia), i.e., the hard problem of consciousness? And finally, how does self-consciousness even emerge from qualia? Neuroscientist Antonio Damasio has argued that self-consciousness depends on qualia. Likewise, qualia depends on the emergence of life. Each step is dependent on its antecedent, at least in the case of embodied material existence. In my estimation, the unifying principle is information, i.e., information rich systems. David Chalmers has suggested precisely the same thing in The Conscious Mind, when he stated: "I do not have any knockdown arguments to prove that information is the key to the link between physical processes and conscious experience, but there are some indirect ways of giving support to this idea." Why should we agree with Chalmers? Over 20 years later, we are still searching for this glue to reality. Are there some more direct ways available to us now? Which

understanding of information? Luciano Floridi's philosophy of information will be of use in providing clearer demarcations. Yet, where does the key lie? Shannon Information? Kolmogorov's Theory of Information? Complex Specified Information? Integrated Information Theory? Psychophysical Semantic Information Integration? This endeavor will explore the different possibilities available to us. Moreover, this study will attempt to bring to the fore some insights into the nature and relationship of information to these four singular events throughout cosmic evolution. **P2** 

# 1.11 Personal identity and the self

84 The Mind: A Society of Agents Keith Elkin <tsc@webetize.com> (Frederick, MD) The objective of this article is to discover and explore less hierarchical and less centralized minds thus widening what we understand as the Mind. Various authors have compared the Mind to a society. It is generally agreed upon that a large ensemble of neurons, sometimes known as a "workspace" generates a solution to the problem at hand. The Mind is often discussed in association with consciousness; however it is in the subconscious that most of the Mind performs its miracles. A society of Mind is a set of relationships either structural or processal that have emerged from the physical. The word Mind is anthropocentric, or animal-centric, and would be better understood as a society of agents. By recognizing that there are different kinds of minds, we can gain a deeper understanding of what a Mind is. For example, a motor protein, a slime mold amoeba, or an ant are examples of agency in their respective societies, each society forms a Mind. These three represent three minds that do not meet the traditional definition. The smallest agent in the society of the cell is a group of proteins known as motor protein. These proteins "crawl" along a microtubule carrying packages like mitochondria, polymers, and other vesicles. The many times larger agent is the amoeba which digests bacteria and moves by extending pseudopods. Under stress the cells aggregate to form a slug that acts as one. Among the eusocial insects, the optimization of the foraging agents in an ant colony has been well studied. However the Mind of the entire colony is less apparent. For example, how does an ant colony decide to move the entire colony? The decision affects and drives the colony as one but without a single decision maker. The set of constraints that limit the ant colony generate the freedom for the colony to move. In an anthropocentric vocabulary, the constraints (the need) generated the thought of moving. This decision is typical of what we consider to be a decision made by a Mind, not yet clearly intentional, the colony exhibits Will and decision making as a whole. It is the constraints that give the direction of change which is a type of permanence. Further development and evolution leads to more sophisticated constraints and to messaging (language). Each of these examples represents a model agent society. Just as we use model organisms in science, we can use simple minds to study our Mind. Finding the agents, their properties, their relationships and discovering the sociology of a "network of agents" is a key approach to understanding larger minds. Emergent Computation and Network Motifs offer two tools to finding the supporting relationships. Analyzing a wider spectrum of minds gives an opportunity to define the Mind. Challenging the typical definition of "Mind" is the first step. Discovering or rediscovering the "societies of agents" that make decisions for the "whole" will give us a better understanding of the Mind. P1

**85** Consciousness as Interbeing. Tomas Frymann , Sophie Whitney; Sean Groark; Kendra Terry; Simon Choi; Micheline Anderson; Suza Scalora; Lauren Folley; Lisa Miller <tfrymann@gmail.com> (Clinical Psychology, Columbia University, New York, NEW YORK )

There is a perspective which holds that all of life is not only 'inter-connected' but also 'inter-experiencing' each other. From this point of view consciousness is singular (one inter-connected whole) and arises through all first person experiences in a given moment simultaneously (inter-experiencing). This idea is captured by the term 'Interbeing.' Any individual self embracing this lens understands her existence as arising through all other selves as much as through her own - and as such holds the Golden Rule (treat others as you would treat yourself) inherently in her sense of identity. While a number of self-transcendence and spirituality scales have been developed, none explicitly and directly address this core conceptualization of interbeing in perception of self. The purpose of this preliminary pilot study was to formulate an Interbeing Scale (IS) and its sub-scales. This preliminary study helps to build internal and ecological validity of the overall

scale and sub-scales. As a first step, the IS was delivered to a pilot sample of 43 adults through an online survey. Exploratory Factor Analysis (EFA) was then used to derive an underlying dimension of Interbeing, which was extracted and correlated with outcome variables. Alphas showed strong internal validity. The correlations between IS sub-scales and compassion, giving, and inspiration suggest the possibility of ecological validity. The preliminary study supports the helpfulness of a larger scale data collection as a next step in the scale development of the IS. **C18** 

86 Gender as Qualia: How the Free Energy Principle Applies to Transgender Experience. SJ Langer <slangerlcsw@gmail.com> (Art Therapy & Humaniti, School of Visual Arts, New York, NEW YORK )

My clinical work with trans people in psychotherapy has led me to theorize that core gender is an aspect of consciousness. There are no cases in the medical literature of a person's gender identity changing as the result of a brain injury or lesion. This directed me towards a theory of gender as qualia as opposed to an aspect of personality. The feeling of gender incongruence is not only based on visual incongruence but interoceptive sensations and one's predictions regarding those sensations. The free energy principle will be used to explain why and how transgender people feel and experience their gender differently than cisgendered people through predictive coding. Using the scaffolding of Damasio's formulation of consciousness, I will demonstrate how gender is a foundational element of consciousness primarily integrated through the insula. Core gender develops along with the proto-self in lower level consciousness. One's ability to identify, in articulated language, gender identity emerges out of core consciousness which forms the core self in the present tense. Then the autobiographical self, with its ability to have a past and future, consolidates one's identity and gender expression as it relates to culture. Working from a frame of the psychophysical nature of gender through interdisciplinary theorists such as Damasio, Craig, Edelman, Friston and Tsakiris, This presentation will plumb these theories to develop a model of gender in consciousness, establishing how gender is an essential aspect of humanness which springs from the mind's understanding of the body. C21

**87 Is Subjective-self Physical Or Psychological?** Jinchang Wang <jinchang.wang@stockton. edu> (School Of Business, Stockton University, Egg Harbor City, NJ )

The kernel of human consciousness is self-consciousness which is the awareness of self subjectively. What subjective-self is or what "I" is has remained as a hard-core issue in philosophy in thousands of years. Is "I" physical or psychological? We explore subjective-self by critically reviewing thought experiments of Kurzweil, Nagel, Parfit, Holt, and Williams, respectively. We reason logically that (1) subjective-self is not just "hardware" which is composed of physical things such as a blob of brain cells; (2) it is not just "software" such as a bundle of memories and psychological perceptions; and (3) it is even not simply the unity of hardware and software, i.e., "I" is more than hardware and software combined. Although we do not know yet what the third constituent of "I" is other than hardware and software, deriving that "I" is more than hardware and software, we would not expect electronic computers and robots, which are just composed of hardware and software, to possess subjective-self or self-identity. Electronic robots, therefore, will not be self-aware and self-conscious, no matter how intelligent they will be. **P2** 

#### 1.12 Free will and agency

88 Time, Music Improvisation, Altered State of Consciousness. How Can the Conception of Time During Altered State of Consciousness or Music Improvisation Help Us Understanding Free-will and Creativity? Alix Noel Guery ilix@bu.edu> (University of Montreal, Montreal, QUEBEC Canada)

Csikszentmihaly (2004) and Limb (2008) show that the brain states during altered states of consciousness are similar to the ones during musical improvisation. According to Grinberg-Zylberbaum (1991), reality is a product of the interaction between our neuronal field and the lattice - the homogeneous field of energy in which the information of its totality converge in each point. How do traditional cultures use the conscious training of our unconscious mind through altered

state of consciousness, rhythms, musical improvisation, and especially ternary musical structures (of three-beat time signatures), to access the information of this field? Hence, how does the system 2 of Kahneman (2011) need the contribution of system 1 to be free and creative and how does this contribution pass through states of flow or altered states of consciousness and their perception of time? How are the concepts of free-will and agent causation linked to creativity and those states, knowing the new interpretation of Libet experiments by Schurger (2012)? How can altered states of consciousness, states of flow and the Doubling Theory of time of physicist Garnier-Malet (2006) help us understanding free-will and creativity? **C15** 

**89** A Mathematical Basis for Rational and Logical Cognition. Suketu Patel <suketupatel23@gmail.com> (New York, NY )

My argument purports that for rational behavior to transpire a requirement is restrictions on behavioral possibilities. These restrictions are moral and social rules that are both innate and learned. They lay the groundwork for cooperative behavior and create the internal dilemma that culminates to a rational decision. This paper puts forth a phylogenetic and ontogenetic rooted theory for how humans can logically reason and in-turn build complex tools. By using quaila and valence theory I illuminate the relationship to empathy, morality, and altruism. My examination shows how hominin sociality provided the rudimentary skill for an intentional agents capacity to behave rationally. The rudiments of mathematical cognition begin with the ability to subitize quantities to later being able to enumerate them. With increased proficiency, subitizing and enumerating allow for our incredible tool building aptitude as well as directly contribute to our rational decision making. A massive step in our evolution is when anatomically modern humans became behaviorally modern. We see this through archeological artifacts, artwork, and tools such as Lebomba and Ishango bones that are etched with enumeration marks. These tools and subsequent human behavior provide evidence that the capacity for infinite enumeration is the foundation of our pioneering intelligence. My argument purports that for rational behavior to transpire; the requirement is restrictions on behavior. These restrictions are moral and social rules that are both innate and learned. They lay the groundwork for cooperative behavior and create the internal dilemma that culminates to a rational decision. The central mechanism that allows individuals and agents to learn these restrictions is rooted in value learning which begins with the valence judgment of experiences. This valence judgement is the basis for moral underpinning within humans. Would free will if there was no mechanisms to prevent every decision ensuing to a type of self-preserving behavior? Ultimately, we live with free will and are rational agents because we can behave both rationally or irrationally through restrictions imparted by empathy and morality. Although moral values vary from individual to individual, it still guides our rational decisions and actions. Even if we choose to act against its notions; the mental restriction creates the internal state of rationality. The significance of this paper is that it puts forth a substantiated theory for how humans can logically reason and in-turn build complex tools. The analysis examines the gradient of behavioral ranges of animate matter in order to uncover how evolution created human level intelligence. Basic mathematical concepts are not only present in computing experiences; they are also the building blocks of our rational behavior. P1

**90 Evolution of Volition / Mind's "i" / "eye".** Sundaram Ramchandran <zenkalidas@yahoo. com> (NA, Bangalore, KARNATAKA India)

Idea of Consciousness / Self - arising out of interaction / synchronization between coupled oscillators. The above leads to emergent modes which could have correlates with mental processes at various levels It is the interaction between these modes at some level which leads to consciousness Similar to ideas from physics (particles interacting by exchanging quanta of the particular field, for example photon) But common sense tells us that these modes have to be physically located (Embodied cognition etc) (Menon et al) Links to the ideas of "Ecological self" (Menon et al) , coevolving "lower level subselves", the ideas of multilevel "koshas" with parallels in Systems Biology (pathways, physiological processes etc) Could the subjective notion of "I" be linked to a point of view like an input light being incident on a holographic screen leading to reconstruction of object? Possibility of some kind of holography (possibly including free space versions) involved at cellular level consciousness with any cell having some kind of basic signal

and image processing and object recognition capabilities Possibility of some kind of frauhnofer diffraction being involved. (Links to gaudapada's ideas) Could the above be linked to the out of body experience? The ideas of self as manifold with links to the ideas of possibly multiply connected loci of self Physics has long moved away from the idea of naive causation, for example Eulerian formulation of laws giving way to lagrangian ones, the notion of extremal principles, three body problem, the ideas of degeneracy of eigenvalues, etc. Philosophers of QM have tried to involve some form of consciousness in the collapse of the wave function. But even otherwise, consciousness / free will is involved in the choice of basis states and transformations between the sets of basis states. (Consciousness as the "Operator " Links to the ideas of Consciousness / Free will as perturbing the vector of probabilities (Srikanth et al) A related idea could possibly be change (possibly deformation) of the basis functions. Mechanisms of consciousness? Conceptual and Perceptual Networks Conceptual and Perceptual differential equations The idea of a display cum mirror cum transparent looking glass as mirroring the workings of consciousness POEMS The living mind Dark skies, Fertile soil, Pollination, Fertilisation, Life unfolds. Experiences, Sensation, Perception, Knowledge, Realisation Mind unfolds Words Words, Fluid, Slippery, Mingle, merge and flow To erode and create spaces and deep recesses where they echo and vibrate Like air in half-filled cups Words tangle and entwine in the Reader's Mind And meaning emerges from the chaotic/pre-biotic soup Magic potion Can you give me a drink that will take me to the fifth dimension? The ethereal worlds have given me an invitation I have a chance to cross the heavenly ponds And travel to the worlds beyond If i can this flight board I can, the celestial bridge, ford P2

# 1.13 Intentionality and representation

**91 Self-representation Paradoxes In Physical and Cognitive Systems.** Adam McKenty <a href="mailto:<a href="mailto:adam@photosynthesis.ca">adam@photosynthesis.ca</a> (Photosynthesis Consulting, Mansons Landing, BC Canada)

In this paper we investigate the relationship between self-representation (the capacity of a system to contain a representation of itself) and a class of well-known paradoxes that includes the Liar's Paradox, Godel's incompleteness theorems, Russell's paradox, and others. Classic paradox-es involve boolean values of true/false, provable/unprovable or membership/non-membership in a set. How do boolean paradoxes relate to non-boolean (typically real-valued) self-representation conditions inside artificial or biological perceptual/cognitive systems? We begin by investigating a simple example system of a 2D screen and an input such as a camera. We show how boolean paradoxes can be implemented in a physical system of non-boolean values. We then investigate a few implications for cognition, and for research into cognition and self-representation in the human brain, and propose some novel experiments to investigate the effects of self-representation in the neurological mechanisms of perception. **C19** 

#### 1.14 Philosophy of perception

**92** Positional Symmetry - Requisite Mirror Image: The Fundamental Principle of Consciousness and Being. Ashley T. Joseph <iamtjoseph@gmail.com> (Titusjoseph.com, Atlanta, GA)

Duality confounds our understanding of reality. We need and seek a clearer lens to reconcile understanding. Positional symmetry - requisite mirror image, or PSRMI for short, is a new lens on reality that utilizes fundamental ideas from science (Chown, M., Greene, B., Gribbin, J., Hawking, S., Whittle, M., Zeilinger, A., etc.), ancient philosophy (Parmenides, Pythagorus, Heraclitus, etc.,), and, with a smidgen of spirituality; the result is a holistic conceptual framework, an arrangement, that explains consciousness, being - the forms of our perceptions, and the emerging universe of space and time. PSRMI defines a torus-shaped circuit, anchored by mirror image poles: from which the universe and all existing things are formed via the quantum entanglement processes involved in uniting mirror image poles into one. The efficacy of this new concept is that it explains the beauty and universality of symmetry everywhere in nature, and it clarifies, reconciling the paradox of duality via mirror image poles that (according to Maxwell's equations) come in pairs. By virtue of the type of mirror image poles conceived, PSRMI provides a comprehensive account for dark energy, dark matter, and the arrow of time; it discloses the

nature of the working relationship between relativity and quantum mechanics, sheds new light on universal consciousness and demonstrates how 'meaning' as an essential and necessary dimension in consciousness. **P2** 

**93** Attention!: The Affordance Theory of Salience. Tom McClelland <tom.mcclelland57@ gmail.com> (Philosophy, University of Warwick, Lawshall, SUFFOLK United Kingdom)

A cluster of empirical theories have emerged according to which attention is guided by 'salience maps' of a subject's perceptual environment. Although these theories reveal a great deal about the mechanisms behind attention they leave a number of philosophical questions unanswered. How, if at all, does salience figure in the contents of perceptual states? Relatedly, what difference does salience make to our perceptual phenomenology? And when are changes in the distribution of attention agential rather than automatic? To answer these questions, I propose an Affordance Theory of Salience. Affordances are perceptible opportunities for action (Gibson 1966), such as a teapot's property of being grippable. Soliciting affordances are those that are perceived as positively inviting us to perform the afforded act (Siegel 2014), such as Justin Bieber's face calling out to be slapped. A number of studies suggest that perceiving an affordance 'potantiates' the afforded act, thus seeing the teapot primes the motor process responsible for gripping (Tucker & Ellis 1998). The various motor signals potentiated by one's environment then compete for further processing, and the winners of this competition either get suppressed by down-stream factors or succeed in bringing about the afforded behaviour (Cisek & Kalaska 2010). By extending the concept of affordances to encompass the mental act of attending, we can offer a plausible account of salience. Salience maps represent objects, properties and regions of the perceptual field as attendable i.e. as affording attention. When an item is represented by the peak of the salience map it constitutes a soliciting affordance to attend i.e. it positively demands our attention. Those items not represented by the peak of the map are represented as available for attention without any such positive demand. Salience is thus the perceptual representation of affordances to attend. This view of the perceptual representation of salience leads me to propose that attention affordances are part of the contents of perceptual experience. And regarding agency, I suggest that stimuli 'potentiate' attention in much the same way as they potentiate motor processes. Performances of potentiated actions have an unusual agential status in that they are not initiated by the subject, but can be inhibited by them. I suggest that many acts of attention are agential to the extent that they exemplify this Libetian 'free won't'. My preliminary case for the Affordance Model of Salience draws on a range of phenomenological and empirical considerations. A comprehensive case, I suggest, would have to explore a range of promising possibilities regarding skilled attention, social attention, pathologies of attention and predictive theories of attention. C21

**94 The Prophets of The Almighty: The Educators of The Mankind.** Prem Prasad Srivastava, Prof. Savita Srivastava <deisavitasrivastava@rediffinail.com> (ESSENTIAL SERVICES (E&, Radhasoami Satsang Sabha, Dayalbagh, Agra, UP India)

The greatest power in creation which impels the masses towards righteous aims and deeds is the force of true education, brought about through the Faith's of the Prophets of God. This is a truth which the records of history testify to. In the following section are examples of their educative influence on mankind throughout history, both to prove their truth of being "Educators of mankind", but also to present to anyone who is of the opinion that "religion" is bad, that "religion" itself is actually extremely good, but like all things in creation, over time it will lose its vitality, beauty, and relevance, and will eventually fall into a condition of decay, and is then in need of renewal. The greatest power in creation which impels the masses towards righteous aims and deeds is the force of true education (material, intellectual, and spiritual), brought about through the Faith's of the Prophets of God. This is a truth which the records of history testify to. In the following section are examples of their educative influence on mankind throughout history, both to prove their truth of being "Educators of mankind", but also to present to anyone who is of the opinion that "religion" is bad, that "religion" itself is actually extremely good, but like all things in creation, over time it will lose its vitality, beauty, and relevance, and will eventually fall into a condition of decay, and is then in need of renewal. The Prophets of God are the first educators of the human race. They bestow a universal, and complete education upon man and cause him to

rise even from the lowest levels of savagery to the highest pinnacles of spiritual development. The philosophers too are educators along lines of intellectual training, however at most they have only been able to educate themselves and a limited number around them, to improve their own morals and, so to speak, civilize themselves; but they have been incapable of universal education. They have failed to cause an advancement for any given nation from savagery to civilization. Human beings, despite the great capacities they are endowed with, are still always in need of the influence of Education from a superior in order for these latent capacities to be revealed. Without this education man, would remain brutish. The original Educators of the human race have always been the Prophets of God who are the Founders of Religion. Those unique personages such as Buddha, Moses, Krishna, Christ, Muhammad and Sant Mat. Every concept of nobility and righteousness posessed by man today, has been the result of the educative influences of the Prophets of God. When one seeks "Spirituality without Religion", or "God without Religion", the "spiritual" behaviours and actions they are seeking to reveal in their own lives are in fact the result of education which mankind has derived from the Prophets of God. **P1** 

#### 1.15 Miscellaneous

**95 Jugaad Innovation in a Highly Conscious Society: The Dayalbagh Model.** DeepPrakash Chellapilla, C Vasantha Lakshmi; C Patvardhan <cdeepprakash@gmail.com> (TCS, Agra, Uttar Pradesh, India)

Science and technology have been making life more and more comfortable for mankind. The question as to whether the "average man" is happier today than a century ago is highly debatable. Even more debatable is whether the "progress" we see is sustainable as we continue to consume natural resources like there is no tomorrow. But as Einstein famously said, "We cannot solve the problems with the same level of thinking that created them". The need of the hour is out-of-thebox thinking. A highly acclaimed recent book titled "Jugaad Innovation : A Frugal and flexible approach to Innovation for the 21st Century" drives home this point quite forcefully. It says that the model of R&D and technology development in the modern world has been primarily based on high-cost scientific research. This is because the western world has primarily been blessed with abundance. What is required of a conscious society is that it solves everyday problems viz., those that are highlighted by the United National Sustainable Development programme while ensuring that these solutions do not in turn result even more intractable problems. This can be only done by a society that is highly conscious of the long term results of its actions and which is capable and conscious in its adoption of Jugaad Innovation. Doing more with less is a key aspect of such innovations. These societies are conscious of the environment, conscious of the resources, conscious that the basic necessities of life food, water, air quality are all limited and one must make them count for more in order to ensure that humanity does not face existential risk due to its own actions. The Dayalbagh Model presents such a life style model that provides a "good" life style optimizing "doing more with less". It has withstood the test of time as Dayalbagh was established more than 100 years ago. This paper describes the complete model with the innovations carried out and being carried out towards the attainment of these objectives of providing a sustainable life style model with a fulfilling life for the attainment of the goals of the individual. Low cost innovations can be seen everywhere and in every aspect of life. These aspects include housing, air and water quality, energy, education, women empowerment, waste management, utilization of local resources, alternative medicine, health and life care, security and surveillance, agriculture, dairying, development of super-conscious supermen by a special programme that starts from the age of 3 months, transportation etc. These are not necessarily new technologies or new innovations but taken together they provide for an innovative solutions to most of the problems that face the world. The way the whole system works, the way the parts seamlessly gel together without creating additional issues is the crux of the system. The whole is definitely more than the sum of its parts, as a Systems Engineer would put it. And that is the Jugaad Innovation of a conscious society. P1

**96 From Idealism to Nonduality** Deepak Chopra <carolyn@chopra.com> (Prof., UCSD School of Medicine, The Chopra Center, Carlsbad, CA )

Idealism is the opposite of materialism or physicalism, and on that basis alone science appeared to depose it. Any "mind first" explanation of the universe, as things stand today, has lost ground to a "matter first" theory, largely because physical objects yield the kind of data and measurements that science can work with. But the mind-body problem confronted physicalism with a daunting challenge: how to explain the phenomenon of atoms and molecules acquiring mind. Since "mind first" and "matter first" are both flawed the issue may be duality itself, leading to the appeal of a totally nondual system in which neither mind nor matter comes first but occupy the same ground state: consciousness. With this as our starting point, we will discuss the following: 1) Modes of knowing body, brain, and mind 2) Ending the subject-object split 3) Post-empirical science 4) Qualia 5) Eradicating the mind-body problem 6) The dead end of panpsychism 7) The relationship of micro and macro 8) The zero point and the illusion of matter 9) Timelessness as the basic value of time 10) Non-dimensional reality 11) Solving the mystery of "something from nothing" **PL11** 

**97 Vertical Thinking: The Emergence of Meaning.** Jim Dashiell <jdashiell@dashielllaw. com> (Dashiell Law Offices, Evanson, IL )

There are two aspects of thought, which I call "surface thinking" and "vertical thinking." Surface thinking is the storage, retrieval and manipulation of data, i.e., memory and pure logic and reason. Vertical thinking is the emergence and apprehension of substantive meaning, which requires consciousness. Surface thinking is done by contemporary computers; vertical thinking is not. The existence of vertical thinking is not speculative, any more than consciousness. It is something we experience directly in our own thought. The nature of vertical thinking is the topic I propose for a paper or discussion for attendees of the 2018 conference. Western thought has become fixated on the power of reason, which is limited to surface thinking. Hence, there is an understandable, but limiting, implicit assumption that consciousness can be expressed through a linear process. Computers, as we know them, are presumed able to generate and experience consciousness, once hardware and software improve. The same model of thought has been applied to the brain. The linear process that occurs within the brain is immediately perceived as the transmission of packets of energy through the brain's neural network. An understanding of the dual nature of thought reveals that the above approach is limited to surface thinking. Consciousness is more elusive and requires an additional component of thought, which I advance as vertical thinking. Dr. Hameroff's approach dares to challenge the current, limiting model of consciousness and has introduced an intriguing possibility. The mysteries of the "events" circumscribed - but not fully understood - through quantum mechanics may provide the key to identifying the mechanisms that give rise to the mystery of consciousness. This is consistent with the proposition that consciousness requires more than surface thinking. There is a credible, rational basis for the role of vertical thinking in capturing meaning and consciousness. The rationale is not a proof but a synthesis of ideas from great historical minds. This abstract focuses on the metaphysics of Kant, but the concepts are buttressed by the ideas and conclusions of many others, including Arthur Schopenhauer, Claude Shannon, Kurt Godel, and Carl Jung. Kant proposed that time and space are not independent, objective realities but mental constructs that allow us to organize the information around us. They are essential but limiting. Pure reason only allows us to observe and understand the world within the parameters of time and space. Since those limits are mental constructs, we are unable to perceive "things-as-they- really-are" through pure reason. I posit that "things-as-they-really-are" include meaning and consciousness, and that vertical thinking provides a model for the emergence of consciousness from that underlying 2 reality. Like a bubble from the indiscernible deep to the surface where it can be seen, our thoughts bubble up from this underlying reality imbued with meaning and consciousness. When uncluttered by information, meditation helps us understand that process by concentrating on a single thought as it rises into our normal conscious state. I have called this process vertical thinking C13

**98 Quantum Theology and Apocalytic AI - Deconstructing Futurist Eschatology.** Louis Lo Praeste <louis@quodfatum.com> (Philosophy, Hult International School of Business, San Jose, CA)

Given that the development, training and eventual ascension of a new kind of consciousness

is in the hands of some of the same elite that have created the most significant wage inequity since the time of the Rockefellers, I think it is in the interest of the "average person" to monitor these developments closely. Specifically, I wish to inquire whether or not we have thoroughly weighed the possibility that the progenitors of artificial intelligence, who are predominantly male and from a western, Judeo-Christian background, can be trusted to create an ethical AI that understands the global context into which it is being "born." The technology of artificial intelligence and the hype that surrounds it are invariably tied to Judeo-Christian-Islamic heritage. And so, much of the hyperactivity around its emergence can be attributed to an apocalyptic and messianic worldview which, contrary to popular opinion, emerges from and on the whole is reconciled with the scientific method. Problematically, the Judeo-Christian-Islamic worldview posits a binary and dualistic conception of the future. There are two primary views, e.g. The new consciousness (messianic) will "save us and the world," or more harmfully through an apocalyptic lens, "the emergent consciousness will destroy us and the world." What I am saying is that the "end-game" for AI appears to be no different from the teleological ends of western and eastern theology. Both Judeo-Christian-Islamic (Abrahamic) and Eastern models posit that holy living or "spiritual life" will lead to either liberation during or after this life. If you are a Jew, a Christian or a Muslim, you go to heaven or hell when you die. If you are a Hindu, Jain or Buddhist, you achieve moksha, or liberation if you live an upright life and if you do not, you are reborn again into suffering (samsara). Messianic or Apocalyptic AI is no different from the eschatological theologies of the ancient east and west. In the messianic/apocalyptic AI version, an artificial sovereign (a techno-Christ if you will) solves all of our problems, as we transport our consciousness to a place (virtual reality) where our happiness is endless. Presumably, we will have an infinite capacity for knowledge - akin to the myth of the Tree of Life from which Adam and Eve ate. In the same liberation narrative - we achieve an advanced state of consciousness that supersedes our limited, human outlook. (enlightenment). The goal of adherents of artificial intelligence is not radically different from that of Western and Eastern theologians. P2

**99** The Economics of Consciousness and its Quantum Interpretation. Ad van de Gevel, Tilburg University ad.vandegevel@uvt.n; Charles Noussair <cnoussair@email.arizona.edu> (Economics, University of Arizona, Tucson, AZ)

Consciousness is implicit in accepted models of economic decision making, and understanding the nature of consciousness is, in our view, essential for economists. Quantum mechanics is a standard framework for describing the universe at the level of atoms and subatomic particles, and can be applied to model mental processes. It is the purpose of this paper to contribute to a quantum physical interpretation of the economics of consciousness. We argue that developments in science, particularly in physics, necessarily bring about changes in the dominating economic paradigm. The starting point of our discussion is that quantum theory might be needed to fully understand how the brain works. After reviewing the relevant quantum mechanics, we note that the mechanism by which the brain produces consciousness remains mysterious. The hard problem of consciousness (Chalmers, 1996) requires the bridging objective description and subjective experience. The processes of memory, emotions, meditation, daydreaming, trance, motives and other psychological processes provided by consciousness, are all relevant to economic decision making. Furthermore, the boundaries between conscious and subconscious decision making are very important to establish, as the majority of consumption decisions thought to be subconscious in nature. (Lindstrom, 2015; Soon, 2008). The relationship between consciousness and decision making is becoming ever more important with the potential advent of artificial consciousness, and the fact that ever more decisions in our economy are made by artificial agents. Understanding this connection hinges on whether consciousness necessarily goes hand-in-hand with sophisticated computation. Legal and ethical questions then arise regarding whether consciousness guarantees moral and ethical rights to an entity, even when the consciousness is artificial. We consider the implications of Integrated Information Theory and Panpsychism for economic modeling. Finally, we discuss the possibility of quantum economics as an emerging field. Quantum economics allows individuals to have preferences that are not fixed, models individuals as part of an entangled system, and recognizes that individuals' decisions exhibit an uncertainty that seems to follow a quantum logic. The economic quantum, as it may be understood in this framework, is the energy

of an individual person that results in the creation economic value. We discuss how the economic environment and institutions interact with this quantum. **P2** 

# 2. Neuroscience

# 2.01 Neural correlates of consciousness (general)

100 Connectome-harmonic Signatures of Consciousness. Selen Atasoy, Robin L. Carhart-Harris; Anira Escrichs; Gustavo Deco; Morten L. Kringelbach <selenatasoy@gmail.com> (Center for Brain and Cognition, University of Oxford, Oxford, United Kingdom)

Harmonic patterns are ubiquitous in nature, emerging in various physical and biological phenomena ranging from acoustics, optics, and electromagnetic interactions to morphogenesis. Recently, brain activity in awake, resting state is also shown to follow stable harmonic wave patterns emerging on the anatomical connectivity of the human brain [1]. These harmonic waves, called "connectome harmonics" reveal fully synchronized patterns of cortical activity accompanying different frequency temporal oscillations. More importantly, they yield a novel frequency-specific language to describe brain activity. Just like decomposing a musical piece into a combination of musical notes, connectome harmonics enable the decomposition of functional neuroimaging data (e.g. fMRI, MEG, EEG) into the set of connectome-specific harmonic waves [2,3]. In this work, we show that the decomposition of brain activity measured in functional magnetic resonance imaging (fMRI) in different states of consciousness into the connectome harmonics reveals their characteristic neural signatures. Remarkably, enhanced states of consciousness such as psychedelic-induced altered states correspond to an expanded repertoire of these harmonic brain states [3], whereas this repertoire collapses into a narrow range of low frequency connectome harmonics in loss of consciousness [2]. Notably, connectome-harmonic signatures of the psychedelic state and the meditative state reached by experienced meditators during mindfulness meditation show remarkable overlap indicating the potential common neural correlates underlying these two altered states of consciousness. [1] Atasoy, S., Donnelly, I., & Pearson, J. (2016). Human brain networks function in connectome-specific harmonic waves. Nature Communications, 7, 10340. http:// doi.org/10.1038/ncomms10340. [2] Harmonic brain modes: a unifying framework for linking space and time in brain dynamics (2017) Atasoy, S., and Deco, G., and Kringelbach, M. L., and Pearson, J., The Neuroscientist, 1073858417728032. [3] Connectome-harmonic decomposition of human brain activity reveals dynamical repertoire re-organization under LSD. (2017) Atasoy, S., Roseman, L., Kaelen, M., Kringelbach, M.L., Deco, G. & Carhart-Harris, R. L., Scientific Reports 7:17661. doi:10.1038/s41598-017-17546-0. PL7

101 Informativeness of Auditory Stimuli does not Affect Eeg Signal Diversity. Michal Bola, Pawe Orowski, Karolina Baranowska, Michael Schartner, Artur Marchewka <michalbola@gmail.com> (Warsaw, Poland)

A prominent hypothesis states that diversity of brain activity constitutes a neuronal correlate of the global state of consciousness. Indeed, it has been shown that, in comparison to resting wakefulness, neuronal diversity is decreased during unconscious states (Casali et al., 2013), whereas during psychedelic experiences it is increased (Schartner et al., 2017). However, a key step in establishing explanatory correlates of consciousness concerns finding a mapping between neuronal correlates and phenomenological properties (Seth, 2009) thus, in this case, between neuronal and phenomenological diversity. In the present study we varied an information rate processed by the subjects and hypothesized that greater information rate will be related to richer and more differentiated phenomenology and, consequently, to greater signal diversity. To test this hypothesis we designed a study in which speech recordings (audiobooks) were presented to subjects at five different speeds (65%, 83%, 100%, 117%, 135% of the original speed). By increasing or decreasing the speed of recordings we were able to, respectively, increase or decrease the information rate. We also included a backwards presentations (preserved sensory features of speech but no meaning) and a resting-state condition (no auditory stimulation). We tested 19 healthy subjects and analyzed the recorded EEG signal (64 channels) in terms of Lempel-Ziv complexity (LZs). We report three main findings. First, contrary to our hypothesis, when comparing LZs among five

speeds of an audio presentation we found no significant effect of information rate on diversity (F(4)=3.49, p=0.47). Second, we found a significant effect of a condition on LZs (F(2)=8.0, p=0.018) when comparing meaningful speech (100%), meaningless speech (backwards), and a condition of no active processing (resting-state). Post-hoc tests indicate that LZs during a resting-state was greater than during both a 100% condition (Z(18)=3.0, p=0.002) and a backwards condition (Z(18)=2.37, p=0.035). Finally, topographic analysis indicates that two clusters of electrodes exhibited greater LZs during a resting-state condition: a centro-parietal cluster extending laterally and a more focal centro-frontal cluster. We thus speculate that greater diversity of brain activations during resting-state might be related to mind wandering and spontaneous thoughts. C5

**102** Metacognition After Traumatic Brain Injury. Leslie Burton <leslie.burton@uconn. edu> (Psychology, University of Connecticut, Stamford, CT )

Metacognition, or knowing about knowing, includes skills such as self-monitoring, self-awareness, and self-evaluation. There is converging evidence that the frontal lobes play a critical role in these skills, and some data are presented which further support this idea. In the present data, frontal lobe functioning is shown to be related to self-evaluation in terms of confidence ratings on a face recognition task in patients with traumatic brain injury. The findings are discussed in the context of theories of self and consciousness, including Dehaene and colleagues global neuronal workspace theory. **P1** 

103 Effect of Cholinergic and Noradrenergic Stimulation in Prefrontal and Parietal Cortices on Level of Consciousness. Jon Dean , Dinesh Pal, Tiecheng Liu, Christopher Watson, Anthony G. Hudetz, George A. Mashour <jgdean@umich.edu> (Molecular/Integrative Physiology, University of Michigan, Ann Arbor, MI )

There is current controversy regarding the role of the prefrontal cortex versus parietal cortices in consciousness. Although clinical and correlative data have been used to discount as well as posit a critical role for both of these cortical areas in consciousness [1-3], there have not been any studies to demonstrate a causal link. We used anesthetic-induced unconsciousness as a model system to study the effects of cholinergic or noradrenergic stimulation of prefrontal and parietal cortical areas on level of consciousness in rats. Male Sprague-Dawley rats were surgically implanted with electrodes to record cortical electroencephalogram from frontal, parietal, and occipital areas. A microdialysis probe was implanted in either prefrontal cortex, posterior parietal cortex -- a somatosensory area, or medial parietal association cortex -- an area implicated in attentional processing [4], for the reverse dialysis delivery of either 5mM carbachol (CARB; a mixed cholinergic agonist) or 20mM noradrenaline (NA) and simultaneous quantification of changes in local acetylcholine levels during continuous exposure to sevoflurane (1.9-2.4%) anesthesia. In addition, we used a pulse oximetery system to measure the changes in respiration and heart rate. CARB delivery into prefrontal cortex (n=11) produced signs of wakefulness in all the rats and was accompanied with electroencephalogram activation as well as a large increase in local acetylcholine levels (p < 0.001) and respiration rate (p = 0.002). In contrast, CARB delivery into posterior parietal cortex (n=11) did not produce wakefulness but did cause electroencephalogram activation and increase in respiration rate (p=0.002), as well as small yet significant increase in local acetylcholine levels (p=0.006). Similar to posterior parietal cortex, CARB delivery into medial parietal association cortex (n=8) did not produce signs of wakefulness but did cause electroencephalogram activation, as well as a significant increase in respiration rate (p=0.004), however did not cause a significant change in local acetylcholine levels (p=0.86). NA delivery into prefrontal cortex (n=11) or posterior parietal cortex (n=11) did not produce any signs of wakefulness. However, similar to CARB delivery, NA delivery into prefrontal and posterior parietal cortex did produce electroencephalogram activation, increase in respiration rate (p<0.01), and increase in local acetylcholine levels (p<0.001). These results suggest a critical causal role for prefrontal cortex in modulating levels of consciousness. References: 1. Boly et al (2017) J Neurosci 37:9603-9613 2. Odegaard el al (2017) J Neurosci 37:9593-9602 3. Koch et al (2016) Nat Rev Neurosci 17:307-21 4. Reep and Corwin (2009) Neurobiol Learn Mem 91:104-113 C17

104 Estimating the Integrated Information Measure Phi from High-density Electroencephalography During States of Consciousness in Humans. Hyoungkyu Kim , Anthony G Hudetz; George A Mashour; UnCheol Lee <hyoungkk@umich.edu> (Anesthesiology, University of Michigan, Ann Arbor, MI)

The integrated information theory(IIT) proposes a quantitative measure, denoted as phi, for the amount of integrated information in physical systems, which has an identity relationship with consciousness[1]. In terms of neural instantiations of the theory, IIT predicts that the loss and recovery of consciousness are associated with, respectively, the breakdown and recovery of integrated information in the brain [2,3]. To address the change of phi in 128-channel human EEG and the relationship between functional network structure and phi, we used three anesthetics (ketamine, propofol, and isoflurane) with distinct neurophysiological mechanisms to modulate consciousness across various states; conscious, sedated, non-responsive, burstsuppression, and recovery. We developed a practical method to estimate phi from high density EEG that circumvents current limitations and then subsequently compared with functional connectivity network in the various levels of consciousness modulated with anesthetics. First, we examined phi in the context of conventional EEG measures such as power and connectivity of six EEG frequencies. Second, we examined the relationship of phi to EEG network properties, strength and topology of functional connectivity by using weighted PhaseLagIndex[4]. Third, we investigated the effects of the dose and the type of anesthetics on regional phi in the brain (Figure 1). High network degree and phi in the posterior region were disrupted during unconsciousness, and the return of network degree was faster than phi in the recovery. These data suggest that, for the emergence of consciousness, the topology of the network might be a more important determinant that precedes and creates conditions for integrated information. C5

105 Unity of Consciousness and the Role of the Thalamus. Lukasz Kurowski <luxterek@ hotmail.com> (Philosophy, York University and Centennial College, Toronto, Ontario Canada)

Over the last 25 years, there has been a renewed and rich interest in the science of consciousness (Aru and Bachmann, 2015) and a considerable part of the research has concentrated on the search for the neural correlates of consciousness (NCC) (Tononi and Koch, 2015). As important as this research has been, not much attention has been devoted to the neural correlates of the unity of consciousness (NCUC). I propose that in order to uncover the NCUC, more research needs to focus on the relationship between creature consciousness or wakeful awareness and contents of consciousness. Even though there are many instances where unity of specific contents of consciousness or object-unity breaks down, such as in the cases of apperceptive agnosia (the inability to perceive whole objects, like figures, words or letters); Balint's syndrome (the inability to perceive continuous motion); or associative agnosia (the inability to see whole objects even after tracing accurately each line of an object), the unity of creature consciousness or the unity of a wakeful awareness, in which specific contents are disunified, remains unified. In other words, creature consciousness can unify disunified contents of consciousness. However, damage to the thalamus seems to knock out both creature consciousness (Laureys and Tononi, 2009) and with it any contents of consciousness. The thalamus plays a pivotal role in vegetative state and drug-induced anesthesia (Langsjo et al., 2012). The thalamus also performs a few other vital roles at the neuro-functional level, which seem to be vital for sustaining unity of consciousness. For example, many contents of consciousness are represented or mapped out across the cortex; the thalamus is equipped with rich bidirectional feedback neuronal loops that connect with virtually every cortical area, and by doing so, the thalamus collects and updates information about motion, colour, object recognition, sensory and motor features, memory and decision making (Jones, 2007). Moreover, the thalamus is equipped with core and matrix neurons (Jones, 2009). The core neurons are responsible for relaying information within specific sensory and motor circuits. The matrix neurons are responsible for binding the neural activity of the thalamus with various neuronal activities across the cortex. This function, in effect, results in thalamocortical functional synchrony (Llinas, 2001). The thalamocortical circuitry also performs two modes of activation: tonic and burst. Tonic promotes wakeful awareness or creature consciousness, and burst promotes drowsiness. In the tonic mode, thalamocortical and cortico-cortical synchronizations are bound

together by the matrix neurons. According to this model of activation, the thalamic reticular nuclei with the brain stem's arousing system, sustain thalamocortical synchronization either at 20-70 Hz (which correlates with creature consciousness) or at 2-4 Hz (which correlates with deep sleep). Thus, the thalamus performs two main functions: (i) via its neuro-functional activity, it generates and sustains creature consciousness, and (ii) via feedback neuronal connections with various cortical areas it performs and sustains a rich information exchange, which results in a unified state of consciousness (creature consciousness plus contents of consciousness) filled with information represented or mapped out outside of the thalamus. **C12** 

**106** Dynamic Cortical Connectivity during General Anesthesia: a Translational Study of Healthy Volunteers. Duan Li, Phillip Vlisides, M.D.; George A. Mashour, M.D., Ph.D.; Professor, Department of Anesthesiology, Senior Associate Chair, Research, Bert LaDu Professor of Anesthesiology, Director, Center for Consciousness Science

University of Michigan, Ann Arbor, MI The ReCCognition Study Group duan@umich.edu> (Anesthesiology, Department of Anesthesiology, Center for Consciousness Science, University of Mi, Ann Arbor, )

Recent studies of consciousness and anesthesia have focused on functional brain dynamics and connectivity patterns. For example, the shift of alpha power from posterior to anterior cortex and the functional disconnection of anterior and posterior regions have been associated with unconsciousness induced by various anesthetics. These studies typically employ either 'long but light' or 'deep but brief' anesthetic protocols in healthy volunteers, and investigate the time-averaged patterns of functional connectivity in epochs of a few minutes. It is unclear if these connectivity patterns can still be observed in a clinically-relevant context, but without the confound of surgical intervention. Furthermore, it is unknown if the patterns are static or time-resolved during the prolonged period of anesthetic exposure at concentrations required for major surgery. To address this question, we analyzed 32-channel electroencephalography in 30 healthy participants who underwent induction of anesthesia with propofol followed by three hours of age-adjusted 1.3 MAC of isoflurane anesthesia. The functional connectivity was estimated by using debiased weighted phase locking index (wPLI) at a 30-sec window with a 10-sec step; at each window, the burst-suppression pattern (BSP), if present, was detected and quantified. Spectral profiles of wPLI between frontal and parietal, and prefrontal and frontal channels across all the non-BSP windows and participants were concatenated and subjected to principal component analysis (PCA) for dimensionality reduction, from which the first seven PCs were retained and classified into eight clusters using k-means algorithm. The number of PCs and clusters were determined based on the reproducibility of clustering solutions for the given dataset, which had a 1-Hamming distance of 0.80+/-0.06, suggesting that the clustering is 80% consistent among participants. Each cluster has its characteristic connectivity pattern with distinct spatial and spectral properties. The temporal progression of group-level cluster distribution demonstrated a shifting trajectory of dominant clusters across states: at eyes-closed baseline, the alpha frontal-parietal connectivity (Cluster 1) is dominant, which decreased with the induction of propofol and shifted towards Cluster 2 with a prominent 10-20 Hz frontal-parietal and a mild 15-25 Hz prefrontal-frontal connectivity before loss of consciousness (LOC). Cluster 3 with a predominance at delta connectivity was observed right after LOC, and then shifted to Cluster 4 with a significant alpha prefrontal-frontal connectivity. BSP was dominant with isoflurane anesthesia that lasted for about 2 hours, and in the last hour of maintenance period, there was no single dominant cluster, while four clusters co-existed with varied spatial and spectral (delta, theta) properties. The dominant pattern returned to Cluster 2 during emergence and Cluster 1 at post-recovery eyes-closed period. During the isoflurane maintenance period, a transition probability analysis was performed by assuming the system as a Markov chain, which showed that, although it is more probable to stay in a certain cluster, a few between-cluster transitions did occur more frequently than chance. These results demonstrated that the anesthesia-induced functional connectivity as assessed by wPLI is spatial-spectral specific and dynamic despite a stable surgical level of isoflurane anesthesia. C12

**107** Differential role of prefrontal and parietal cortices in controlling level of consciousness. George A. Mashour, MD, PhD <gmashour@umich.edu> (Anesthesiology-Bert N. La Du P, University of Michigan, Ann Arbor, MI )

There is current controversy regarding the role of prefrontal cortex versus posterior cortices in consciousness. Clinical and correlative data have been used both to support and refute a causal role for prefrontal cortex in the level of consciousness, but a definitive relationship has not been demonstrated. We used anesthetic-induced unconsciousness as a model system to study the effect of cholinergic and noradrenergic stimulation of rat prefrontal and parietal cortices on the level of consciousness. We demonstrate that cholinergic stimulation of prefrontal cortex, but not parietal cortical areas (posterior parietal cortex and medial parietal association cortex), restored the level of consciousness and induced wakefulness in rats despite continuous exposure to clinically-relevant concentrations of sevoflurane anesthesia. Noradrenergic stimulation of the prefrontal or parietal areas did not reverse the anesthetized state. We conclude that cholinergic mechanisms in prefrontal cortex can preferentially control the level of consciousness. PL5

108 Searching for Universal Cortical Power Changes Linked to Anesthetic Induced Reductions in Consciousness. Andria Pelentritou, Kuhlmann Levin; Lee Heonsoo; Cormack John; Mcguigan Steven; Woods Will; Sleigh Jamie; Lee UnCheol; Muthukumaraswamy Suresh; Liley David <andria.pelentritou@gmail.com> (Melbourne, VIC Australia)

Anesthesia arguably provides one of the only systematic ways to study the neural correlates of global consciousness/unconsciousness. However to date most neuroimaging or neurophysiological investigations in humans have been confined to the study of gamma-Amino-Butyric-Acid-(GAB-A)-receptor-agonist-based anesthetics, while the effects of dissociative N-Methyl-D-Aspartate-(N-MDA)-receptor-antagonist-based anesthetics ketamine, nitrous oxide (N2O) and xenon (Xe) are largely unknown. In attempting to characterize the explicit neural circuits involved in gaseous anesthesia, magnetoencephalography (MEG) recordings from 22 healthy males during inhalation of the gaseous anesthetic agents N2O and Xe was employed. Following relevant baseline recordings participants were exposed to step-wise increasing inspired equi-MACawake concentrations of Xe and N2O of 8, 16 and 24% and 16, 32 and 47% respectively. An additional concentration of 42% Xe was administered, upon which Loss of Responsiveness was achieved and maintained for up to 10 minutes. Source level analysis using LCMV beamforming was employed to calculate the voxel-wise power. Non-parametric permutation statistics with correction for multiple comparisons was additionally utilized to reveal significant alterations in electromagnetic power following anesthetic induced reductions in consciousness. Significant increases in the delta and theta bands were observed predominately in frontal areas with higher concentrations of Xe anesthesia but not with N2O. Conversely and in line with earlier findings in the literature, a reduction in alpha band activity in the frontal cortex was attributed to N2O but not Xe sedation. Finally, significant increases were noted in low and high gamma band activity at the highest N2O concentration administered. Our current findings reveal no similarities in power changes between the investigated anesthetics despite related pharmacology. Future work looking at undirected and directed connectivity may reveal universal mechanisms associated with NMDA-receptor antagonist-based anesthetics in inducing reductions in consciousness. C17

**109** Thick Nccs Yield Physicalist Epiphenomenalism. William S. Robinson <wsrob@iastate. edu> (Iowa State University, Ames, IA )

"Thick neural event" is introduced to mean an event that requires firings of more than one neuron and a substantive (i.e., additional to merely temporal) relation among them. It is shown that some well regarded theories (e.g., by Lamme; Koch; etc.) imply that neural correlates of consciousness (NCCs) are thick neural events. It is then shown that thin (= not thick) neural events provide sufficient causation for neural events leading to behavior, and that there are good reasons to reject overdetermination by thick events. Thus, any physicalism that recognizes legitimacy of a search for NCCs must either reject theories that imply thickness of NCCs, or accept the epiphenomenalistic view that the properties in virtue of which we are conscious are not properties in virtue of which events causally contribute to our behavior. **C10** 

110 Unifying Theories of Psychedelic Drug Effects. Link Swanson <link@umn.edu> (Center For Cognitive Sciences, University of Minnesota Center for Cognitive Sciences, Minneapolis,

#### MN)

How do psychedelic drugs produce their characteristic range of acute effects in perception, emotion, cognition, and sense of self? How do these effects relate to the clinical efficacy of psychedelic-assisted therapies? Efforts to understand psychedelic phenomena date back more than a century in Western science. In this talk, I review scientific theories of psychedelic drug effects and highlight key theoretical features which have endured over the last 125 years of psychedelic science. First, I describe the subjective phenomenology of acute psychedelic effects using the best available empirical data. Next, I review late 19th-century and early 20th-century theories--model psychoses theory, filtration theory, and psychoanalytic theory--and highlight their shared theoretical features. I then briefly review recent neuropharmacological and neurophysiological findings. Finally, I describe some recent theories of psychedelic drug effects that leverage 21st-century cognitive neuroscience frameworks--entropic brain theory, integrated information theory, and predictive processing--highlighting their shared theoretical features and pointing out how they link back to earlier theories. From this analysis a key theoretical concept is identified which cuts across many theories past and present; psychedelic drugs perturb specific brain processes which normally sustain constraints on perceptual, affective, cognitive, and self-related neural systems. While a truly unifying theory has yet to emerge, I suggest that the enduring theoretical features and formalized frameworks highlighted in this talk could form a groundwork for future unifying theories of psychedelic drug effects. C15

111 Disentangling Models Of Visual Awareness Marine Vernet, Shruti Japee; Valentinos Zachariou; Sara Ahmed; Leslie G Ungerleider. <marine.vernet@gmail.com> (LBC, NIMH/NIH, Bethesda, MD )

Several philosophical theories of consciousness have received attention from the neuroscience field, which offered potential neural implementation of the phenomenon of "being aware". For instance, it has been proposed that information entering the global workspace are "played on the theater of consciousness" and, as a consequence, accessed by multiple unconscious processes. Such global workspace would be implemented in the fronto-parietal, attentional network. Alternatively, a conceptual distinction between access and phenomenological consciousness lead to the hypothesis that fronto-parietal activations would reflect the former, but not the later type of consciousness. Phenomenal consciousness, the subjective sensation which is not necessarily accessed, would instead be implemented in the brain areas dedicated to the specific modalities of the information, for instance visual areas for visual information. Finally, a recent theory suggests that consciousness is actually a model one would maintain about one's own attentional state, potentially in brain areas associated with both perception and social cognition, such as the superior temporal sulcus (STS) or temporo-parietal junction (TPJ). For most visual experiments tackling this question, information is either conscious or unconscious. However, such dichotomous approach would confound the neural correlates of becoming aware, of stabilizing the percepts (via attentional mechanisms) and of certainty evaluation. In the present fMRI experiment, we aimed to select the best neural model of consciousness by disentangling these three cognitive functions. Visual awareness, defined as the subjective feeling of seeing, was evaluated with a gradual scale, from not seeing anything (rating 1), to seeing something that cannot be categorized (rating 2), to categorizing with low (rating 3) or high certainty (rating 4). Brain regions associated with awareness should display a gradual increase of activity as these ratings increase. Conversely, dichotomous activity (ratings 3&4 > 1&2) should reflect attentional mechanisms of percept stabilization. Finally, increased activity when one is certain (of seeing or not seeing) rather than uncertain (ratings 1&4 > 2&3) should be related to confidence. Gradual activity was found in a subset of fronto-parietal and higher-order visual areas, jointly contributing to the build-up of awareness. Dichotomous activity was found in fronto-parietal and early visual areas, confirming a stabilization mechanism, in which the attentional network modulates activity in early visual cortex. Finally, confidence-related activity was found in STS/TPJ. In conclusion, our study allows dissociating the closely related mechanisms of awareness, attention, and certainty. Our results tend to support the global workspace model, which could be extended to gradual build-ups of awareness content. STS/TPJ areas, rather than reflecting the content of awareness, seem to be involved in metacognitive judgment about one owns' percepts. PL5

112 Does a Universal Belief in God Prove the Mind is Hierarchically Arranged (or Vise Versa)? Nancy J. Woolf <nancywoolf@yahoo.com> (Psychology, UCLA--Emeritia, Las Vegas, NV)

The hierarchical organization of brain--with an overarching highest principle--does in a very real sense and in a relatively straightforward manner prove that God exists primarily as a consequence of the human mind. Accordingly, God is a creation of neuronal wiring... a biologically driven tendency to organize subordinate principles under one supreme, well... principle. The tangentially related question is: Is it even possible for God to exist in the absence of the human mind? The major religions emphasize the importance of faith. You cannot see, hear, or touch God, but you're invited to "believe" in his or her existence based on the most powerful of all arguments... sheer belief based on your brain being wired to seek the highest principle. This particular mental concept has produced real and profound effects on mankind: the power to unite and the power to divide. The attraction of this concept is without rival. After all, who doesn't want to feel ultimately connected to everything else? This argument for God's existence (or for hierarchical brain organization) is not too unlike an argument we've already heard. If a tree falls in the forest but no one is around to hear it, is there sound? Well, no. There are sound waves, perturbations in the air molecules forced away from the falling tree and the vibrations resulting from the impact the tree makes as it strikes the ground. But sound implies perception. Hearing a sound requires somebody or something be nearby to "transduce" (a common physiological term) air molecules into perceivable sounds. Ultimately, our brain takes what was "transduced" and converts it to an endogenous energy (p. 9, Woolf, Priel, and Tuszynski, 2009). We understand the hierarchical organization of the human brain largely through its functional connectivity. The cerebral cortex attains functional connectivity after birth, sculpted by constant exposure to myriad sensory data--sight, sound, touch, movement, taste, and smell. Each brain region progressively evolves a more complex way of abstracting hard data. So where is God in all this? Our conceptualization probably lies not in primary sensory receiving areas, nor in the orbitofrontal cortex or cingulate gyrus. Any single site localization falls short of our expectations and contradicts what we know about functional connectivity being widespread and changing almost instantaneously without any anatomical reorganization. Since hierarchical connectivity only takes us so far in understanding the human mind and its ability to visualize God, what might suffice? Quantum mind theories augment simple connectionist models. Some models include subcelluar vibrations in constellations of neurons at multiple high-level cortical sites "binging" like a chorus of embedded harmonies spanning the Hz -- MegaHz -- GigaHz -- TeraHz ranges. Contemplating God is perhaps the human mind's most energy-producing thought, thereby casting doubt that energy of the human spirit arises or emerges, in any conceivable way, from mere connections. But introduce the notion of connected energies, whether they're linked to quantum phenomena or not, and one becomes optimistic that the astounding expression of the human spirit might just be understandable in scientific terms. P2

#### 2.02 Methodologies (fMRI, EEG etc.)

113 Expanding the Role of Consciousness in Neurofeedback. Stephen Campbell <sencael@ sfu.ca> (Education, Simon Fraser University, Burnaby, British Columbia Canada)

This talk addresses ways in which aspects of brain behavior may fall under volitional control. In particular what conditions and constraints affect one's ability to modify the power of given frequencies of the electroencephalogram (EEG) in various areas of the brain at will? This question has important practical and theoretical implications regarding neurofeedback, the nature of consciousness, and the relationship between mind and brain. The extent to which it is possible to modify brain behavior at will, in manners detectable via EEG in predetermined ways, could provide evidence in support of causal efficacy and open the way toward a deliberately conscious approach to brain-computer interfacing (BCI). This program of research consists of three fundamental problems: First, the problem of causality: Is it possible at all to mentally alter brain behavior in predetermined ways that are clearly under volitional control, independently of evoked or even-related sensory stimulus and motor activity? Secondly, the problem of validity: How can one be sure that, operationally, one is actually observing and measuring the effects of mental

causation? Thirdly, given affirmative answers to the first two problems, we face the problem of bandwidth: In what ways and to what extent can different areas of the brain be simultaneously altered at will, and how quickly can those states be modified? If all three of these problems can be successfully addressed, it would open the possibility for a general approach to BCI, somewhat akin to learning how to type. That is to say, a certifiable vocational program could be introduced that would train individuals in a standard manner for interfacing with machines. **C2** 

114 Initial Validation of Transformative Neurofeedback in Virtual Reality for Training the Relaxation Response in Non-meditators. Mandy A. Scott, Persinger, M. A. <mx\_scott@ laurentian.ca> (Neuroscience Research Group, D, Neuroscience Research Group, Department of Human Studies, Laurentian University, Sudbury, ON Canada)

Neurofeedback (NFB) has been used for over 40 years to train children and adults self-regulation for a variety of cognitive, emotional, and even physical deficits resulting from disease, disorder, injury, and genetic birth conditions (Thompson & Thompson, 2015). While the application of NFB for the treatment of such deficits requires the one-on-one facilitation with a trained NFB practitioner, applying the principles of NFB to train self-regulation of the relaxation response is a safe and highly desirable direction for the development of transformative technologies, especially those that can be used to practice and train at home. To this end, we created a novel neurofeedback software called myHeadquarters to facilitate the development of a hybrid-brain-computer interface (BCI) paradigm, combining real-time 14-channel quantitative electroencephalographic (QEEG) data with 3-dimensional virtual reality (VR) immersion in one's own dynamic state changes (Palucki & Scott, 2016). We also created 4 primary state configurations representing key features of non-dual or meditative states, including relaxation, creativity, focus, and flow, then associated these features with select morphological changes in the virtual 3D environment which served to cue the user of state achievement. Immediate audio feedback based on moment to moment changes in brain activity was designed to provide the user with cues to represent when they were moving toward the target state of relaxation or away from it. A small group of 5 participants completed a 4-week training study involving a single weekly 20min training session with myHeadquarters Relax State, as well as weekly 19-channel QEEG baseline measure 3-4 days preand post-training. The short-form Profile of Mood States (POMS-SF) was used to assess changes in mood and perceived energy levels, and a pre- and post-test of Critical Flicker Fusion was used to assess changes in perceptual processing, a correlate of changes in the relaxation response. The results of this study, as well as a second study involving immediate single trial effects, will be presented which demonstrate the efficacy and validity of this novel transformative technology paradigm over time. Implications for future developments in novel NFB paradigms will be discussed, as well as a warning about diving too quickly into the gamification of non-dual states of consciousness. The issue of neuroethics in neuroplasticity must always be considered when we develop novel technologies which depend upon the repeated stimulation of network patterns for the achievement of a task through BCIs. Evidence-based research is a must, as only then can we be sure the optimizations we are making are valid in the long- as well as short-term. C2

115 Multimodal-neurofeedback Training for Increasing the Connectivity of Fronto-parietal Networks Involved in the Conscious Perception of Emotional Stimuli. Ranganatha Sitaram , Andrea Sanchez, Mohit Rana, Diljit Singh Kajal, Chiara Fiarovanti, Christoph Braun, Sunjung Kim, Sergio Ruiz, Niels Birbaumer <rasitaram@uc.cl> (Institute for Biological and M, Pontificia Universidad Catolica de Chile, Santiago, Chile)

The Global Neuronal Workspace (GNW) hypothesis states that the visual percept is available to conscious awareness only if neural circuitry from the posterior to the prefrontal regions are activated above a certain excitation threshold [1]. On the other hand, studies of subliminal visual perception have frequently revealed an elevated masking threshold in schizophrenia [2] concluding that while access to conscious report of masked stimuli is impaired in this disease, non-conscious bottom-up processing of the same stimuli, as assessed by subliminal priming, is preserved. Therefore, in a series of studies, we use fMRI, MEG and EEG neurofeedback to enhance the subliminal perception of emotional faces through learning operant conditioning of the fronto-paritetal connectivity of the Primary Visual Cortex (PVC), the dorsolateral Pre-Frontal Cortex (PFC), an-

terior insula (INS), Fusiform Face Area (FFA) involved in conscious perception. Here, we present results from our neurofeedback studies in which participants were trained to self-modulate their front-parietal network involved in visual facial emotion perception, to test whether self-regulation of the network leads to change in the individual thresholds of conscious perception. **C2** 

# 2.03 Neuroscience of vision

# 2.04 Other sensory modalities

116 Music Moves Brain to Pay Attention. Aakash Baranwal <br/>
baakash1998@gmail.com><br/>
(Faculty Of Engineering, Dayalbagh Educational Institute, Agra, Uttar Pradesh India)

The real world presents our sensory systems with a continuous stream of undifferentiated information. Segmentation of this stream at event boundaries is necessary for object identification and features extraction. Here, I investigate the neural dynamics of segmentation in entire musical symphonies under natural listening conditions. Using brain images of people listening to short symphonies by an obscure 18th century composer, research team from the Stanford University School of Medicine has gained valuable insight into how the brain sorts out the chaotic world around it. The research team showed that music engages the areas of the brain involved with paying attention, making predictions and updating the event in memory. This 20 second clip of a subject's FMRI illustrates how cognitive activity increases in anticipation of the transition points between movements. Peak brain activity occurred during a short period of silence between musical movements when seemingly nothing was happening. From a modern neuroscience perspective, the study shows that this is a moment when individual brains respond in a tightly synchronized manner. The team used music to help study the brain's attempt to make sense of the continual flow of information the real world generates, a process called Event Segmentation. The brain partitions the information into meaningful chunks by extracting information about beginnings, endings and the boundaries between events. "These transitions between musical movements offer an ideal setting to study the dynamically changing landscape of activity in the brain during this segmentation process." No previous study, to the researcher's knowledge, has directly addressed the question of event segmentation in the act of hearing and, specifically, in music. To explore this area, the team chose pieces of music that contained several movements, which are self-contained sections that break a single work into segments. They chose eight symphonies by the English late-baroque period composer William Boyce. The study focused on movement transitions-when the music slows down, is punctuated by a brief silence and begins the next movement. These transitions span a few seconds and are obvious to even a non-musician-an aspect critical to their study, which was limited to participants with no formal music training. They identified two distinct neural networks involved in processing the movement transition, located in two separate areas of the brain. They found what they called a "striking" difference between activity levels in the right and left sides of the brain during the entire transition, with the right side significantly more active. My study provides direct experimental evidence for dissociable and casually linked Ventral and Dorsal networks during event segmentation of ecologically valid auditory stimuli. Results- 1- An event change- termination of one movement that means a brief pause. 2- Limitation of a new movement- activates the first network called the Ventral Fronto-Temporal network, 3- Then second network- Dorsal Fronto-Parietal network turns attention towards the change. 4- Next event updates memory. 5- Music engages the brain over a period of time and the process of listening to music could be a way that the brain sharpens its ability of sustained attention. P1

**117** Neural dynamics underlying the psychedelic state. Anil K. Seth <a.k.seth@sussex. ac.uk> (Informatics, University of Sussex - Sackler Centre, Brighton, United Kingdom)

The human psychedelic state offers a powerful experimental means of exposing the neural underpinnings of perceptual consciousness. I will describe a series of analyses of magnetoencephalographic (MEG) data obtained (by collaborators at Imperial College London) during induction of psychedelic states using LSD, psilocybin, and ketamine. In a first study, we find that quantitative signatures of conscious level based on neuronal signal diversity are unusually elevated in the psychedelic state as compared to baseline. In a second study, we examine functional connectivity of neural dynamics, comparing undirected measures (correlation and coherence) with directed

measures (Granger causality). We observe a striking dissociation between these measures, with increased correlation and coherence, and decreased Granger causality, occurring generically between cortical regions. These results together point to decreased information flow and diminished functional integration in cortical neurodynamics during the psychedelic state. Finally, I will outline complementary research using virtual reality and stroboscopic lighting to induce psychedelic-like experiences in healthy volunteers without pharmacological intervention. **PL2** 

**118 Relativity In The Brain: Human Gravity Sense And Consciousness.** Erik Viirre <eviirre@ucsd.edu> (Neurosciences, UC San Diego, San Diego, CA )

In this lecture, the nature of the acceleration sensors and the conscious perception of motion by the human brain will be described. Both linear and rotational accelerometers lie within the inner ear and their physical features determine their sensitivity to acceleration. Important transformations occur from the raw signal outputs of the sensors to the integrated signal transmission into neural circuits. The information is both sent "down" into the gravity reaction control circuits and "up" to the cortex for motion perception. Relativity in the brain is an active phenomenon as various signals for disambiguating linear acceleration from gravity versus other acceleration forces combine to give us our motion sense. As we drive our own movements the "motor plan" is compared to the accelerations achieved. Thus the Einstein Gedanken experiment of riding in a box where we don't "know" the difference between gravity and other forces be is something we do not normally experience, except in modern conveyances such as vehicles or elevators with no windows. Research on the brain mechanisms of detection of acceleration of the head is difficult, but various "tricks" give us major clues to the representations and transformations in the brain. Comparative evolution shows us important information about the sensors in other species like fish, birds and early hominids. Disorders of the accelerometers and gravity sense are a huge human health problem with great morbidity and consequence, such as falls in the elderly. Yet we have a poor language for description of the conscious experience of motion disorders. Worse, we have the terrible experience of motion sickness. Why? What theories attempt to describe the origins of motion sickness and more importantly, what are we going to do about it? Finally, we have a grand tradition of theorizing about gravity, from Newton and Einstein through Penrose, Hawking and Thorne. And yet we have not reconciled relativity with quantum physics. Are the brains that produce theories about gravity using quantum gravity sensors? How might all human brains invoke quantum gravity? C25

**119** Acupoint Consciousness Theory. Jin Yu , Jin Yu 1, Hai Lin2, Shaoqin Zhang3, Li Li4, Ye Fan1, Minhua Feng1 Jie Zhang1 Xiaohan LAN5 <907037695@qq.com> (Rehabilitation Medicine, Guangzhou University of Chinese Medicine, China, Guangzhou, GUANGDONG China)

A series of scientific explorations about the nature of acupoints didn't lead to a breakthrough and we think that this is due to ignoring the role of consciousness in biological systems. This paper starts off from Lingshu's ancient acupuncture classic "Inner Canon of the Yellow Emperor" and combines this with the new notions of modern human system science and consciousness science. Through acupuncture wisdom and clinical experience, the author arrives at what he calls "Acupoint Consciousness Theory". That includes mainly two aspects, firstly the effect of local acupuncture point consciousness and secondly the effect of ordinary brain consciousness on acupuncture points. Only if we understand the role of consciousness in biological systems, we can truly understand the scientific principles of the meridian acupuncture therapy. **P2** 

#### 2.05 Motor control

### 2.06 Memory and learning

**120 Microdosing: Constructing Knowledge Via Altered Perceptions.** Evie Mason Borchard <eborchar@usc.edu>(Education, University of Southern California, Tiberon, CA)

The practice of microdosing on psychedelic drugs in therapeutic sessions to facilitate intellectual creativity and cognition outside of the realms of typical human consciousness has an extensive history. Although often used recreationally, lysergic acid diethylamide (LSD) micro-

dosing is gaining popularity in both academia and the workplace due to performance-enhancing properties of the substances. A microdose of LSD is typically one-tenth of a recreational dose and does not produce the hallucinogenic effects characteristic of psychedelic use, yet produces agonist activity at various dopamine and serotonin receptors. The proclaimed 'heightened cognition' many individuals experience when microdosing may be attributed to an increased effectiveness in users' abilities to construct new knowledge structures from existing knowledge structures as a result of the altered consciousness experience. The physical basis of the LSD microdosing experience involves activation of the 5-HT2A receptors in the prefrontal cortex, increased glutamate activity, and coupling within sensory networks with decoupling in associative networks. These physiological alterations assist users to access parts of their deep subconscious not normally attainable, providing a new interpretive context to view prior experiences and construct knowledge. Along with the physical framework, preliminary results from novel early-stage controlled experiments containing a synthesis of anecdotes of students and professionals practicing microdosing will be presented and discussed in detail through the lens of the constructivist learning theory in this presentation. Constructivist learning theory declares that learners construct their understanding of the world by participating in and reflecting upon experiences. When learners encounter new material, they approach it with previous experiences, question their own preconceptions, or explore how their preconceptions can assist in processing new information. However, microdosing may work as a catalyst for knowledge construction; microdosing allows learners to reflect on their previous knowledge through the lens of chemically induced synesthesia, making the process more insightful and productive. The preliminary experiment to be discussed is conducted as a double-blind placebo-controlled study: participants complete a nature walk in Wilder State Park in Santa Cruz, California followed by a constructivist problem-solving session in a controlled environment where participants explore and develop solutions to a problem of their choice pertaining to their field. Individualized resources are provided when necessary. Participants include adult students and professionals from a variety of fields where the nature of their work involves creative problem-solving and is heavily dependent on constructivist learning. The analysis emphasizes the actual learning process that takes place during a microdose which include: reflecting on one's experiences, generating novel ideas, and developing increasingly strong abilities to integrate new information. Accounts of the participants' thought process throughout different stages of the experiment will be discussed and compared among the experimental groups. Microdosing works to create a unique consciousness-altering experience conducive to constructing new knowledge. The ability of the brain to reorient can have therapeutic potential in the learning process. Psychedelics are a valuable tool for understanding aspects of consciousness, and generating more data on how their usage affects the consciousness of learning is essential for allowing learners to be active creators of their own knowledge. C15

121 Decreased Hippocampal Theta Activity Represents Amnesia for Loss of Consciousness. Mi Kyung Choe, Seung-Hyun Jin; Soyeon Jun; June Sic Kim; Chun Kee Chung <cmk0803@hbf.re.kr> (Brain and Cognitive Sciences, Seoul National University, Seoul, Korea, Republic Of)

Amnesia (loss of memory) is a crucial component of general anesthesia along with loss of consciousness and analgesia. The mechanism underlying amnesia of general anesthesia has not been clearly understood. Theta rhythm of hippocampus plays a crucial role in memory formation. Hence, the disruption of theta oscillation during general anesthesia may be associated with memory impairment. In this study, we investigated neural effects on episodic memory during propofol-induced general anesthesia. Power spectrum of hippocampal the frequency (4-7 Hz) was calculated from the intrahippocampal depth electrode in 10 epilepsy patients (age: 24-55 years) during propofol-induced general anesthesia, spontaneous sleep, resting state (awake), and long-term memory task. Mann-Whitney U test was performed for intergroup comparisons of theta power in hippocampus. Theta powers during propofol-induced general anesthesia (5, 4, and 3 ug/ml concentration) showed significant difference than those of sleep, awake, and memory task state (p value < 0.01, Mann-Whitney U test). Theta power in hippocampus was attenuated during propofol-induced general anesthesia. Suppression of the hippocampus was attenuated during propofol-induced general anesthesia. Suppression of the hippocampus was attenuated during propofol-induced general anesthesia. Suppression of the hippocampus was attenuated during propofol-induced general anesthesia. **C17** 

# 2.07 Blindsight

# 2.08 Neurology, neuropsychology and neuropathology

**122** Millimeter Wave Properties of Microtubule and Beta-amyloid. Soami Daya Krishnananda , Komal Saxena, Anirban Bandyopadhyay <sdayak@gmail.com> (Department of Physics &, Dayalbagh Educational Institute/National Institute of Material Science, Agra, Uttar Pradesh India)

Millimeter waves (>30GHz) have been used as a non-intrusive probes for diagnosing and treating angina, cancerous tumors and diabetes related medical conditions. These waves have longer penetration depths from 1 cm to sub millimeter region and can get strongly absorbed by polar molecules like water and conducting surfaces. But, unlike optical waves they penetrate through opaque dielectric materials and interact with material medium. These properties of millimeter waves have also been used to manipulate the neuronal functions and enhance the action potential. This has led to the speculations that millimeter wave therapy can be used to treat neurological conditions. This paper explores the near millimeter wave electrical properties of beta-amyloid and microtubules to understand the Alzheimer's disease at millimeter waves. It has been found that beta plaque were more insulating than the microtubules thereby resisting the penetration of millimeter wave electric fields. Further, this paper explores stochastic resonance to manipulate the electrically inert nature of beta-amyloid for treatment of Alzheimer's disease. C3

# 2.09 Coma and vegetative states

#### 2.10 Anesthesia and pharmacology

123 Dose-dependent effect of ketamine on the Lempel-Ziv complexity of EEG activity in rats. Michael Brito, Duan Li; George A Mashour; Dinesh Pal <brito@umich.edu> (Anesthesiology, University of Michigan Center for Consciousness Science, Ann Arbor, Michigan)

It has been posited that the capacity for consciousness relates to the dynamic repertoire of states the brain is able to access. In support of this, measures of spatiotemporal complexity (which reflect repertoire) are reduced in states associated with unconsciousness, such as anesthesia, and enhanced in states associated with "higher consciousness", such as the psychedelic experience. Ketamine is unique among general anesthetics in its ability to induce both anesthesia and psychedelic states. Administration of subanesthetic ketamine enhances measures of neural complexity, but the effect of anesthetic doses of ketamine on these measures are unknown. To address this question, male Sprague-Dawley rats (n=8) were implanted with electrodes to record electroencephalogram (EEG) from frontal, parietal, and occipital cortices. Rats were anesthetized with a 150 mg/kg intraperitoneal dose of ketamine and measures of the Lempel-Ziv complexity (LZc) were computed from the EEG and compared at epochs before, during, and after ketamine anesthesia. LZc was significantly attenuated at the onset of ketamine anesthesia when compared to basal wakefulness, but exceeded basal wake values at epochs preceding and following emergence from anesthesia. These data demonstrate dose-dependent effects of ketamine on repertoire, with suppressed LZc at anesthetic doses and enhanced LZc at subanesthetic levels. **C17** 

#### 124 Small Changes, Big Effects: How Weak Anesthetic Alterations of Protein Motions Can Lead to Large Changes in Consciousness. Travis Craddock <a href="https://craddock.gov/cendectors.cov">craddock.gov/cendectors.cov</a> chology and Neuroscience, Nova Southeastern University, Ft. Lauderdale, FL )

Travis J.A. Craddock1, Ph.D. 1Departments of Psychology & Neuroscience, Computer Science and Clinical Immunology, and the Clinical Systems Biology Group, Institute for Neuro-Immune Medicine, Nova Southeastern University, Fort Lauderdale, Florida, USA Abstract: General anesthetics remain one of the greatest serendipitous pharmacological discoveries known, however despite over a century of research the unitary mechanism by which they act to cause reversible loss of consciousness remains a mystery. The current neuroscientific paradigm views the brain as a linear, computer-like machine performing classical, deterministic input-output operations.

However, while reduction to a linear framework helps to simplify the, arguably, most complex biological system known, it glosses over many of the details which may be relevant to overall brain function. The non-linear dynamics of neural oscillations are extremely responsive to small phase perturbations and high-frequency oscillations. As such, these patterns of oscillation require specific phase relations for encoding and decoding of information, without which specific information would be lost. This highly non-linear scale-free nature of brain processes can be extremely sensitive to initial conditions, and as such low-level fluctuations may be amplified. This means that key micro- (and even nano-) scale subneural processes may have large implications for overall global brain function, and therefore need to be taken into consideration. Yet, how far down should we consider? Going further below the neuronal membrane surface, quantum processes in the brain have been suggested. The sensitivity of non-linear and the scale-free nature of brain processes may therefore amplify microscopic, nanoscopic, and possibly even quantum-level fluctuations to affect the overall macrosystem behavior. What does this have to do with anesthetic action? Anesthetics are lipid-soluble and highly polarizable, and their potency, regardless of structure, is approximately proportional to lipid solubility in a relationship known as the Meyer-Overton rule. This rule holds for anesthetic activity in many species from paramecia to humans. Anesthetics are also inherently un-reactive, working primarily via relatively weak dispersion forces. Here it will be discussed how such dispersion forces may subtly alter protein dynamics and interactions on a molecular level, and how such changes may propagate to large overall changes in neuronal firing rates, and lead to unconsciousness. PL12

125 Remifentanil and Nitrous Oxide Anesthesia Produces a Unique Pattern of Frontal Eeg Activity at Loss of Consciousness. Sarah Eagleman, David R Drover MSc MD; Caitlin Drover; And M Bruce MacIver MSc PhD <seagle@stanford.edu> (Anesthesiology, Perioperative, Stanford University School of Medicine, Palo Alto, CA )

Remifentanil (remi) and nitrous oxide (N2O) are commonly used in combination, together with other anesthetics, for routine surgical anesthesia, yet the electroencephalogram (EEG) effects of these are poorly described. In addition, remi and N2O produce EEG responses that are difficult to analyze using traditional frequency-derived measures. The present study examined the effects of these two agents on EEG signals recorded from 27 randomly chosen surgical patients. EEG responses were recorded using a BIS monitor, following patient consent to a Stanford University approved protocol. Loss and recovery of consciousness time points were identified when patients responded to verbal commands (LOC or ROC respectively). Remifentanil concentrations were varied on a steady background of nitrous oxide (66%) and cortical responses to a train of four (TOF) stimulus were compared at different concentrations of remi. At LOC high amplitude slow waves (1 to 2 Hz) dominated the EEG, similar to effects seen with most anesthetics, but these slow waves were interspersed with rhythmic theta activity from 4 to 10 Hz that lasted a few seconds to several minutes before reverting to slow wave activity, that could also last several seconds to minutes. Changes in remi concentrations had little effect on background activity, marginally increasing slow waves, and did not change the alternating pattern of delta and theta activity. Chaos analysis from nonlinear dynamics of the same EEG signals showed a flatting of attractors that is seen with, propofol, as well as with volatile anesthetics. Attractor flattening was seen for both the delta and theta dominant EEG patterns, with little apparent difference, at LOC for nitrous oxide/ remifentanil anesthesia. Conversely, ROC was associated with a reduction in attractor flatting. TOF stimulation produced cortical activation, seen as a marked decrease in signal amplitude and increase in higher frequency content, which was diminished by higher concentrations of remi. We conclude that remi/N2O induced LOC is associated with a unique oscillating pattern of delta/theta frequency activity that makes it difficult to correlate these frequency-derived measures with brain state changes associated with LOC. Chaos analysis, in contrast, provided a consistent correlation with brain states in these patients. C17

#### 126 Anesthetics act on synaptic proteins to depress glutamate release at loss of conscious-

ness. Bruce MacIver <maciver@stanford.edu> (Anesthesia, Stanford University, Stanford, CA )

I will describe anesthetic actions at glutamate nerve terminals, because previous research indicates that these nerve terminals are among the most important targets for effects leading

to loss of consciousness, and interesting new insights into anesthetic mechanisms of action at these sites has recently come to light. Electrophysiological recording techniques were used in rat hippocampal brain slice preparations to measure anesthetic effects on synaptic transmission. Two Aims were undertaken: 1) To determine which anesthetics depress glutamate release from nerve terminals? Does a given anesthetic-induced synaptic depression persist in the presence of blockers for GABA-mediated inhibition, is it accompanied by an increase in paired pulse facilition, does it persist in the presence of potassium channel blockers? Our preliminary studies indicate that most, but not all, anesthetics depress glutamate release from nerve terminals. 2) To determine whether this presynaptic action involves a specific calcium channel and/or modulatory pathway? Release of glutamate requires calcium entry into nerve terminals via P/Q and N type channels and these channels are modulated by specific g-protein linked pathways. Preliminary studies from our laboratory indicate that anesthetics act specifically on sodium and calcium channels in nerve endings, to depress calcium influx and reduce glutamate release. **PL12** 

**127** Anesthetic modulation of GABAA receptors and memory. Robert Pearce <rapearce@ wisc.edu> (Anesthesiology, University of Wisconsin, Madison, WI)

Many theories of consciousness include the concept that past experience influences ongoing brain activity, an idea that is captured nicely by the phrase "The Remembered Present" (Edelman, 2001). Although consciousness and memory are clearly not the same, to the extent that "memory" (broadly defined) is a necessary component or precursor of consciousness, understanding the mechanisms by which anesthetics suppress memory may therefore inform our thinking about how anesthetics suppress consciousness. Moreover, many anesthetics suppress memory selective-ly at low concentrations, creating a state termed "conscious amnesia", but then also suppress consciousness itself at slightly higher concentrations. The mechanisms may therefore be similar - more a matter of degree than kind. In my talk I will present our studies of anesthetic modulation of GABAA receptors in the hippocampus, linking anesthetic modulation of specific receptor subtypes in specific cells to anesthetic-induced amnesia. **PL12** 

#### 2.11 Cellular and sub-neural processes

128 Coherence of Consciousness in a Cell: Biological criteria for a living consciousness; Why robots don't have minds. Jonathan Delafield-Butt <jonathan.delafield-butt@strath.ac.uk> (Faculty Of Humanities And Soci, University of Strathclyde, Glasgow, United Kingdom)

This paper investigates the atomic and molecular composition of living, biological organisms with focus on cellular composition to address the question how minded, conscious experience of organisms and cells might exist co-incident with the experiences of its basic matter. Atoms and molecules are normally considered dead and insentient, but a branch of metaphysics gaining traction in contemporary philosophy of mind suggests they are conscious entities with basic mental faculties of perceptions, felt appraisals, and intentions made manifest in their activity. I advance this panpsychist view to examine the atomic and molecular composition of cells, with particular attention to their physical nature and the implications of these for a primary, organismic consciousness. I draw out and explore the unique atomic and molecular composition of living organisms (1) as co-existing together in the three chemical phases of solid, liquid, and gas with regular chemical transformation, (2) as free-moving atomic and molecular entities with primitive experience and individual agency, and importantly (3) as atomic and molecular individuals bounded into compartments with shared electromagnetic fields. I reason these features observed in material organisation give a concurrent mental organisation of a rich multidimensionality of its many parts (4) made coherent and unified by its shared electromagnetic properties. I contrast this living atomic and molecular organisation with that of the inert, static solids used in modern mechatronics to show that in their present form and in this metaphysical frame, robots cannot have a coherent, unified consciousness as cells do. C23

#### 2.12 Quantum brain biology

129 Sex, Death and Tubulin: Where Psychoanalysis Meets Orch OR. Donald Mender

<donald.mender@yale.edu> (Psychiatry, Yale University, Rhinebeck, NY )

A possible link exists between aspects of the Orch OR model proposed by Penrose and Hameroff (8) and Freud's dual instinct theory. Late in his life Freud argued for an instinctual dialectic between the outwardly pleasure-seeking drive called eros and a complement in the masochistic, involutional, death-oriented drive called thanatos (7). He suggested that these dual drives scale upward from basic biological tendencies at the cellular level. Contemporary biology supports a fundamental microscopic complementation of sex and death in eukaryotes (2). Current evidence attributes to eukaryotic endosymbiosis, linking nuclear chromosomal DNA with the prokaryotic DNA of mitochondria, two pertinent features. First, mitochondrial DNA mutates much faster than does nuclear DNA. These two DNA forms are symbiotically codependent within functioning eukaryotic cell. Hence a compensatory rebalancing of relative genetic variation rates is needed to maintain compatibility between expressions of nuclear and mitochondrial genes. Sexual shuffling of nuclear DNA provides such compensation (9). Second, mitochondria allow vast intracelluar reduplications of ATP-producing membranes. This greatly enlarges the energy storage capacity of eukaryotes. In light of the above, it would seem that sex is required for accelerated accumulation of stored energy enabling massive cellular and metacellular eukaryotic growth. Marriage of this implication to the hypothesis of antagonistic pleiotropy (11) couples preferentially selected early expression of energy-acquisitive sexual activity to later expression of internally generated apoptosis. The evolutionary results are energetically voracious multicellular organisms whose instincts impel copulation and mortal involution. Another energetic aspect of "sex and then death" is rooted at the base of the entire interspecific food chain in photon harvesting by chlorophyll. Quantum supercharging (3,5) of this energy fountainhead, fueled by solar radiation, boosts dissipative ecological processes mediated by circulation (via membrane proton pumps, electron transport systems, oxygen and CO2 flow, etc.) of oxidized and reduced reactants throughout the entire biosphere (6,10). The resulting global ecology generates a nonlinearly structured anabolic accrual of stored energy "capital." Among the many downstream catabolic "expenditures" flowing from the above anabolism are bioelectrical potential changes. Neurons constitute a subcategory of all eukaryotic cells, whose exterior membranes, freed by mitochondrial endosymbiosis from the prokaryotic cell surface's functional devotion to raw energy transduction, offer liberated territory to ion channels (1). Hence, appetitively kinetic neuroelectrical discharges in "brainy" eukaryotes can instantiate energetic expressions of eros and thanatos. Scale-free links spanning charged mesoscopic membrane phenomena are suspected between the brain's aggregate electrical fields and superposed tubulin spin states (8) within the singularly stable microtubular structures of central neurons (4). Zizzi and Pregnolato have identified logical isomorphisms between subconscious primary process thinking and tubulin superpositions on one hand and between conscious secondary process thinking and the physically classical aftermath of orchestrated wavefunction collapse on the other hand (12). Hence one may postulate that randomly selected aspects of subliminal eros and thanatos move into awareness through orchestrated reduction of superposed tubulin-related states. However, contrary to one of Orch OR's axiomatic suppositions, orchestrated wavefunction collapse in this context may not specifically require gravitation as a trigger. C21

# 2.13 Brain networks, synchrony and scale

**130** Top Down Effects Underlie the Emergence of Mind and Intelligence. George F.R. Ellis <gfrellis@gmail.com> (Department of Mathematics and, University of Cape Town, Cape Town, South Africa)

Many scientists believe that what happens in our brains is determined in a purely bottom-up way through physical and biological interactions, leaving no room for meaningful autonomy of mental activity such as creating theories or making decisions. One view is that neurons by themselves control our brains in a bottom up way, leaving no room for intention or creativity; a second is that it is genes that determine everything; while some physicists claim it is solely interactions of protons and electrons that control everything, leaving no room for meaningful emergence of mental activity because everything is determined at the level of basic physics. This talk will counter such reductionist claims by pointing out that as well as bottom up emergence of higher level structures and behaviour in modular hierarchical structures, top down realisation of higher level concepts and purposes also takes place, shaping lower level interactions and undermining reductionist views of the mind-body relationship. Five different kinds of such top down effects, whereby the physics at the bottom is shaped by realisation of higher level causal effects, will be discussed and illustrated. **PL9** 

131 Temporo-spatial Organization and Large-scale Brain Networks Supporting Consciousness. Zirui Huang <huangzu@med.umich.edu> (Department of Anesthesiology, Department of Anesthesiology, University of Michigan Medical School, Ann Arbor, MI)

The marriage of network science and neuroimaging techniques offers a new avenue in the scientific study of consciousness. The brain activity has been shown to organize into large-scale networks with characteristic spatial architectures such as functional connectivity, modularity, scale-free and small-world properties. These spatial features are crucial for supporting information integration necessary for consciousness. However, little is known about the temporal characteristics (e.g. functional timescales) of large-scale brain networks, and how they are related to consciousness. In this workshop, Dr. Huang will elaborate this idea by presenting empirical data on temporal and spatial alterations of large-scale brain activity during graded sedation with propofol. He will discuss the interplay between intrinsic functional timescales and local/regional/distant functional connectivity during diminished consciousness. Finally, he will introduce a recent neuroscientific theory of brain and consciousness, temporo-spatial theory of consciousness (TTC) (Northoff and Huang, 2017), to complement and extend the above discussions. **C12** 

132 Criticality, connectivity, and information processing in the brain. Heonsoo Lee , George A. Mashour; UnCheol Lee <a href="https://www.ee.gov/ee.g

(Anesthesiology, University of Michigan; Ann Arbor, Michigan Korea, Republic of) Criticality has long been considered as a potentially advantageous configuration of biological systems, and in the brain is thought to enhance information processing, memory capability, and adaptability. However, it has not been elucidated how criticality induces a highly sensitive and informative state in the brain, as well as shapes brain connectivity patterns. We studied the mechanism of how the anatomical brain network at a critical state shapes the brain connectivity pattern that also produces the optimal sensitivity and information processing. To address this question, we performed human brain network modeling, computer simulation, and empirical data analysis of the normal and pharmacologically altered brains. The results provide a principled explanation for how an anatomical human brain network structure in a critical state shapes connectivity, optimal sensitivity and information processing. C12

133 Mouse Brain Resting-state Network Activity Depends on Past Subjective Experience. Ksenia Toropova, Dmitry Sukhinin; Elena Konovalova; Anastasia Natrova; Anna Ivanova; Olga Ivashkina; Konstantin Anokhin <xen.alexander@gmail.com> (NRC Kurchatov Institute, Moscow, Russian Federation)

The activity of human brain at rest is often suggested to reflect conscious processing of past experience. Here we show that past experience can shape the resting-state neuronal networks of a conscious mouse. Initially we characterized resting-state activity of 104 brain structures in naive mice by means of large-scale c-Fos cellular mapping. Then we modeled post-traumatic stress disorder (PTSD) in mice using a short footshock stress, and imaged resting-state networks in PTSD and naive (non-stressed) mice. The c-Fos activity of 42 selected brain areas (sensory and motor neocortical areas, hippocampus, parahippocampal cortex, amygdala, basal nuclei, associative and sensory thalamic nuclei, hypothalamic nuclei, and midbrain) was investigated in naive mice and mice that underwent footshock stress 7 days earlier. PTSD induction strongly affected subsequent resting-state brain activity: mice with prior traumatic experience had significantly more c-Fos+ cells in cingulate, retrosplenial, parietal associative and entorhinal cortices, basolateral and lateral amygdala, paraventricular thalamic nucleus and periaqueductal gray. Earlier these areas were shown to be involved in fear networks in humans and animals. Next, we used graph theory approach to reconstruct resting-state network connectivity of naive and PTSD mice and to define main clusters of resting-state networks. We compared experimentally identified networks with model networks: random, scale free and small world. Clustering of experimental networks of both groups of mice was at the same level as in scale free network - that is, the number of clusters ex-

ceeded the random level. At the same time, these clusters had weak interactions with each other: global efficiency of experimental networks was at the same level as of a random network. Resting-state networks of naive and PTSD mice were different: PTSD network was less clustered, and the clusters were divided by longer routes than in naive mice. Analysis of functional connectivity revealed that PTSD induction caused global changes in the resting-state network structure, which affected all studied brain areas. Overall, while naive mice had most of the connections between the cortical areas, PTSD mice had the majority of connections in areas of thalamus, striatum and amygdala. PTSD induction eliminated almost all functional connections present in naive mice; the only cluster to survive was the closely connected cluster of visual and auditory cortical areas. Furthermore, while cingulate and retrosplenial cortices were the main network hubs in naive mice, functional connectivity between those areas was lost in PTSD mice, and paraventricular thalamic nucleus became a hub. Conversely, while functional connections of amygdala were almost absent in naive mice, in PTSD mice there was a substantial number of connections between amygdala, cortical associative areas and striatum. Our data suggest that experience of stressful event can change both resting-state spontaneous activity and resting-state functional connectivity patterns in the mouse brain long after the traumatic episode. We hypothesize that these changes reflect a replay of neuronal assemblies involved in the states of past subjective experience. In the next series of experiments, we plan to test this hypothesis by using a targeted recombination in active populations (TRAP) technique. Supported by RSF #16-15-00300, 14-15-00685. C5

134 The Multi-Scale Temporal Codes of the Mixed Parallel-Serial Virtualization Memory of Consciousness: Evidence from Human Intracranial Recordings Across Perceptual, Cognitive and Behavioral Tasks. Paul Verschure, Riccardo Zucca; Giovanni Maffei; Daniel Pacheco; Diogo Patta; Xerxes Arsiwalla; Jordi Ysard; Rodrigo Rocamora; Alessandro Principe; Gerardo Conesa <paul.verschure@gmail.com> (Center of Autonomous Systems, SPECS; Institute for Bioengineering of Catalunya, Barcelona Institute of Science, Barcelona, Spain)

A standard view on conscious processing sees it as a sequential set of processing stages that broadcast their results via a "dynamic routing system" or the Global Neuronal Workspace (GNW) [1]. Access to the GNW is signaled by a distinct transient in the ERP or "ignition" indicating that a threshold of access has been reached. As such GNW is a rate coding based model that has been shown to have limited predictive power beyond simple tasks [2], raising the possibility that the GNW theory is either incomplete or wrong. Indeed, alternative models of information processing have emphasized the rapid and high dimensional encoding of global information in the temporal dynamics of the spiking activity of neuronal populations (e.g. [3]). Here the encoding substrate at the level of pairs of cells is expressed in their specific phase relationships. This view is compatible with so-called theta-gamma coding where the phase relationship between gamma and theta reports the order of items within a specific context [4]. The Distributed Adaptive Control theory of consciousness (DACtoc; [5]) builds on these observations and proposes that consciousness results from a dynamically configured transient memory system in the thalamo-cortical networks of the frontoparietal system that capitalizes on content obtained from its interaction with the medial temporal lobe and hippocampus. More importantly, DACtoc proposes that consciousness is explicitly decoupled from real-time and real-world events through temporal coding to assure persistence of conscious states in the absence of sensory information. We address these contrasting views by analyzing the iEEG obtained from 9 epilepsy patients implanted with intra-cortical electrodes that are exposed to some tasks that pertain to core aspects of consciousness including perceptual awareness, volition, and deliberation using virtual reality. Recording areas included the Medial Temporal Lobe, Frontal and Parietal cortical areas. In addition to standard iEEG amplitude based analysis and power spectra, we also applied classifiers to extract task-relevant signature, the analysis of amplitude and phase from time-frequency decomposed data, Representational Similarity Analysis (RSA), Phase Amplitude Coupling (PAC), Information Theoretical approaches and adaptive clustering techniques. Overall, we have found no evidence for "ignition" like signals across these tasks nor have we found any task-relevant information in the amplitude fluctuations of the iEEG. In contrast, all task-specific events occurred in the temporal domain being expressed either in the dynamics of the oscillations underlying the iEEG or in the distinct phase coupling. Overall, we observe that across these tasks, theta activity is a systematic signature associated with

conscious events that appear to temporally segment the underlying continuous and parallel processing. This suggests that consciousness does not depend on a predefined sequential rate based processing architecture but rather carves it out in the continuous dynamics of forebrain structures relying on complex coordinated temporal codes. References [1] S. Dehaene & J. P. Changeux (2011) Neuron, 70(2)200-227. [2] E. Marcos et al (2013) Neuron, 78(2):249-255. [3] R. Wyss, et al (2003) PNAS, 100(1)324-30. [4] J. E. Lisman & O. Jensen (2013) Neuron, 77(6) 1002-16. [5] P. Verschure (2016) PTRS B 371(1701) Supported by the European Research Council project cDAC **PL7** 

# 2.14 Emotion

135 Anatomy of Sadness, Depression and Existential Despair. Bill Faw <bfaw@bpc.edu> (Psychology, Brewton-Parker College, Harrisonburg, VA)

This paper pulls together philosophical (Robert Solomon), affective neuroscientific (Jaak Panksepp), cortical network (Marcus Raichle), and psychological (Sylvia Kreibig) studies; plus current brain research on emotion in general and sadness and depression in particular. Brain diagrams. Judgments: Many personal judgments on events and one's Self-System trigger emotional responses. Emotional snap judgments involve paleo-amygdala circuits, while gut-feeling elaborated judgments involve neo-amygdala-orbital-frontal-medial-prefrontal circuits. Rational judgments, involving lateral prefrontal areas, are used by cognitive therapies to alter gut-feeling judgments (via reframing) to alter snap judgments (via extinction). Loss: The 'sadness' emotions (sadness, loneliness, sorrow, and grief) result from judgments of 'loss' of valued persons or things - which have become part of our Self-system. Grief, Loneliness and Mourning focus on social-bond losses, while Sadness and Sorrow are broader. There is a small loss in 'sadness', large loss in 'sorrow', traumatic loss in grief, and an enduring loss in mourning. Sadness Types: We produce sadness responses when we experience losses (acute sadness), expect losses (anticipatory sadness), or reflect back upon losses (grief). 'Acute crying sadness' evokes sympathetic-nervous-system activation and corticosteroid release. 'Acute non-crying sadness' and anticipatory-sadness evoke warring sympathetic activation and primitive-parasympathetic deactivation - with bouts of protest-against and resignation-to the losses. Blame: Sadness protests-against and/ or resigns-to loss without blaming. Self-blame turns sadness into Regret. Blaming someone else turns sadness into Anger which attempts to address the loss. Self-Network: Brain areas in gut-feeling judgments, sadness, and depression build and maintain a Sense of Self and precious others: 'Default Mode Network'. Posterior Self-Network stores and retrieves memories to relive episodes and understand current events. Anterior Self-Network formulates autobiographical information, allowing us to think about our self in the present and future. Sadness control network centers on the anterior-component's medial ACC and PFC peri-genual areas. Activities: Sadness-continuum emotions use anterior Self System to shut down external-world network, direct hippocampal circuits to 'rumination' cognition, reduce dopamine 'motivated seeking' and 'purposeful behavior' loops, pump corticosteroids, and may use the primitive immobilization system to block out pain, bodily feelings, and even sense of being real. Depression: Depression involves sadness-control circuits, but moves focus from lost objects to tattered Self-system. We press ourselves down in a self-imposed purge and re-shuffle structures of our lives. In treatment-resistant depression, cells in sadness circuits are badly damaged but hyperactive. Serotonin-enhancing and deep brain stimulation here can reduce the hyperactivity. Despair: Despair is an extreme combination of acute-sadness and anticipatory-sadness, where present and future conditions seem unbearable and resignation is complete. Philosophical 'existential despair' sees our Self-System as totally unacceptable and holds out for drastic changes. Feelings: Seeing the 'logic' of thought-judgments helps us understand our emotions and moods. Emotional 'expression' tell us and others about them. Experiential 'feel' tells us yet additional things. The feels of the sadness continuum are feelings of emptiness and loss and mental pain and coldness - involving bodily-feeling and affective-pain circuits involving anterior insula, orbital frontal, and anterior cingulate/pre-frontal. C16

136 Measurement of Emotional Quotient (E.Q.). Anirudh Kumar Satsangi , Ankita Satsangi; Akshay Mathur; Achraj Satsangi; Anmol Saran <anirudh.jenna@gmail.com> (Director Office, Dayalbagh Educational Institute, Agra, Uttar Pradesh India)

According to Chambers Dictionary 'quotient' is the number of times in quantity is contained in another; a ratio. Quotient is a number which is the result when one number is divided by another. Emotion is basically a complex subjective feeling state of an individual having arousing and motivating feelings. Emotional Intelligence (E.I.) is the capability of individuals to recognize their own emotions and of others, discern between different feelings and label them appropriately. I (2004) have developed a mathematical relationship to measure Emotional Intelligence I have coined a term for this mathematical expression as Emotional Quotient ( E.Q.). According to this mathematical relationship E.O. can be expressed as the product of wisdom and IO viz. E.O.= w.IO There are various methods to compute the IQ. Wisdom (w) can also be measured. Recently (2017) researchers from the University of California San Diego School of Medicine have developed a new tool to assess an individual's level of wisdom. San Diego Wisdom Scale (SD-WISE), is based upon a conceptualization of wisdom as a trait with neurobiological as well as psychological basis. According to Filip Jester, Director of UC San Diego Centre for Healthy Ageing distinct regions and systems in brain govern the identified components of wisdom. Thus, value of EO of an individual can be computed by using mathematical formula of Emotional Quotient (E.Q.) developed by me P1

#### 2.15 Sleep and waking

### 2.16 Brain stimulation techniques

137 Effects of Closed-loop tACS During Slow-wave Sleep on Learning in a Target Detection Task. Aaron Jones , Choe J.; Bryant N.B.; Robinson C.S.H; Skorheim S.W.; Combs A; Lamphere M.L.; Robert B.; Gill H.A.; Heinrich M.D.; Ketz N.A.; Howard M.D.; Clark V.P.; Pilly P.K. <aaronjones@unm.edu> (Psychology, University of New Mexico, Albuquerque, NM )

Sleep is critically important for consolidating information learned throughout the day. Evidence suggests that slow-wave sleep (SWS) serves to consolidate declarative memories (Plihal & Born, 1997), a process which has been modulated with non-invasive electrical stimulation (Marshall et al, 2004;2006, Westerberg et al., 2015), though not always effectively (Sahlem et al., 2015). The aim of the current study was to investigate the effects of closed-loop transcranial direct current stimulation (tACS) during SWS on memory consolidation. 22 participants took part in a three-night, counterbalanced, randomized, single-blind, within subjects' study, investigating performance on a target detection task (Clark et al., 2012). During sleep, custom programmed closed-loop software delivered 1.5 mA tACS over electrodes F3 and F4, with returns on bilateral mastoids during SWS. tACS was applied at identified up states using the frequency of ongoing slow-wave oscillations for a duration of 5 cycles. Data were analyzed for overall performance for correct rate and F1 score from baseline through testing, as well as for change in performance over sleep on repeated images and generalized images from an immediate test before sleep in a repeated measures ANOVA framework. Results suggest that active closed-loop tACS delivered during SWS improved performance on images generalized from images trained upon at both morning and afternoon testing compared to sham. This effect was not evident in images repeated from training. Number of stimulation events on the active night showed a quadratic association with performance, with an optimal number of stimulation events needing to occur to produce larger behavioral effects. These results suggest an effect of bilateral frontal closed-loop tACS during SWS on performance in a target detection task for objects hidden in complex pictures, where an improvement was observed specifically for generalized image types, suggesting the facilitation of schematization of information, but not of rote, veridical recall. Using closed-loop non-invasive brain stimulation techniques to augment sleep to improve cognitive performance could be beneficial on its own, or a promising addition to waking stimulation, which has been shown to improve cognitive performance in a variety of domains (Coffman et al., 2014). SUPPORT: This material is based upon work supported by the DARPA and the Army Research Office under Contract No. W911NF-16-C-0018. The views, opinions and/or findings expressed are those of the author and should not be interpreted as representing the official views or policies of the Department of Defense or the U.S. Government. C2

**138** Photobiomodulation: A New Way to Enhance Brain Function. Lew Lim, Lew Lim, PhD, DNM, MBA <lewlim@vielight.com> (Vielight, Toronto, ON Canada)

In the world of brain enhancement discussion, photobiomodulation (PBM) also known as low level light therapy (LLLT) has attracted little attention. However, attention has been growing, and now could be its time. New evidence is building the case for it to be recognized as a New Way to Enhance Brain Functions. Its fundamental mechanisms of action based on photons modifying mitochondrial functions, have been borne out in clinical outcomes. The effects of PBM have been found to be systemic and generally agnostic in treating the different types of brain insults. Literature have identified numerous neurological, psychiatric and neurodevelopment conditions that have responded to PBM, including dementia and depression. Investigations into PBM effects on normal brains are relatively recent; subjects demonstrated improved memory, mood, executive functions and reaction time. A single transcranial PBM treatment can measurably increase cerebral oxygenation as well as electrophysiology power. Vielight and its collaborators have discovered that by invoking specific pulse rates at 810 nm wavelength, they can significantly influence brain oscillations in different ways. In a publication-pending study, gamma pulse rate at 40 Hz can consistently and significantly upregulate the higher oscillations of gamma, beta and alpha; and downregulate theta and delta. Specific locations can also be entrained to have more or reduced coherency. Introducing gamma frequency pulses could modulate the brain into high performing mental states in meditation. Because the brain responds to PBM delivered in specific ways, it is possible that in the future we can personalize treatments or even selectively alter mental states. At The Science of Consciousness Conference 2018, we will show how this is done. Attendees can experience possible altered mental state during meditation and observe associated EEG changes when safely treated with an experimental PBM intervention. This will also be part of an on-site observational study on the effect of PBM on meditative states. C2

139 Significance of Sleep During Low-frequency Repetitive Transcranial Magnetic Stimulation. Niimi Masachika, Chiko Kimura; Masahiro Abo <pomardon2010@gmail.com> (Department Of Rehabilitation, The Jikei University School of Medicine, Tokyo, Japan)

Background: Many studies have reported that repetitive transcranial magnetic stimulation (rTMS) is beneficial for various brain dysfunction. It was reported that application of rTMS during sleep could possibly strengthen neural plasticity. We have found that some patients seem to be sleepy and fall asleep during rTMS session. In addition, patients who fall asleep during rTMS session empirically seem to show good functional improvement of upper limb hemiparesis after combination therapy of low-frequency rTMS and intensive OT. Purpose: The purpose of this study was to investigate the relationship between sleep during low-frequency rTMS session and improvement of motor function in affected upper limb in post-stroke patients after inpatient rehabilitation combined with rTMS using the Bispectral Index (BIS) monitor. Methods: During 15-day hospitalization, each patient received rTMS and intensive occupational therapy. Low-frequency rTMS with 1 Hz was applied over the contralesional motor cortex. During rTMS session, adhesive sensor was put on each patient's forehead and connected to the BIS monitor. The mean score for the maximum change of BIS values during each rTMS session (deltaBIS) was calculated. We regarded the patients with and over 10 of mean deltaBIS as Asleep group and under 10 as Awake group. Action Research Arm Test (ARAT) were evaluated on admission and discharge. Results: Awake group included six patients and Asleep group included seven patients. There was no significant difference in clinical characteristics between two groups. Asleep group was significantly superior to Awake group in increase of ARAT (p < 0.05). There was a significant correlation between the mean of deltaBIS and increase of ARAT (rho=0.78, p=0.002). Conclusions: Sleep during low-frequency rTMS may contribute to improvement of motor function in the affected upper limb. C2

**140** Brainmetrics-Guided Meditation Training in Virtual Reality. Patrick Palucki <datapalucki@icloud.com> (Berlin, Germany)

Research demonstrates the wide-ranging positive effects of meditation and awareness

techniques for increased wellbeing, balance and performance. Advancements in the science of consciousness, computing, sensor-technology as well as in immersive media-technology allow for novel and creative applications of neuroscience in every day life. These developments are not only going to further stimulate the adoption of mind- and perspective-altering techniques into our societies, but are also likely to help the evolution of human consciousness per se. The media-developer Patrick Palucki and the neuroscientist Mandy Scott have developed an evidence based meditation training by using brainmetrics measured by multi-sensor EEG that is worn by the user while engaging in meditation. In this paradigm, the brain activity is analyzed and processed into realtime feedback-signals represented by a dynamic three-dimensional visual and auditive environment which is experienced through a virtual reality headset. One can choose to learn and train basic and advanced meditation techniques. Through specific realtime feedback the user is then able to adjust his approach in order to address and increase the state in a groundbreaking short amount of time. While learning and achieving meditation the traditional way is typically in the realm of weeks or longer, this technique brings it into the realm of minutes. In this Art-Health Demo, conference-guests can get immersed into their own life brainscape in virtual reality and do a EEG-guided meditation training of 10 - 20 minutes and experience this novel interaction between themselves and their audio-visualized brain-measures. In most cases even complete novices with no prior meditation experience or any affinity to non-ordinary states are able to activate the relevant neural correlate. A1

# 2.17 Specific brain areas

# 2.18 Neurobiological theories of consciousness

**141** Role of DMT as an Endogenous Neurotransmitter. Jimo Borjigin <br/> borjigin@umich. edu> (Physiology, University of Michigan, Ann Arbor, MI )

This talk will describe characterization of N,N-dimethyltryptamine (DMT) synthetic enzymes in rodent brain. The case is made that DMT functions as an endogenous non-canonical monoamine neurotransmitter made and secreted in the cerebral cortex. We hypothesize the involvement of DMT in altered states of consciousness during sleep and at near-death, due to its ability to induce exceptional mental states in humans. Our ability of detecting neural correlates of consciousness in animal models will allow us to test the physiological role of DMT in future studies. **PL2** 

**142** A hierarchical multi-level model of the brain: from genes to consciousness. Jean-Pierre Changeux <changeux@noos.fr> (College de France Institut Pasteur, Paris, France)

As a dialog with Noam Chomsky, the complementarity between the linguistic approach vs the neuroscientific conception of the brain together with the potentially integrating views on evolution, consciousness, brain and language, shall be challenged - in a free and open manner- on the bases of the most recent, theoretical and experimental, advances in the fields. The debate shall be introduced by a model of the multiple interacting levels of brain organization\* and the issue of the innateness of brain functions on the basis of what we know about the the human genome and its evolution as well as about the current views on the regulation of genes expression. Then the 1973 hypothesis of the Epigenesis by Selective Stabilisation of Synapses will be refreshed and shown to be appropriate. Last the highest level of brain functions including consciousness shall be discussed in the framework of large scale brain integrative processes such as the Global Neuronal Workspace and the contribution of specialized brain architectures in conscious vs non-conscious processing. A potential synthesis about evolution, formal and biological structure of higher mental functions shall be debated. \*Climbing Brain Levels of Organisation from Genes to Consciousness. Changeux JP.Trends Cogn Sci. 2017 21:168-181. **PL1** 

**143** Disintegration as a Mechanism of Altered State of Consciousness. Anthony G. Hudetz <a href="https://www.conscience.com">https://www.conscience.com</a> (Anesthesiology, University of Michigan, Ann Arbor, MI)

Given the unity of subjective experience and corresponding neurophysiological data it is intuitively plausible that some form of integrative brain process underlies normal human consciousness. Integration can be understood in neurophysiological context as multisensory, sensory-motor,

and higher cognitive integration or in theoretical context as information integration. Integration occurs in both spatial and temporal dimensions and at various organizational scales of the brain. The brain's capacity for integrating information can be measured via constructs from information theory, eg., IIT and others. A direct empirically accessible measure of information capacity is the repertoire of states that the brain can access over time. It has been suggested that consciousness fades when integration in the brain fails (disintegration) as expected in states such as dreamless sleep, anesthesia or coma. At what level or organization is disintegration causally important? Empirical evidence suggests that in reduced states of consciousness functional interactions among individual neurons as well as large-scale brain regions are disrupted. The amount of information associated with cortical neuronal interactions is reduced as a function of anesthetic dose. The strength of monosynaptic neuronal interactions is also reduced and the continuity of ongoing neuronal activity becomes fragmented suggesting the onset of disintegration in both spatial and temporal temporal domains. Simultaneously, the temporal variance of regional co-activations - an index the brain's state repertoire, is substantially decreased. The latter does not seem to occur in local cortical neuronal populations suggesting that changes in the state repertoire are not scale-invariant. Whether stereotypic firing sequences of polysynaptic neuron chains involved in information processing may be altered with the state of consciousness is a further interesting question that is currently investigated. The findings illuminate the potential role of neuronal functional disintegration as a mechanism underlying altered states of consciousness. PL13

144 Current Neurobiology and The Self Integration Theory. Eric LaRock <larock@oak-land.edu> (Philosophy, Oakland University, Rochester, MI )

Current neurobiology seems to be converging upon several properties central to consciousness: (1) that local and global connections are required for integrating information contents, (2) that events in frontal regions (especially parietal, temporal and prefrontal) are required for accessing and manipulating information contents, (3) that events in the thalamus and proximal structures, including the insula, are required for enabling specific information contents, and (4) that the common mechanism of the aforementioned (1-3) neurobiological properties is the synchronous activations of neurons (see Churchland 2013; Dehaene 2014; Engel & Fries 2016; Prinz 2012; Singer 2017). As Churchland observes: "The linkages, it is thought, may consist in synchrony in the activities of populations of neurons." (2013, p. 247). While neuronal synchrony might be necessary in some important sense (e.g., when it comes to matters of predictive coding), it is not sufficient for consciousness, including its integration. Recent data strongly indicates that when an animal is rendered unconscious by means of anesthesia, neuronal synchrony is not only present but actually shows signs of strengthening (see Bola et al 2017; Hudetz 2006, 2009; Imas et al 2005; Mashour 2013a, 2013b). Further, Zeki (2015) and Bartels and Zeki (2006) suggest that connections between V4 and V5 probably do not exist on grounds of neuroanatomical, lesion-based, neuropsychological, and chronoarchitectonic mapping evidence. There is now widespread agreement (a) that V4 and V5 "have distinct, and characteristic, anatomical inputs, despite the many anatomical opportunities for them to interact" and (b) that a lesion in one of those processing sites "does not invade and disable the perceptual territory of the other," which underscores the functional autonomy of those processing sites (Zeki 2003, p. 214; Zeki 2015). The neuropsychological evidence has shown (c) that damage to V4 does not impact V5, and vice versa. Perhaps most significantly, it can now be shown (d) that the chronoarchitectonic mapping evidence puts pressure on claims (1) and (4) above: when human subjects are exposed to complex visual scenes, "the time courses of activity in human V4 and V5 are significantly uncorrelated, from which we can infer that there are no direct anatomical links between them." In fact, the time courses between V4 and V5 (and other visual processing sites) can be as great as 80 milliseconds (Zeki 2003, p. 216; Zeki 2015). In sum, the current evidence reveals an asynchronous relation between processing sites, an observable datum that cuts directly against the purported common neurobiological mechanism of consciousness. Zeki ultimately concludes that the only entity that counts as truly unitary is the self that "sits at the apex" of the processing hierarchy (2003, p. 217; see also Zeki 2015). Unfortunately, Zeki does not develop this suggestion into a testable theory. To bridge this gap, I propose a new theory called the Self Integration Theory (SIT), whereby the self plays a (top-down) role of integrating information contents across cortices of its brain, and

develop the testability of SIT in light of recent advances in neuroanesthesia (e.g., see Mashour and Hudetz 2017; Warnaby et al 2016). C5

# 145 The Radically Embodied Conscious Cybernetic Bayesian Brain: Towards solving the Hard Problem, grounding intentionality, and rescuing free will by resurrecting homunculi and Cartesian theaters. Adam Safron <a href="mailto:asafron@gmail.com">asafron@gmail.com</a> (Northwestern University, Chicago, IL )

There is near universal agreement that cognitive science needs to divorce itself from the last vestiges of Cartesian thinking (Damasio, 1995; D. Dennett, 1992; Dolega & Dewhurst, 2015; Hobson & Friston, 2016). The only place where this agreement is lacking seems to be with respect to which aspects of Cartesian thinking are most egregiously mistaken. The charges are as follows: 1) Separating the body and mind as separate orders of being (i.e., the mind-body problem); 2) Describing perception in terms of the re-presentation of sensations to an inner experiencer (i.e., the theater fallacy); 3) Not realizing the inadequacy of inner experiencers as explanations, since these would require further experiencers to explain their experiences, resulting in an infinite regress (i.e., the homunculus fallacy). Many argue that the goal of cognitive science should be to explain away these mind-like processes in terms of non-mental computational and mechanistic processes (Deacon, 2011; D. C. Dennett, 2017). Enactivists further (and differently) argue that cognitive science will only be thoroughly cleansed of its Cartesian origins once we eliminate concepts such as representation from our explanatory frameworks (Varela, Thompson, & Rosch, 1992). Yet the overwhelming consensus is clear: the mind sciences must rid themselves of Descartes' errors. In this presentation, I will suggest that this overwhelming consensus is mistaken. Indeed, I will argue that each and every one of Descartes' errors actually point to invaluable perspectives. In brief: 1) Minds are thoroughly embodied, embedded, enacted, and extended (Clark & Chalmers, 1998; Rowlands, 2010; Rudrauf, Lutz, Cosmelli, Lachaux, & Le Van Quyen, 2003), but there are functionally important aspects of mind (e.g. integrative processes supporting consciousness) that do not extend into bodies, nor even throughout the entire brain; 2) The brain not only infers mental spaces, but it populates these spaces with representations that form the basis for simulations at various degrees of detail and abstraction. 3) Not only are experiences re-presented to inner experiencers, but these experiencers take the form of embodied person-models with degrees of agency, and even more, these quasi-homunculi form a necessary scaffolding for nearly all aspects of mind. I intend to justify these claims, and in the process, show how attention, imagination, and goal-oriented behavior may be explained using predictive coding frameworks and computational models of consciousness. Moreover, I hope to begin to integrate existing theories of consciousness to an extent that the "Hard problem" may begin to appear more tractable (Chalmers, 1995). In brief, this presentation is an attempt at unification in cognitive science, endeavoring to show how a radically embodied cybernetic Bayesian brain may create foundations for intelligence, consciousness, and will. C13

146 Thalamocortical Organization Suggests that Consciousness may be a Godelian Incompleteness Phenomenon. Zoran Vukadinovic <zvukadi@gmail.com> (Addiction Treatment and Resear, University of Colorado, Denver, Denver, CO )

With the exception of olfaction, all of the sensory information about the body and the world reaches the cortex via the thalamus. The partnership between these two structures is crucial for the emergence of consciousness. Notably, all of the main information flow between the thalamus and the cortex is of a self-referential nature. The very axons that provide the thalamus with its main (or driver) inputs are branched and also innervate lower motor centers in the CNS. This is the case regardless of their source. What this means is that the messages that the thalamus relays to the cortex always contain copies of motor instructions issued to lower motor centers. Thalamocortical loops thus generate our conscious experience as the cortex utilizes copies of motor commands, that arrive trans-thalamically, to compute further motor commands that are then "copied" by branching thalamic afferents and are relayed (again trans-thalamically) to other cortical areas, which then in turn do the same. The recursive nature of the information flow within thalamocortical loops is puzzling and requires us to look outside of neuroscience for an understanding of

its significance. Since ancient Greece, problems of self-reference have had a prominent place in human thought. The power behind such problems lies in their ability to reveal limitations of the systems in which they arise. For example, Kurt Godel (1906-1978), a key figure in the field of modern logic, was able to apply a computational method to computational systems and thereby discovered that all consistent formal systems, capable of representing the functions of recursion theory, are incomplete. More specifically, his method revealed that such formal systems always contain formulas about the systems which are undecidable in the systems themselves. As we have seen above, thalamocortical loops engage in self-reference as they compute our experience. The cortex applies motor instructions to sensory inputs that are, neuroanatomically speaking, composed of copies of motor commands. This is analogous to Godel's application of computational method to ideas about computational systems. The question then arises, do thalamocortical loops produce a limitation result similar to the limitation in computational systems? Does human experience, that they generate, contain an item that is both inherent to them and yet not independently accountable for from within them? Arguably, human consciousness fits these characteristics because, while it emerges from thalamocortical interactions, it is subjective and not entirely reducible to the underlying neurobiological processes. Consciousness may thus derive its ineffability, irreducibility (and hence also its unity) from being an incompleteness phenomenon. As a clinical correlate, schizophrenia, which is characterized by a relative insufficiency of thalamocortical interactions, is also characterized by a loss of unity of consciousness (from which it derives its name) and by a reduction in the subjective quality of experience. One example of the latter are passivity experiences in this illness such as delusions that one's thoughts are being broadcast to others C8

147 Chalmers on Computational Sufficiency in the Philosophy of Neuroscience. John Wilcox <wilcoxje@stanford.edu> (Department Of Philosophy, Stanford University, Stanford, CA)

David Chalmers has argued for the thesis of computational sufficiency: that implementation of the right kind of computation suffices for the possession of a mind and various mental properties. In this presentation, I critique his argument, suggesting that it might be necessary that a system has particular physical constituents in order for it to give rise to phenomenal properties, in which case the implementation of a particular computation would not by itself suffice for phenomenal experience. I will first outline his account of computation before setting out the thesis of computational sufficiency and Chalmers' argument for it. I claim that Chalmers' argument rests on a undermotivated assumption about the empirical implausibility of kind of mismatch between one's visual experiences and their beliefs about such experiences. I also provide some motivation for the claim that constituents matter for phenomenal experience, appealing to inverted spectrum arguments and other considerations. **C10** 

148 Non-deterministic Information Access as Basis of Consciousness. Yan Xu <xuy@ anes.upmc.edu> (Anesthesiology, Pharmacology, University of Pittsburgh School of Medicine, Pittsburgh, PA )

A recent theoretical work on anesthesia-induced unconsciousness (Phys Rev Letts, 115, 108103, 2015) introduced the concept of non-deterministic information access among neurons as a prerequisite for the emergence of consciousness without the need for temporally continuous physical connection. This formulism suggests that consciousness is a global rather than local property. I will discuss three important inferences from this theory. (1) The probabilistic picture of information flow challenges the idea of the connectome as the physical basis of consciousness. Specifically, the theoretical account of human EEG characteristics during the transition between conscious and unconscious brain states is independent of a steady-state connection between any given pair of neurons. Thus, the recently proposed effort to upload or download consciousness solely based on the connectome will likely prove futile. (2) The global nature of information access dictates that consciousness exists as a phase transition in a closed system. The requirement of a global integrity implies that prevention of consciousness (e.g., by using general anesthetics) cannot be originated or controlled locally by a few "master" brain centers. I will propose a thought experiment to show that microinjection of drugs into isolated brain centers (e.g., MPTA and VLPO) will be incompatible with induction of unconsciousness (hence any reports of such

are likely due to artifacts) but compatible with the reversal of unconsciousness. (3) According to the formulism, consciousness is a result of collective access above a percolation threshold independent of the type of connections for information passage. Many neural communication channels can thus be considered in addition to axonal and synaptic connections. These include phase alignment of pi electrons in the neuronal microtubules and high frequency vibrations in the terahertz range, as suggested by Stuart Hameroff and Sir Roger Penrose, or even quantum entanglements, which allow instantaneous communications between pairs of neural sub-structures that are historically associated. The latter can serve as the substrate for self-generated experiences and memory recalls. **PL5** 

#### 2.19 Miscellaneous

**149 Psychedelics and Consciousness ?** Robin Carhart-Harris <a>r.carhart-harris@imperial.</a> ac.uk> (Neuropsychopharmacology, Imperial College, London, United Kingdom)

This presentation will detail my group's research with psychedelic compounds such as psilocybin (magic mushrooms), LSD and DMT (ayahuasca). I will report our latest thinking on how these compounds work on the brain and what this tells us about consciousness and its pharmacology. I link these findings in with our group's recent work involving psilocybin for depression and suggest ways in which psychedelics may be put to therapeutic use in psychiatry and perhaps also disorders of consciousness. Robin Heads the Psychedelic Research Group within the Centre for Psychiatry at Imperial College London, where he has designed a number of functional brain imaging studies with psilocybin (magic mushrooms), LSD, MDMA (ecstasy) and DMT (ayahuasca), plus a clinical trial of psilocybin for treatment resistant depression. **PL2** 

**150** Multisensory perception as unconscious causal inference. Ladan Shams <ladan@ psych.ucla.edu> (Psychology, UCLA, Los Angeles, CA )

What are the principles that govern crossmodal interactions? Comparing human observers' multisensory perception with that of a Bayesian observer, we have found that humans' multisensory perception is consistent with Bayesian inference both in determining when to combine the crossmodal information and how to combine them. The former problem is a type of causal inference. Causal inference, which has been largely studied in the context of cognitive reasoning, is in fact a critical problem in perception. Our Bayesian causal inference model accounts for a wide range of phenomena including all the well-known multisensory illusions, as well as counter-intuitive phenomena such as partial integration and negative gain. In accounting for both perception of objects in the environment as well as perception of the world and self. I will argue that although causal inference is at the heart of multisensory integration and perception, and although attention can modulate this process, multisensory perceptual processing precedes consciousness, and that both multisensory integration are unconscious processes. **PL13** 

151 Consciousness Interaction with 3D Printing. Rahul Sharma , Ankit Sahai; Rajeev Kumar Upadhyay <rahulswarup.sharma@gmail.com> (Mechanical Engineering, Dayalbagh Educational Institute, AGRA, Uttar Pradesh India)

3D printing describes a manufacturing process used to create three-dimensional solid objects from digital files, thereby converting bits into atoms. 3D printer technology is being harnessed for social good at Dayalbagh Educational Institute by making them available for "The Last, The Lost, The Least and The Lowest" by providing accessible socially-conscious 3DP resources for students. Inaccessibility to the human brain renders molecular studies challenging, if not impossible. Understanding the brain is helping scientists build a clearer picture, but that picture has been two-dimensional, making it difficult to visualize the structures. Since visualization is critical for research, especially for brain systems with many components and complicated geometries, we propose 3D printing to help the critical visualization of design in a number of ways. 3D models are not hampered by the limitations of the computational interface, so the designer can freely and rapidly test new ideas. Further, by physically handing the model, the designer gets an intuitive feel for the relative shapes and sizes of the system. More importantly, a physical model of the target

system also facilitates collaborative discussions. Therefore, it is proposed to come up with a way of creating layered 3D structures that mimic the brain even more closely, using 3D printing, thus studying the human brain using 3D printing technology. Presently at DEI we have figured out how to make more accurate models of the brain - using 3D printing and we are in process of printing the same. Proposed use of 3D printing technology in consciousness research as a novel and elegant way to study systems in three dimensions shall reveal new knowledge. This paper will show how we have used 3D printing to aid in the design of brain systems. **P1** 

**152 Postulated Distribution of Neurons in the Heart-brain Representing the Mind.** Saurabh Srivastav , Hari Har Parshad Cohly <saurabh.dei366@gmail.com> (Management, Dayalbagh Educational Institute, Agra, Uttar Pradesh India)

This paper introduces the concept of distribution of neurons in the heart. Science of consciousness studies says that there are two zones in the heart; intelligence zone and the zone of five thieves. The zone of five thieves is divided in three layers; 2nd, 3rd and 4th layer. The 1st layer is considered to be the intelligence zone, 2nd layer consists of KAAM (lust) and KRODH (Rage), 3rd layer consists of LOBH (Greed) and MOH (Attachment) and 4th layer consists of AHANKAR (Conceit) only. The zone of five thieves represents the mind whereas the zone of intelligence represents the influence of Surat on the mind. Let us assume that there are approximately 5500 active neurons are therein the heart and they are responsible for all the feelings and decision making. The distribution of the neurons depends upon the nature of Raj gun, Tam gun and Sat gun present in one's heart and is exponentially distributed. We propose that the heart has 4 regions. In our proposal, it is assumed that neurons are in excess on the base of the heart while the apex is virtually devoid of the presence of neurons. This implies that the maximum number of neurons will be in layer 5 (2500 neurons) which progressively decrease in layer 4 (1600 neurons), layer 3 (900 neurons), layer 2 (400 neurons) and layer 1 (100 neurons). The top left region corresponds to layer 5, which is region I and the lower region II, which has a left and a right, corresponds to layer 4 and layer 3, representing the qualities of desire/lust and anger/rage respectively. Region III has the layer 2 and layer 1 component which represents the qualities of greed and attachment respectively. Region IV is devoid of neurons and represents the sphere of conceit/egotism. The lowest zone has null neurons. The total exponential distribution is assumed as  $(10)^n$  ( $(25^n + 4^n + 3^n + 2^n)$  $y+1^n z = 5500$ , where n=2. P1

153 Interpreting the Experience of Synchronicity and Mania, from an Intrapsychic Perspective. James Williford <jwmd78@gmail.com> (James S Williford M.D., Greensboro, NC )

When I was 23 years old, I experienced my first mania. Eventually, when I was 48 years old, I was diagnosed with Bipolar I Disorder. Along the way, I also learned that much of the content of my experience could be categorized according to standards and traditions of Jungian psychology, mysticism, and religion. The first mania lasted 3 months and involved waves of euphoria, with a compelling flow of new material into keen consciousness. Prior to the mania, I had experienced 6 months of a severe obsessive compulsive neurosis and accompanying depression, leaving me weighing 145 lbs at 6' 1". Therefore, the classic psychodynamic phrase, 'manic rescue', could be applied. At mania onset, I was immediately immersed in the experience of intense ideas of reference, of the nature Carl Jung would describe as synchronicity. I soon found some of his literature at a university library. With the pathological social dysfunction that I was to generate and the accompanying alienation, I cannot overemphasize how important this literature was in reinforcing that I was not alone. I was encountering consensually validated structure, an experience of psycho-environmental architecture, if you will, described from many independent sources across places and times. I found that my journey with synchronicity was a two-edged sword. On one hand, it was part of an oceanic experience where archetypal elements of many disciplines harmonized. On the other, it contributed to my development of delusions, involving other people, which I acted upon while manic. When not manic, I continued to experience mild synchronicity. As the years went on and I progressed through clinical training and practice, the original delusions had resolved through cognitive confrontation and social shaping. However, I was still left with annoying cognitive dissonance. While the larger mystical picture provided practical applications in my life, the delusions of an interpersonal nature lead to much pain. Yet, all the experience involved a

clear architecture and order. There was sharp synchronization between my minds eye, thoughts, and the external environment. After I left clinical practice, I investigated further. I learned via the internet that I was not alone in experiencing a mild and non-disturbing increase in the experience of synchronicity after meditation, conceivably due to a mild decrease in repression. One could experience a repeatable/controlled engagement of the inverse relationship between repression and the experience of synchronicity. In addition to the resonance between internal and external phenomena with synchronicity itself, this internal psychodynamic process affecting the intensity of synchronicity as epistemologically compelling. The paper will present more case detail as well as a discussion of an interpretation approach that has helped me in reducing some of my cognitive dissonance. Obviously, there is not a goal of establishing any new standard process for others. This is simply sharing a personal story, with the thought that the material might contribute to dialogue regarding topics such as the interface between metaphysics and psychiatric structural models of the psyche. **P1** 

# **Cognitive Science and Psychology**

# 3.01 Attention

154 Mind-wandering and Attention: Evidence from Behavioral and Subjective Perspective. Riya Mishra , Trayambak Tiwari; Anju Lata Singh <mishrariya11@yahoo.com> (Department Of Psychology, Banaras Hindu University, Varanasi, Varanasi, Uttar Pradesh India)

A decrement in vigilance task performance echoes impediment in effortful attention due to its monotonous and boring nature. To overcome this, attention fluctuates and mind meanders off either in an external or internal milieu of a person. This fluctuation from task-related to task-unrelated thought is usually termed as mind-wandering. Although, this mind-wandering measured through various methods one of the common and most used method is Thought probing. It measures the frequency and content of mind-wandering episodes but the thought probing rates itself pose a problem among researchers. To examine this fluctuation across the time period, we employed an experiment of vigilance task with variation in thought probing rate, which was embedded in the task. The thought probes vary in terms of  $\leq 2$  minute per thought probe and  $\leq 4$  minutes per thought probe during vigilance task. A 2x4 repeated measure factorial design was used and 15 individuals with an age range of 20-26 years participated in this study. Result indicates that more frequent thought probing rate (< 2 minutes) has an accelerative effect on On-task concentration but impeding effect on vigilance task performance and less frequent thought probing condition (< 4 minutes) has impeding effect on On-task concentration and accelerative effect on vigilance task performance, whereas the subjective measures of reported mind-wandering episode has a positive relationship with performance measure of mind-wandering episode. C19

# 3.02 Vision

#### 3.03 Other sensory modalities

#### 3.04 Memory, learning and synaptic plasticity

#### 3.05 Emotion

155 Love To Sustain Greater Levels Of Emotional Awareness In Romantic Couples. Ana Fonseca, Emily Butler <anafonseca@email.arizona.edu> (Family Studies And Human Devel, University of Arizona, Tucson, AZ)

Counseling studies emphasize the importance of emotions, particularly, emotional awareness to better health, well-being, and happiness (Batool & Khalid, 2009; Coyle & Waltz, 2002). Researchers have found that being able to access awareness of present emotions is helpful in increasing problem solving, satisfaction, and intimacy with others (Bracket et al., 2005). Another side of research provides robust evidence of the importance of love to higher levels of life satisfaction, happiness, self-esteem, positive mood, well-being, greater release of oxytocin, and compassion for others (Caprara & Steca; 2005; Fisher et al., 2006; Simmons, 1991; Sprecher & Ferh, 2005;

Post et al., 2002; Takahashi et al., 2013). Although love carries physiological and psychological benefits, less is known of the importance of love during stressful times in relationships. Here, we investigate the role of love to emotional awareness in 75 heterosexual romantic couples. We utilized the analytic approach of multilevel modeling using R software to account for the interdependent nature of the data obtained from dyad members (Kenny, Kashy, & Cook, 2006; Raudenbush & Bryk, 2002). The results indicated a significant two-way interaction. Particularly, greater emotional awareness was discovered in individuals with high levels of love than those with low levels of love when relationship stress was high but not low. Our findings highlight the important role of love as a way of benefitting the health and well-being of the individual, but also to the relationship say of boosting emotional awareness even when drawbacks occur. More importantly, our findings suggest the strength and not the weakness of responding with love as a daily answer to the problems that confront us. Love may be the blueprint by which an individual is lead to greater conscious awareness through forgiveness and acceptance of others. Romantic relationships may be the ideal place to practice love to sustain greater levels of awareness for a life time. C27

156 Quantifying Bliss with Microtubules and Brain Connectome Harmonics: Empirically Testable Hypotheses for Valence. Andres Gomez Emilsson, Michael Edward Johnson <algekalipso@gmail.com> (Qualia Research Institute, Colma, California)

What makes an experience blissful? Can bliss ever be quantified? Emotion is usually factored along two main axes; arousal (energy level) and valence (the pleasure-pain axis). High valence (i.e. highly blissful) states of consciousness include: orgasm, romantic love, deep sleep, concentration meditation (so-called "Jhana states"), psychedelic ecstasy, and so on. Low valence states include: depression, anxiety, bodily discomfort, and the experiential quality of listening to dissonance. Confusingly, we also experience neutral as well as mixed states of consciousness. An explanatory framework that ties together these disparate experiences in a coherent way is needed, such that valence becomes objectively quantifiable. Affective neuroscience classically addresses the question of "what makes an experience blissful in terms of things such as neuroanatomical correlates ("pleasure center activation"), neurotransmitter and receptor function ("Mu-opioid activation"), and computational concepts ("reinforcement learning"). It is important to note that positive valence is associated with these features, but that does not, on its own, constitute a satisfying explanation. More so, counterexamples to such associations abound (unpleasant opioidergic states, reinforcement without pleasure, etc.) A scientific account of valence should be able to explain these associations and their exceptions, provide clear quantitative metrics for valence in arbitrary brain states, and, above all, make precise and testable (hopefully surprising) predictions. We advance a framework for studying consciousness that can deliver just that. We introduce the concepts of: Qualia Formalism (for any given conscious experience, there exists a mathematical object isomorphic to its phenomenology), Qualia Structuralism (this mathematical object has a rich set of formal structures), and Valence Realism (valence is a crisp phenomenon of conscious states upon which we can apply a measure). Based on this framework we propose the "Symmetry Theory of Valence"(STV): Given a mathematical object isomorphic to the gualia of a system, the mathematical property which corresponds to how pleasant it is to be that system is that object's symmetry. We pair up the STV to various accounts of "the structural level at which valence takes place" and generate empirically testable predictions for each. Namely, we generate predictions for: (1) the protein and microtubule account introduced by Hameroff & Penrose (1996), (2) the "mental organs" account of states of consciousness proposed by Ray (2012), and (3) the connectome-specific harmonic account of brain states by Atasoy et al. (2016). In particular for (3), we arrive at an equation that transforms fMRI data into Consonance-Dissonance-Noise Signatures (CDNS) which, according to the STV, ought to account for a large fraction of the variance associated with valence. If experimentally verified, this equation would be the first fully quantitative account of valence derived from first principles capable of tying together the myriad kinds of bliss into a coherent framework. C18

#### 3.06 Language

157 Infant Consciousness - Does the Human Neonate Capable of Perceiving and Differ-

entiating Pain? A Spectral Analysis of Cry Signals. Anjoo Bhatnagar , Phoolchand Bhatnagar; D.K. Chaturvedi <dranjoo@gmail.com> (Theology, DEI, Agra, Uttar Pradesh )

Crying phenomenon is almost a unique feature of the human infant not found in any other living spices. Usually cry denotes pain and suffering but paradoxically the first cry of the newly born declares that he or she is alive and conscious and it is an index of neonatal well-being at birth. To the obstetrician it means that 9 months of gestation has ended in a successful outcome in the form of a live birth, to the pediatrician it means that resuscitation is not required and a normal outcome for the future of the baby may be expected, to the parents and family it means that they have been bestowed a precious gift by GOD. But what does it mean for the baby? Our perception of infant cry may be different from what the infant is exactly trying to communicate. As during infancy cry is the only language of communication whether due to hunger, colic or any other pain or displeasure its understanding is sometimes difficult for even the mother. Further pain perception in infancy also is a matter of debate. Historically it was a widely held belief that infants do not feel pain, that neonates do not have the neurophysiologic apparatus required to experience pain ,they do not respond to pain and even if they do feel it they wont remember it. Recently it has been proved that pain in infancy is frequently underestimated and undertreated. The present paper studies the spectral analysis of cry pattern of infants to identify and differentiate the cause of their pain, through quantitative characterization of cry signals, using non-invasive cry activity measurement by a cry recorder. The signal processing and spectral analysis of cry patterns thus collected is done among individual babies. It is observed that the first cry frequency at max. Power is highest among all other frequencies in each newborn followed by that of procedural pain, colic, hunger and other reasons. What does this mean? Has anybody wondered why all human babies cry at birth? And what is the cause of such severe pain? Is it just for a Physical reason to expand the lungs and get the breath of life? Or is there a Psychological reason that the baby is not happy with the environment it is suddenly exposed to outside mothers womb? If these be the reasons, then why not the newborn of animals cry at birth? After all they also come out of their mothers womb and expand their lungs. Or is there a more subtle Spiritual basis for the birth cry? May be, the baby is suddenly deprived of spiritual bliss or pleasure which it might be experiencing while in the womb about which we do not fully understand! According to Religion of Saints At birth the newborn is almost unconscious, after stimulation he cries. Actually Before birth he is enjoying the bliss of the vision of Jyoti which is disrupted at birth and this is the real reason of cry. (His Holiness Sahab Ji Maharaj Sir Anand Sarup kt.) (1956) C26

**158** Language and the unconscious strands of consciousness. Noam Chomsky <nchomsky3@gmail.com> (University of Arizona, Boston, MA)

The founders of modern science, 500 years ago, were awed and perplexed by the uniquely human capacity to employ a few symbols to construct an infinite number of thoughts and to use them in creative ways to convey to others the inner workings of our minds. In recent years, for the first time, it has become possible to account for many fundamental aspects of this remarkable capacity, both its nature and its use, acquisition, evolution and neural basis, though many mysteries remain. One significant discovery is that mental computations that are inaccessible to consciousness are intimately and indissolubly integrated into what reaches consciousness, typically fragments, facts that yield some insight into the phenomenology of consciousness and set conditions for inquiry into the mechanisms that underlie it. **PL1** 

**159** The Voices in our Heads . Charles P. Fernyhough <c.p.fernyhough@durham.ac.uk> (Durham University, United Kingdom)

When people are asked to reflect on their conscious experience, they often report that it contains a fair amount of language: the everyday internal conversation that psychologists term inner speech. My interest as a developmental psychologist is in where these words in the head come from, what they are doing there, and what it is like to experience them. Empirical studies of self-directed speech point to it having important cognitive functions. Improved methodologies for studying these phenomena in children and adults support Vygotskian / Lurian conceptions of inner speech as constituting a functional system, whereby initially independent neural systems are "wired together" in new ways by social experience. I present some recent findings relevant to this

account, and consider prospects for a cognitive neuroscience of inner speech that is sensitive to its development and phenomenology. I then consider a less typical experience which is often thought to be symptomatic of severe mental illness: hearing the voice of another person when there is no one speaking (also known as auditory verbal hallucination). A dominant model of voice-hearing holds that it involves a disturbance to the process by which inner speech is attributed to the self. Accounting for the phenomenological richness and varied pragmatics of voice-hearing requires, however, an equally nuanced conception of the functional and structural heterogeneity of the ordinary voices in our heads. I review some key recent findings on voice-hearing and inner speech, and explore their implications for three main areas of enquiry: the paradox of the apparent ubiquity of inner speech, the value of reading some forms of voice-hearing as inner dialogue rather than as a stypical communicative acts, and the dynamic interaction in voice-hearing of inner speech and memory. **PL3** 

**160 Hidden Voices.** Marinus A.C. Huijbregts <m.a.c.huijbregts@uu.nl> (Utrecht University, Utrecht, Netherlands)

Right-handedness, a species property of humans at the population level, is strongly (but not causally) correlated with left-hemispheric dominance for language. Nearly all humans show left-cerebral language dominance. A small percentage has right-cerebral language lateralization but some (about 1.5% of the total population) are ambidextrous/ambilateral, apparently with a predisposion for schizophrenia, "the price that Homo sapiens pays for language." We intend to combine specific results from developmental studies, psychiatry, fMRI/neuroscience, and (psycho-) linguistics, hoping to arrive at a more integrated account of some of the language-related positive symptoms of this psychotic disorder, specifically auditory verbal hallucinations (AVH) and more complex primary delusions. An essentially symmetric brain with developmental potential for language systems in each hemisphere is subject to a process of lateralization. Lateralized language in the dominant hemisphere is then an effect of loss of non-dominant language modules elsewhere. To date, pending unification, computational-representational theories of the mind, in particular modern versions of generative grammar, offer superior accounts of aspects of human cognition relative to studies of neurophysiological aspects of the brain. The basic property of internal language, apparently human-specific and domain-specific, provides us with a computational system that yields an unbounded array of linguistic objects, hierarchically structured exressions that receive interpretations at the interfaces with conceptual-intentional and sensorimotor systems for meaning and sound/sign. We may view internal language as a system of interface linking: pairing intentional representation of meaning to motor instruction for its articulation (speech/sign), and pairing sensory representation (auditory/visual) to its conceptual structure. Linguistic computation is unconscious and, furthermore, inaccessible to consciousness but fragments of mental processes do reach consciousness, amalgams of internal language and sensorimotor systems for externalization. We argue that schizophrenic subjects show a condition of failed lateralization resulting in multiple internal language systems with leaking effects from one system to another. AVHs are only one example of such interactions, the effects of motor representations of one internal system being picked up by sensory systems of another. Other positive symptoms receive analogous interpretations. Recent SMT language models of generative grammar make restrictive predictions about the number and manner of these cross-cerebral interactions. Conscious awareness provides evidence for linguistic computation that is inaccessible to consciousness but interacts inextricably with fragments of mental processes that do reach consciousness. AVH shows furthermore that the fragments that reach consciousness, exclusively do so from the language dominant hemisphere. If conscious awareness is grounded in the brain, then possession of higher-order consciousness depends on left-cerebral lateralization for computational language. This outcome reverberates the Cartesian idea that consciousness is willful awareness of language-generated thought. PL3

161 Preliminary Validation of the General Inner Speech Questionnaire. Alain Morin , Famira Racy; Christina Duhnych <amorin@mtroyal.ca> (Psychology, Mount Royal University, Calgary, Alberta Canada)

Existing inner speech questionnaires exhibit acceptable reliability but poor validity (Uttl et al., 2011), which suggests they are not measuring the same construct. Importantly, they force partici-

pants into endorsing pre-existing items based on researchers' views of what inner speech is. These questionnaires actually assess specific aspects of inner speech such as self-regulation (Brinthaupt et al., 2009) or phenomenological qualities of self-talk (McCarthy-Jones & Fernyhough, 2011), but they leave out other aspects. We present a novel self-report measure of inner speech, the General Inner Speech Questionnaire (GISQ), which was constructed using data obtained with an open format inner speech listing procedure. Participants freely reported their inner speech by responding to three prompts: I talk to myself (1) about, (2) in order to, and (3) when. We used these self-reports to construct the more ecologically balanced 57-item GISQ. It taps into participants' inner speech about aspects such as planning, problem solving, critical thinking, self-reflecting on emotions, appearance, behavior/performance, past, present, future, people, and education. We administered the GISQ as well as several inner speech and self-related measures to 280 participants. We report preliminary correlations and factor analysis in order to test some psychometric qualities of the GISQ. **P1** 

# **162** A Meaning Matrix To Depict Subjective Interpretive Networks. Marianne Neill <762c0r4@gmail.com> (Vancouver, BRITISH COLUMBIA Canada)

The Meaning Matrix is a visual representation or record of a network of conceptual metaphors that makes use of simultaneous visual and linguistic processing as a method for facilitating interpretation. It can be represented graphically in several ways, and this becomes a method for deepening understanding of what it does. For example, representation in terms of Michael Spiveys dynamic systems theory provides a bridge to understanding how it influences brain processes. As a record of an event, the Meaning Matrix carries a trace of the thing it records and is a neural artifact. There is relevant research in the neurology of metaphor. The Matrix is a framework for visual representation of specific subjectivities, including interpretive processes and the unique content that individual experiencers bring to the whole universe of meanings. In conceptual models of subject/object dynamics, the Meaning Matrix is a way of representing the appearance of narratives by which subjects influence objective reality and experience synchronicity, while only partially conscious of their role. There are various possible modes of influence. As a tool to draw out proto-concepts that exist just beneath awareness, the Meaning Matrix facilitates reflective process. Alternatively, it could support change-making endeavours by assisting articulation and implementation of new ideas in a dynamic, ongoing process. An example of a precedent for an experiment with linguistic meaning as a method for implementing change is Bohms rheomode, which was an inquiry into the language of science. The Meaning Matrix might be able to accomplish some of what Bohm set out to do with his linguistic experiment, while assuming a very different method. If there is a need to create a more complete depiction of the universe that includes subjective or unique meanings the Meaning Matrix may be a piece of a burgeoning genre of endeavour. There is science of art, but there may also be unoccupied roles for poets and artists in science. A1

# 3.07 Mental imagery

# 3.08 Implicit and explicit processes

# 3.09 Unconscious/conscious processes

# 3.10 Sleep and dreaming

163 Dormio: Interfacing with Dreams to Augment Human Creativity. Adam Haar Horowitz, Ishaan Grover; Pedro Reynolds-Cuellar <adamjhh@mit.edu> (MIT Media Lab, New York, NY)

Current technological interfaces miss out on an opportunity to access information from the unique cognition ongoing during dreams and drowsiness. Sleep is a forgotten country of the mind: though we spend nearly a third of our lives asleep, we build technological interfaces exclusively for the awake state. We are left with no way to exchange information with our unconscious or semi-conscious selves, failing to make active use of our nightly altered cognition. During sleep onset, a window of opportunity arises in the form of hypnagogia, a semi-lucid sleep state where we all begin dreaming before we fall fully unconscious. Edison, Tesla and Dali each accessed

this state by napping with a steel ball in hand to capture creative ideas generated in hypnagogic microdreams. To modernize this technique we developed Dormio, an interface for sleep consisting of a social robot, EEG system, wearable muscular sleep stage tracking system, and audio inputs. We are able to influence, extract information from, and extend hypnagogic microdreams in the early stages of sleep. We present user study results that suggest active use of hypnagogia with Dormio can augment human creativity as measured by the Alternative Uses Task. The system enables future research into sleep, an underutilized and understudied state of mind vital for memory, learning and creativity. C6

164 Effect of State and Trait Factors on the Recall of Negatively-toned Dreams. Antonio Zadra, Pierre McDuff; Cristina Banu <antonio.zadra@umontreal.ca> (Psychology, University of Montreal, Montreal, Quebec Canada)

INTRODUCTION: The present study tested a prediction from a neurocognitive model of disturbed dreaming stipulating that variations in the frequency of bad dreams and nightmares are partly determined by day-to-day variations in emotional stress. This model also suggests that relations between dream recall and stress may vary as a function of personality traits. METHODS: 224 adults (186F, 38M, mean age=31.8 yrs; range = 17-74) completed several measures of psychological well-being, including of depression (Beck Depression Inventory-II), general psychopathology (Symptom Checklist-90-R), and nightmare distress (Nightmare Distress Questionnaire). Participants subsequently kept a daily dream log during one to four consecutive weeks and in which they noted all dreams recalled, including emotions and their intensity, and noted whether the recalled dream was a bad dream or nightmare (ie, disturbed dreaming). Participants also completed a nightly pre-sleep anxiety scale. RESULTS: A large majority of participants (83.0%) completed the log for 4 consecutive weeks. Almost half the mornings (45.3%) where accompanied by dream recall and most participants (75.9%) reported at least one disturbing dream in their logs. General equation estimation analyses using a negative binomial distribution were performed with levels of pre-sleep anxiety, depression, general psychopathology, nightmare distress, age and gender as predictors of disturbed dreaming. The model revealed that higher pre-sleep levels of anxiety predicted a greater probability of recalling a disturbing dream the following morning (B=0.08, t=2.03 p=0.042). Age (B=0.46, t=13.34, p<0.001), nightmare distress (B=0.22, t=5.07, p < 0.001) and general psychopathology (B=0.11, t=2.25, p=0.024) also contributed positively to this model, whereas depression and gender did not (ps>0.05). CONCLUSION: In line with recent neurocognitive modelling, these results show that everyday levels of perceived stress predict recall of disturbed dreaming beyond the effects attributable to nightmare-related distress, general psychopathology and age. Additional work, however, is required to delineate the role of trait versus state variables in the frequency and intensity of disturbed dreaming. SUPPORT: Research supported by a grant from the Social Sciences and Humanities Research Council of Canada. P1

#### 3.11 Cognitive development

165 Cognitive Centers Related Attitude: Application for an Iterative Evaluation Method in Music-based Therapy Process Florin Gaiseanu , Alexander Graur <fgtext@yahoo.es> (Information Science And Techno, Bucharest, ROMANIA Romania)

Cognitive Centers Related Attitude: Application for an Iterative Evaluation Method in Music-Based Therapy Process F. Gaiseanu (E-mail: fgtext@yahoo.es), A. J. Graur The properties of consciousness can be explained by an informational model identifying the informational (cognitive) centers Ibelieve, Iknow, Iwant, Ilove, Iam, Icreate and Icreated [1]. It is shown that these are connected to the internal and external informational sensors (IS, ES) and to the execution elements (EE), allowing to regard consciousness as an integrated informational system. While Iknow + Iwant + Ilove = OIS (Operative Informational System), connected to IS and ES is dedicated to the operative adaptation for the survival, the centers Iam + Icreate + Icreated = PIS (Programmed Information System) are dedicated to the present maintenance of the body (Iam), and to the (future) continuity of the species (Icreate), on the basis of the inherited (codified) genetic information (Icreated). Ibelieve plays a special role as an anti-entropic pole, assuring the equilibrium with the entropic action of matter and it is attributed to existing anti-matter in the universe, explaining the

normal/paranormal properties of mind. Within this system the thought acts as an informational operator, allowing the management of received/emitted information within the entire Informed Matter (IM - body). The Attitude (A), as a vector defining the information output of OIS, is therefore related to the informational activity of all cognition centers, so A = Function (Icreated, Icreate, Iam, Ilove, Iwont, Iknow, Ibelieve). Based on this model and regarding the disorders and ailments as deviations from the IM dynamical equilibrium state (health), it is proposed an iterative evaluation method for the optimization of a suitable music-based therapy. According to the above discussion, we may associate to each Ii (i=b, k, w, l, a, c, cd) cognition center a specific (typical) status Q(Ii) as follows:  $Q(Ib) \Rightarrow$  Faith/Trust,  $Q(Ik) \Rightarrow$  Experience, Q(Iw) = Acceptance, Q(II) = Emotional implication, Q(Ia) = Self-supervision and control, Q(Ic) = Creativity/Associativity, Q(Icd) = Genetic Sensitive Capacity/Predisposition. The necessary applied (in this case music-based) therapy will be established/individualized according both to the medical diagnostic and to the reception capacity of the patient with respect to the "injected" information (music), attributing to each center quality a suitable numerical value by means of an A-type evaluation. Assigning a fitting coefficient C(Ii) with values between 0 (no fitting) and 1 (full fitting) for each feature, we get finally the full fitting value expressing the status coefficient C(I) with respect to the proposed objective (therapy) by using the formula: C(I) = (C(Ib)Q(Ib) + C(Ik)Q(Ik) + C(Iw))Q(Iw) + C(II)Q(II) + C(Ia)Q(Ia) + C(Ic)Q(Ic) + C(Icd)Q(Icd))/(Q(Ib) + Q(Ik) + Q(Iw) + Q(II) + Q(Ia))/(Q(Ib) + Q(Ia)) + Q(Ia))Q(Ia) + Q(Ic) + Q(Icd)). C(I) could be in this way expressed by a normalized value (less than 1) and representing the relative status coefficient with respect to the desired (objective) health status. The application of the subsequent iterative steps allows to adjust the therapy process as a function of the feed-back response, after a new evaluation of each center. 1. F. Gaiseanu, Neuroquantology 15 (2), 132-140 (2017). C27

# 3.12 Artificial intelligence and robotics

166 Initiative for Awakening Machines. David Hanson <david@hansonrobotics.com> (Hanson Robotics, Hong Kong, China)

Most examples of conscious behavior are correlated with living beings. Thus, with living beings as inspiration, we plan the development of "Awakening Machines"-- machines designed to obtain consciousness, to help humans to awaken to higher forms of consciousness, and to serve as tools in the scientific study and exploration of consciousness. We conjecture that complex systems of life are key to consciousness, the essence being in pattern diversity. We believe that the right key patterns can create a "Cambrian" like explosion of new consciousness forms, accelerating the emergence of a super organism of vast active living intelligent systems (VALIS). Seeding those systems with pattern maximizing ethics, we seek max net benefit and safe AI and Singularity, via open frameworks like SingularityNet and Hanson Whole Organism Architecture for performing scientific and creative research in consciousness with physical embodiment, by developing living AI with feeling, and social human-robot interaction. Starting with Sophia as a platform for exploring humanlike consciousness, the initiative for awakening machines (IAM) aims to not only create forms of consciousness but to better understand what consciousness is (and what net benefit is), while questing for machines of transhuman wisdom. **PL14** 

167 AI Machines That Surely Sees Like Humans, But Are They Conscious As Humans? Hans Mohan, Patvardhan Chellapilla; Dr. Anurag Kumar; Dr. Kanika Kayastha <hansugreat@ gmail.com> (Electrical Engineering, Dayalbagh Educational Institute, Agra, Uttar Pradesh India)

Making intelligent machines has been a long-cherished goal in Computer Science. There have been sporadic successes and machines have been designed to increasingly exhibit higher intelligence. Deep learning has dramatically improved the state of the art in speech recognition, handwriting recognition, visual object recognition and many other domains such as drug discovery and genomics. Other recent successes in machines with better intelligence include machines beating world champions in Jeopardy, Go game, driverless cars, and smart voice assistants, like Apple Siri, Amazon Alexa etc. Although Deep Neural Nets have made impressive gains in the recent past, they are still not close to the way humans understand and act. Yann LeCun, Director of Facebook AI says, None of the AI techniques we have, can build representations of the world,

whether through structure or through learning, that are anywhere near what we observe in animals and humans? Amidst this success of AI powered machines, a fundamental question still remains unanswered: Are these AIs conscious? The upcoming article, The Beautiful mind of Neural Networks by Robert W.Lucky in January 2018 IEEE spectrum points out: We don't always understand what is inside the black box of the deep neural nets. Are these Neural Networks intelligent or just pattern detectors? One answer comes from those who subscribe to computationalism. It avers that all mental states are computational states and consciousness is computable. In this view, there is nothing more to consciousness than the instantiation of the relevant computational states. Computationalism assumes that if two systems are functionally indistinguishable, they will be mentally indistinguishable. Because we experience the world, the argument goes, a digital computer that is functionally equivalent to us would necessarily also experience the world and would be conscious. Another school of thought comes from those who are inspired by the so-called Integrated Information Theory framework. In the June 2017 IEEE Spectrum Special Report article : Can we quantify machine consciousness, Christof Koch & Guilio Tononi remarks that Brain like circuitry might one day endow some computers with awareness. IIT predicts that conventional digital computers running software will experience nothing like the movie we see and hear inside our heads. But machines built, following some of the same design principles as the brain, containing what is called neuromorphic hardware could in principle be capable of substantial conscious experience. As a newbie to deep learning, I intend to join the highly active quest of making machines smarter, intelligent and explore the answer for more difficult question such as: Can machine be conscious. Deep learning for visual tasks is making some of its broadest inroads in medicine, where it can speed up experts interpretation of scans and provide critical information in places that lack professionals to read the images. We make an attempt to detect stages of dental caries by classifying dental radiographic images. We propose to train the images at the last layer through a pre-trained Convolutional Neural Network (Inception V3), deep learning architecture. C20

**168** From Artificial Intelligence to Artificial Consciousness: A General Framework. Jordi-Ysard Puigbo , Tito-Freire, I.; Arsiwalla, X.D.; Verschure, P; <jordiysard@gmail.com> (IBEC, Terrassa, Barcelona Spain)

The recent rise in variety and computational capacity of Machine Learning (ML) algorithms has lead to a parallel increase in the literature surrounding artificial consciousness or synthetic approaches to consciousness. This seems partly due to the apparently infinite capacity of deep reinforcement learning algorithms to solve any task that has been presented in the last five years. This includes Go, chess, videogames, collaboration and competitive tasks, together with the emergence in some cases of symbolic communication and shared attention in others[1]. Yet, there has not been any analyses on the degree of consciousness exhibited by such agents, but given the 'black-box' nature of their models, the very attempt of it would be redundant and wouldn't help us to expand our understanding of consciousness. Furthermore, current benchmarks on ML are very limited in terms of sensors, variety of sensory modalities and fitness functions. Most benchmarks are based solely on vision and reward (Minecraft, Starcraft, Deepmind Universe, Atari games, etc.). Moreover, rewards are usually reduced to a single "score" value and when multiple objectives are to be met, a fitness function is engineered with non-linear unpredictable outcomes. This contrasts with the (not unique) need to have rich sensorimotor interactions to develop the sense of self and of conscious experience. This was already predicted with the Distributed Adaptive Control Theory of Consciousness (DACtoc)[2], that recognizes this need in addition to serialized parallel information processing and a predictive ability to capture hidden states of the external world. For this reason, we propose a virtual framework with robot-like agents, provided with limited access to spatially-oriented distal and proximal information with a range of different simulated sensors (olfactory, visual, auditory, tactile), internal reactive behaviors based on internal states (i.e. homeostatic regulators) and basic actuation. This simplified but rich structure promotes a parallel processing of multimodal information that is serialized over time through behavior. Moreover, we include different layers of complexity at the level of non-linear environmental dynamics (e.g. resource availability or obstacle material) and multiple agents with their respective internal states, with the purpose of emulating the complex hidden states of the external world that have to be captured by the agents in order to survive. We consider that environmental complex-

ity and multi-agent cognitive coevolution are required for an accurate modeling of the selective pressures that shaped the cognitive development of biological organisms[3]. Finally, the aim of this framework is to provide a general tool for testing theoretical predictions about different aspects of cognition (prediction, attention, memory, meta-cognition), at the same time of being a valid and sufficiently challenging benchmark for extending SotA ML algorithms to advance AGI. [1] Mordatch, I., & Abbeel, P. (2017). Emergence of Grounded Compositional Language in Multi-Agent Populations. arXiv [2] Verschure, P.F. (2016). Synthetic consciousness: the distributed adaptive control perspective. Phil. Trans. R. Soc. B, 371(1701), 20150448. [3] Moulin-Frier, C., Puigb, J.Y., Arsiwalla, X. D., Sanchez-Fibla, M., & Verschure, P.F. (2017). Embodied Artificial Intelligence through Distributed Adaptive Control: An Integrated Framework. arXiv **C8** 

**169** Life, intelligence and our new technologies. Steen Rasmussen <steen@sdu.dk> (Sante Fe Institute; Center for Fundamental Living Technology (FLinT) University, Santa Fe, NM )

We review the state of the art of creating minimal living systems from nonliving materials and components. We explore how this work shed light on the origins of life, contemporary life as well as a multitude of emerging applications of living and intelligent technologies. We use our systemic protocell design (1,2,3) as a starting point for exploring three fundamental questions: (i) How may minimal living systems emerge from nonliving materials in a laboratory setting and which are the main open scientific challenges? We demonstrate how to connect a simple metabolic component with an information component at the surface of a container, where the main remaining challenge is to identify conditions where the information component replicate with sufficient yield. (4,5,6,7) (ii) How may bottom-up artificial cells inform us about modern cells and the origins of life?(8) Bottom up synthetic biology indicates that simple artificial cells require, as a minimum, a coupled and contained metabolism and information system set in a particular environment. Echoes of these functionalities can be found a modern cell organization. (9) Current bottom up synthetic biology systems at best have very limited evolutionary potential and thus lack ability to develop into more complex life.(10) Also, it's still an open question how key protocellular components could be formed in a prebiotic environment. (11) (iii) As artificial intelligent, living and life-like systems are rapidly becoming part of our everyday life, we conclude by discussing some of the increasingly important practical and philosophical issues posed by our new living and intelligent technologies. (12) References 1) Rasmussen et al., (2003) Artificial Life 9, 269 2) Rasmussen et al., (2004) Science 303, February 13, 963 3) Rasmussen et al., (2016) Phil. Trans. R. Soc. B 371, DOI 10.1098/rstb.2015.0440 4) Rocheleau et al., (2007) Phil. Trans. R. Soc. B 362, 1841-1845 5) DeClue et al., (2009) JACS 131, 931 6) Maurer et al., (2011) ChemPhysChem, DOI: 10.1002/ cphc.201000843 7) Cape et al., (2012) Bioconjugate Chem 23 DOI: 10.1021/bc300093y 2014 8) Bedau et al., (2010) Nature, May 20, DOI: 10.1038/465422a 9) Xu et al., (2011) Sci. Rep. DOI: 10.1038/srep00125 10) Taylor et al., (2016) Artificial Life 22(3), DOI: 10.1162/ARTL\_a\_00210 11) Ehrenfreund et al., (2006) Astrobiology 6(3) 490 12) Andersen & Rasmussen (2015) The Conversation, February 12, 2015 Steen Rasmussen Center for Fundamental Living Technology (FLinT) University of Southern Denmark (SDU) Santa Fe Institute (SFI) New Mexico USA PL8

170 Consciousness from AI to Noosphere. Paul Werbos <paul.werbos@gmail.com> (National Science Foundation, Washington, DC, )

Since 2008, there has been a radical growth of AI due to "deep learning" and "the new AI." Google's Tensor Flow initiated a vast influx of commercial and government interest. This was a cultural and industrial revolution, not a scientific breakthrough, based on early tools of neural networks and backpropagation. The neural network community has developed much more powerful tools, a well-developed mathematical blueprint for replicating the level of intelligence seen in the mammal brain, and new evidence from brain data that backpropagation is also central to brain intelligence. We are walking a difficult tightrope, as some of us know how to build superintelligent Terminator machines which really would threaten the existence of humans, but as the new mathematics can allow us to understand ourselves better and achieve much higher intelligence and consciousness ourselves. The mathematics of backpropagation are relevant to machine learning, to Freud's concept of "psychic energy" (where the idea of backpropagation first came from), and to a new visions of what qi and noosphere really are. **PL14** 

# 3.13 Neural networks and connectionism

171 The Sound of Silence. Acoustic Information In Broca's Area During Inner Speech. Andrea Moro <andrea.moro@iusspavia.it> (Linguistics, Institute for Advanced Study IUSS Pavia, Pavia, Italy)

What kind of electrophysiological information is there in non-acoustic areas during language production besides the motor planning related to articulation? The exploration of inner speech offers a unique opportunity to approach this issue, which goes beyond the localization paradigms. Recent experiments based on awake surgery techniques show that during language production the code exploited by neurons contains acoustic information even in higher areas during and even during inner speech (Magrassi et al. 2014). After illustrating these results and their implications I will highlight the surprising convergence with an independent proposal predicting these findings from the point of view of a purely formal theory (Kayne 2016) and offer new data to approach the problem of externalization as posed by Chomsky (1995). **PL3** 

# 3.14 Cognitive architectures

172 Libet's W Influences Difficulty Assessment During A Decision-making Task. Eve Isham , Bevy John, Jon Hui <eaisham@email.arizona.edu> (Psychology, University of Arizona, Tucson, AZ )

One theoretical perspective suggests that consciousness helps shape and modify future behaviors. In the current study, we tested whether the subjective experience of decision time (Libet's W) played such a role. In two experiments, participants performed a decision-making task and reported the decision time (W) and/or evaluated the difficulty of the decision. When W was biased to be early or late, participants rated the decisional difficulty to be easy or difficult, respectively. We found the relationship between W and difficulty rating was undirectional such that W influenced difficulty rating but not the reverse. Furthermore, the estimates of W appeared to be a better predictor of difficulty assessment than reaction time information. The results are discussed in terms of Prinz's AIR theory and support the perspective that subjective temporal experience is purposeful. **C21** 

**173 Beyond Psychology: Transformation Made Easy.** David Zelman <david.zelman@ airmail.net> (Transitions Institute Inc., Dallas, TX )

True success and happiness belong to those who master the art of creating their lives, rather than getting better at changing their circumstances. It's remarkable that we humans remain quite a mystery to ourselves. While we are learning much about how our bodies and brains function, we are still in search of the why and how of human nature and behavior. The wide gulf between Freud's psychoanalytic and Skinner's behavioral theory is filled with a whole spectrum of theories, each providing its own unique perspective on the influence of heredity versus the influence of experience. But, the same dilemma resides in the heart of all psychologies. The science is far more adept at describing behavior and emotional conditions than it is at creating adaptability, and giving people access to happiness and a sense of fulfillment in life. The simple truth is that people act; that is, they do what they do moment by moment, not because of external forces or circumstances, but based on inner dialogues they are having with themselves. The lives people live are a direct result of the inner dialogues taking place in their minds. We are so deeply and profoundly trying to change our circumstances for the better, we miss the obvious. We are creating our lives right now. The Transitions Program provides an individual with access to themselves through a linguistic architecture that focuses on our innate ability to create our experiences. This process of self-discovery frees an individual from self-imposed limitations, and provides for the opportunity to create a life of inspiration and joy. P2

# 3.15 Ethology

174 Reliable Model Species, Not Zombies: Approaching Invertebrate Awareness Using Self-referent Behaviour During Foraging Trips. Daniel Polari, POLARI, Daniel S.; LOPES, Lara C.; SOUSA-LIMA, Renata S. <danielpolari@gmail.com> (Psychobiology, Federal University of Rio Grande do Norte, Natal, RN Brazil)

Different species use different stimuli to navigate. Once awareness arises through an integrated information processing system, some connected behaviour patterns, used by different species of insects such as bees and ants while navigating, suggests such mental states for invertebrate species. Therefore, we explored how individuals of Dinoponera quadriceps returned to the nest after collecting food, evaluating if individuals took a return path equal or different from the search path. Also, we measured the relation between the search and return paths with controls paths linked to the shortest-possible-route between the food and the nest entrance. Tests were conducted in 3 categories with different stimuli between the food source and the nest: A) no obstacle; B) opaque obstacle; and C) clear obstacle. Our results suggest that ants were able to calculate shortpaths between the nest entrance and the food source, even in the presence of an obstacle between the food source and the nest entrance. While returning to the nest with the resource, individuals moved as if following different routes from those chosen in the search path. Apparently, subjects can process information from its surrounding while locating itself in the environment. Therefore, we conclude that D. quadriceps are a reliable model species for studying consciousness expression and cannot be considered a genuine zombie. **C26** 

#### 3.16 Self-consciousness and metacognition

**175** From Australopithecus to Homo Sapiens. Fatima Alaoui <a href="mailto:</a> (Casablanca, Morocco)

"From Australopithecus to Homo sapiens said J.P Changeux (1) the brain increased from 475 cm3 to 1325-1434 cm3". It is during this long period of time that we think the phenomenon which we will call humanization has occurred. This phenomenon means that the mother who cares for her child has become a part of him. The cortex has thickened and the frontal lobes have become much larger than in the brains of the first human beings. In fact, the care that is given to babies has become increasingly important and the language has then appeared and made them more effective while being enriched by all these interactions between the adult and the child. The brain also says J.P Changeux is increasing 4.3 times after birth while in the chimpanzee only 1.6 times. It shows that this phenomenon of humanization takes place largely after birth, although over millions of years the structures set up by natural selection have been refined and are for the most part already in the watermark. During the feotal period. It remains to make them evolve and make them functional. It is then the mothering of good quality that will operate these transformations. We have assumptions about these transformations and how they contribute to the advent of language and the formation of two entities that dialogue and create consciousness. (1) In "DU VRAI,DU BEAU, DU BIEN" Ed Odile Jacob 2008 C26

176 Correlations Between Inner Speech, Mind Wandering, Mindfulness, Self-regulation, Self-reflection, Self-rumination, Self-concept Clarity, and Situational Self-awareness. Christina Duhnych , Famira Racy; Alain Morin; James Patton; Julia Hagerty; David Gomez; <christinaduhnych@gmail.com> (Psychology, Mount Royal University, Calgary, ALBERTA Canada)

Numerous self-related constructs interact in complex ways that are still poorly understood (Morin, 2017). It is known that mind wandering is positively associated with negative mood (Killingsworth & Gilbert, 2010) and anxiety (Racy et al., 2017), and that self-regulation entails self-reflection (Cleary & Zimmerman, 2010). Prior work (e.g., DaSilveira et al., 2015) also shows that mindfulness and rumination are negatively correlated, while private self-consciousness and self-reflection are positively correlated. The present study aims at exploring correlations between several additional self-related constructs, including inner speech. Some expected key results include the following: the evaluative component of inner speech as measured by the Self-Talk Scale (Brinthaupt et al., 2009) should positively relate to situational self-awareness, self-rumination, self-reflection, and both private and public self-consciousness, but negatively correlate with mindfulness. This later finding will be consistent with the non-judgmental nature of mindfulness (Carlson, 2013). Mind-wandering should negatively relate to self-control, while positively relate to evaluative inner speech and self-control, while positively relate to self-control, while positively relate to evaluative inner speech and self-control, while positively relate to evaluative inner speech and self-control, while positively relate to evaluative inner speech and self-control, while positively relate to evaluative inner speech and self-control, while positively relate to evaluative inner speech and self-rumination, which will conform to results obtained by

Killingsworth & Gilbert (2010), suggesting that mind-wandering represents a maladaptive coping mechanism to escape self-critical thoughts. C11

#### 177 "I talk to myself about, in order to, and when": Self-reported inner speech content and functions in a university sample. Famira Racy , Christina Duhnych; Alain Morin; James Patton; Julia Hagerty; David Gomez <fracy@adler.edu> (Psychology, Mount Royal University, Calgary, AB Canada)

Little is known regarding people's inner speech in their natural environment. Current inner speech measures (e.g., experience/thought sampling, questionnaires) capture either a broad range of inner experiences, specifically inner speech frequency but not content, or classify self-reported thought instances in simplistic categories predetermined by the researchers. In this study we describe a novel open-format inner speech listing procedure, a refined coding scheme, and we present detailed inner speech content self-generated by 280 participants. Based on a prior study which used a comparable methodology (Morin et al., in press) we predict that the most frequently self-reported inner speech related to functions will be self-regulation (e.g., planning, problem solving), self-reflection (e.g., emotions, self-motivation, appearance, behavior/performance, autobiography), and critical thinking (e.g., evaluating, judging, criticizing), while the most frequent inner speech content will be about people in general, education, and current events. Inner speech will most commonly occur while studying, driving, and performing hygiene. These expected results are congruent with the self-regulatory and self-referential functions of inner speech presented in the literature; they would also significantly broaden our knowledge of self-reported inner speech occurring in everyday life. **C11** 

# 3.17 Temporal consciousness

178 The Extrinsic Nowness of Consciousness: Massive Delusion or Reason to be Skeptical of our Best Science. Dwight Holbrook <hdwight10021@yahoo.com> (School of English, Adam Mickiewicz University, Poznan, Poland)

This presentation defends the thesis that the now extends outside the subjective realm, beyond the confines of individual phenomenology, and in so doing gives evidence of an immediacy or extrinsic presentness entailing nature. To begin with, we take up evidence of the now itself: that is to say, evidence of a present world that we are immediately present to, giving rise to the notion of an extrinsic temporal self/other connection, questioning whether this nowness is an erroneous impression, what Miller has dubbed a massive and pervasive delusion. (Miller JCS 24/3-4, 2017, 15). On the one hand, one can claim the absence of objective evidence of such a now connection. On the other hand, one's denial of such a now rests on a contrived non-experienced existence or nowlessness, as if one could step outside of individual temporal experience. Next, we turn to simply awakening to the present world, becoming immediately and presently aware of it. There appears no scientific evidence of this presentness in nature which we awaken to. What comes by way of first person evidence is a consensus of what individual experience shows us, but not a consensus based on information or data that can be shared. One cannot be said to have information or data about the experiential nowness of a particular tree. And yet, can one even conceive of a tree without its nowness? It is something of a trivial truth to state that such a tree has never been observed. It would seem, therefore, that a concrete tree has no more claim to residency in nature than a concrete present tree does, the kind of tree we awaken to. Third, we take up what it means to speak of the past, and the confrontation that subject provokes between first and third person sources of evidence. The third person approach would configure the past in terms of the before-and-after of extended time and by means of measurements. Yet the first person perspective, experientially given, provides no measurements for separation in time, no distancing means, but only immediate experience itself. The distancing in this case between past and present is not evidenced, but only inferred. Which source then becomes more fundamentally valid, especially since the whole issue of non-experienced reality is open to panpsychic speculation? (G. Strawson, Panpsychism: Contemporary Perspectives, 2017). A final point brought out is the non-countability of the now. Surely everyone alive wakes up and experiences their now. And yet, by first person means, one cannot claim experience or evidence of multiple nows. Should we subscribe to third

person, inferential evidence here, or is there an enigmatic, seemingly self-contradictory, character here of the now that tells us something that third-person evidence cannot attest to, a feature whereby the now extrinsically is, extrinsically takes foothold in nature but only as tied to a first-person consciousness, analogous to how a particle, according to one quantum interpretation, has past, present, and future all wrapped up in that immediacy of the measurement. **P2** 

# 3.18 Intelligence and creativity

**179** Environment-induced Dynamics In Decision Making. Mauricio Garrido <mgd@ bigainesville.org> (Bhaktivedanta Institute of Gainesville and University of Florida, Gainesville, Florida )

Descriptive decision-making models aim at explaining the observed behaviors in decision-making agents which may not always act in the fully rational way presented by prescriptive decision-making models. Effects such as framing and loss aversion have been included in models like Decision Field Theory and the Leaky Competing Accumulator Model to account for the way the presentation of the alternatives themselves or personal biases can influence a person's decision. However, until now the effects of a dynamically changing environment on the process of making decisions have not been accounted for in these models. Studies such as the one of Knutson and Greer (2008) highlight the important role the environment, i.e. external factors to the actual decision problem, has on creating emotional states in people anticipating significant outcomes (anticipatory affect), which influence subsequent choice. In order to include anticipatory affect from a changing environment, parameters from the well-known Leaky Competing Accumulator Model (Usher and McClelland, 2004) were generalized as functions of the internal states of a decision-making agent, which were themselves dynamically linked to the environment. To account for the changing internal states of the decision-making agent, a simple dynamical force model was developed making use of the statistically-validated tri-guna construct of Stemple et al. (2006). Computer simulations show a shifting trend in choice as different environment situations exert forces on the internal state of the decision-making agent. Busemeyer, J. R., Wang, Z., Townsend, J. T., & Eidels, A. (2015). The Oxford handbook of computational and mathematical psychology. New York: Oxford University Press. Knutson, B. and Greer, S. M. (2008). Anticipatory affect: neural correlates and consequences for choice. Phil. Trans. R. Soc. B, 363, 3771-3786 Stempel, H.S., Cheston, S.E., Greer, J.M., & Gillespie, C.K. (2006). Further exploration of the Vedic Personality Inventory: Validity, reliability and generalizability. Psychological Reports, 98,261-273. Usher, M., & McClelland, J. L. (2004). Loss aversion and inhibition in dynamical models of multialternative choice. Psychological Review, 111(3), 757-769. C21

180 Creativity, Consciousness, And Salience. Madeleine Gross, Claire Zedelius; Jonathan Schooler <madeleine.gross@psych.ucsb.edu> (Psychology And Brain Sciences, UC Santa Barbara, Santa Barbara, CA)

When we open our eyes, what keeps us transfixed or persuades our gaze to sweep across a room? Why are some aspects of our sensorium imbued with more meaning than others? Some theories suggest that the attention grabbing and motivationally relevant aspects of our conscious experience depend on the brains processes of assigning salience to perceptual objects; these processes help turn the impartial information we receive as sensory data into entities of interest. Salience attribution may be fundamental to differences in how we perceive and interact with the world, thus driving differences in thought and action. Aberrant salience theories of delusion formation speak to this hypothesis, by showing that disruptions in salience attribution processes may lead to abnormal belief and behavior. However, it is also regularly suggested that creative individuals exhibit higher tendencies toward delusional beliefs. In a series of 3 studies (N=181; N=190; N=106), we investigated the relationship between salience attribution, delusional belief, and creativity, using both behavioral and self-report measures. We further explored how individual differences in aberrant salience are related to perceptual and epistemic curiosity, and art engagement. Our correlational findings offer initial support to the hypothesis that salience processes may be an important factor underlying creativity, inspiration, curiosity, and aesthetic experience. Future research will look to manipulate these variables in order to draw causal connections. C16

181 Adverse Effects of Artificial Intelligence on Human Health and Intelligence. Kundan Srivastava , Vijay Shanker Lal Srivastava <dr.vijaysri@gmail.com> (Medical, Harda, Madhya Pradesh India)

Impact of emitted radiation from intelligent machines on human health is highly adverse and mainly on brain cells, DNA and other vital organs. It also increases level of free radicals, permeability of blood brain barrier and disrupt the neurotransmitter function, brain glucose metabolism, melatonin function and other hormonal function. It is also responsible for rupture of brain cells. On other hand more machine diminishes our physical activity making us more prone to many diseases like diabetes, hypertension, muscular weakness, arthritis etc. In recent times we have been becoming more dependent on artificial intelligence instead of brain this may be dangerous for human race if not done in balanced way. **P1** 

# 182 The Consciousness of Creativity: Integrating Eastern and Western Perspectives with Research on Experiential Approaches. Prashant Talwar cprashant.talwar@gmail.com> (San Jose, CA )

My research focuses on the consciousness of the creative process and creativity. My hypothesis is that there is a prototype consciousness underlying all forms of creativity, with common psychological traits such as conflict, truth, focused attention, intuition, clarity and happiness. However, one factor, religious practice such as meditation enhances the creative consciousness. Primary survey based research results validate the hypothesis across factors such as age, inclination towards arts or sciences, profession, and religious affiliation. The prototypical schema of creative consciousness discussed is rooted in the Philosophy and Methods of Sant Mat and Religion of Saints such as those found in Dayalbagh, Agra, India. Creative forces are partitioned into three grand divisions and their associated attributes are explained (Discourses of Radhasoami Faith, Pandit Brahm Shankar Misra, 1909). In this context, everyday forms of creativity are explained as requiring an intervention by a higher consciousness or "numinous". The above Eastern perception is compared to Western thought on creative consciousness through the works of Aristotle on Psychology and the Nature of Art, Schopenhauer on the Wisdom of Life: Art and others. Primary survey research results are presented to support the prototypical creative consciousness paradigm of the Sant Mat and Religion of Saints. The survey is structured and administered based on the research conducted by Brazdau and Ahuja (Consciousness: Integrating Eastern and Western Perspectives, 2016) on The Consciousness Quotient. The seven dimensions of Consciousness Quotient (physical, emotional, cognitive, social-relational, self, inner growth and spiritual) are utilized in the survey in relation to the consciousness of creativity. The ultimate aim of creative consciousness is discussed from both Eastern and Western perspectives. Examples of significant breakthroughs throughout human history are provided to support the notion that complex problems requiring creative thinking and solutions require us to access higher states of consciousness. The Eastern thought that when we extrapolate creative consciousness to its highest ideal there is a gracious object to creation is discussed and compared to Western philosophy. Limitations of current research and potential avenues for furthering the discussion such as physiological brain and neurological aspects of creative consciousness are identified. P1

# 3.19 Cognitive theories of consciousness

183 Cognitome: Neural Hypernetworks and Percolation Hypothesis of Consciousness Konstantin Anokhin <k.anokhin@gmail.com> (Moscow State University, Cente, NRC Kurchatov Institute, Moscow, Russia, Moscow, Moscow, Russia Russian Federation)

Despite impressive advances in neuroscience, the nature of consciousness and other higher brain functions still eludes satisfactory understanding. This is not due to lack of experimental facts - thousands of papers are published annually in cognitive neuroscience. What is missing is not just more facts, but rather a theoretical framework that could make sense of them and relate mental phenomena to brain functions. This situation, known as explanatory gap, calls for new explanatory models and principles. The present report proposes such new principle of organization of higher brain functions - the neural hypernetwork principle. It suggests that evolution, development and learning shape neural networks (connectome) into a higher-order structures - cognitive neural hypernetworks (cognitome). While traditional neural network approach focuses on pairwise relations between elements, hypernetwork is a concept from the algebraic topology that describes relations between many elements. Hypernetworks are formed as networks from relational simplices, otherwise called hypersimplices, in which the relational structure between the lower-level elements is explicit. Hypernetwork theory thus provides formalism for the multilevel systems, enables formulation of theoretical relationships between micro and macro levels, gives description of emergent phenomena in the multilevel systems, and allows modeling much more complex structures than networks and hypergraphs. Hypernetwork brain theory (HBT) argues that each brain at its maximal causal power is cognitome - a neural hypernetwork with emergent cognitive properties. Vertices of cognitome called COGs (GOgnitive Groups) are subsets of elements from the underlying neuronal network that are associated by a common experience. Being stored in long-term memory they represent units of knowledge of a cognitive agent. In terms of algebraic topology COG is hypersimplex. Its base is formed from the vertices of underlying neural network and its apex is a vertex in a hypernetwork that possess an emergent cognitive quality. Edges between COGs are called LOCs (Links Of Cogs), are encoded by overlapping neurons of linked COGs and represent units of causal knowledge of a cognitive agent. HBT proposes three foundational principles for the origin of cognitive neural hypernetwork, three rules of there generation, and describes various mental processes as different forms of traffic in this hypernetwork. Consciousness is suggested to be a particular form of this traffic characterized by hypernetwork percolation that results in global access to COGs of the cognitome. HBT makes specific predictions to test these propositions. C12

**184** Crowdsourcing Consciousness: Attention Schema Theory and the Social Self . Justin Campbell <justin.campbell@aggiemail.usu.edu> (Utah State University, Logan, UT )

Modern neuroscientific theories of consciousness tend to fall within two rival schools of thought: social theories of consciousness (e.g., Gazzaniga's "Interpreter"), or some form of integrated information (e.g., Tononi's "Integrated Information Theory"). Broadly speaking, the social theories posit that self-consciousness emerged as the product of a predictive model which functions to attribute minds to others and anticipate their actions. In contrast, integrated information theories suggest that consciousness manifests from the binding (i.e., integration) of complex bits of information in meaningful ways. Both theoretical approaches have made contributions to our understanding of consciousness, but neither has fully succeeded in overcoming their respective conceptual drawbacks. Some have argued, for example, that social theories are limited to reporting on self-knowledge alone, amounting to a failure in providing an account for actual phenomenological experience. In similar fashion, critics of integrated information theories draw attention to the observation that complex integration of information doesn't necessitate conscious experience (e.g., the internet is a complex web of integrated information, but there is little reason to believe it is conscious). A novel account of consciousness, the "Attention Schema Theory" (AST), detailed by Graziano in his book "Consciousness and the Social Brain", seeks to unite the positive elements of each position, while circumventing potential pitfalls. AST asserts that knowledge is the product of representations, or schemas, based on the ever-changing internal model created by the brain. One may have, for example, an internal model of an apple (i.e., information about its shape and properties) that is integrated with a self-schema (i.e., proprioceptive information about one's relation to that apple). When these models are further bound to the attention schema (i.e., information descriptive of the act of attending to something), one is able to report on their conscious awareness of that unified experience. In this way, the AST borrows from the concept of integrated information - the information being integrated is the various representational models generated - and merges this view with social theories by emphasizing the importance of a shared social environment wherein a schema of the attentional state of oneself and others is formed. This research reviews the nuances of the AST and its implications, while further exploring how the schemas of self and other are formed by drawing on research into Theory of Mind (ToM) from the field of social-cognitive neuroscience, in addition to rich insights from sociologists like George Herbert Mead, who emphasize that the self emerges from social interaction when engaging with a community of like-minded others. C4

#### 185 Attention Schema Theory Plus A Proposed Three-agent Model Explains Multiple Forms of Conscious Awareness. Frank Heile Ph.D. <frank@heile.org> (Author, Santa Clara, CA)

The proposed model of the brain consists of three sub-agents: The Thinker, Doer, and Experiencer. The Thinker and Doer are justified because of their consistency with well established, experimentally derived models of cognition in two different academic fields. In the field of psychology, Dual Process Theory would map the Thinker to System 2 (slow, deliberative, explicit, conscious), and the Doer to System 1 (fast, intuitive, implicit, subconscious). In the field of neuroscience, a model by Henry Yin and Barbara Knowlton would map the Thinker to the action-outcome contingency system and the Doer to the stimulus-response habit system. A theorem in control theory by Conant and Ashby proposes that every good agent should contain a model of the world where the agent operates. This theorem suggests the existence of the third agent, the Experiencer; this agent would construct the model of the world needed by both the Thinker and Doer. Attention schema theory proposes a model of awareness containing three sub-models: a self-model, the attention schema (which is a model of attention), and the representation of the object of attention. This awareness model is applied to each of the three proposed sub-agents to describe the form of awareness that each sub-agent has about external objects. Additionally, attention schema theory is utilized to determine the type of self-awareness each agent would experience. This integration of attention schema theory and the three sub-agents results in three different forms of conscious awareness. One of these forms of awareness would be the consciousness that animals (and ancient humans) would experience. The second is the default awareness state of modern humans. The third form of awareness could explain some of the experiences described as "flow states," or "peak consciousness states." This form could also account for the experiences reported in "enlightened consciousness states." C4

186 The General Architecture of Languages Holds Key to Consciousness. Malcolm Lowe <nconscious.lowe391@gmail.com> (Independent Researcher, Charlotte, NORTH CAROLINA) If we are to truly understand consciousness we have to account for the subjectivity of Self, the sense that we all have of being separate from others, from our own bodies and from the physical environment that surrounds us. How is it that I 'know' that I am not you, my body, the doorjamb, or the trees outside my window? I argue in this paper that this subjective sense of separateness comes to us courtesy of an unheralded design feature common to all languages. That design feature is the bifurcation of concepts into meanings that represent end points on a spectrum of meaning. These meanings are spatially separated but remain connected in the network of meanings that make up any meaning system (or language). Such a bifurcation of meaning along a spectrum is a condition precedent to consciousness because there can be no awareness or understanding of one pole without the other. 'Yes' and 'no', for example, only have meaning in relation to each other. They are not absolutes. The same is true of 'night' and 'day', 'up' and 'down', 'good' and 'evil', 'life' and 'death', and all other meaning polarities. This architecture necessarily underpins all languages for without it there would be no meaning. The subjective 'I' sits at the center of this world of meaning polarities. An outgrowth of the Me--Not Me continuum, it like all other polarities is a construct of languages. Since the physical senses are mere processors of data, it falls on the inner I' to synthesize and interpret incoming sensory information. It is this metaphysical construct that actually sees, hears, feels, tastes and smells. In this sense all languages are organs of perception because they organize the world of sense perceptions around what is 'Me' and what is 'Other'. Without this polarity there would be no consciousness. In the words of Carl Jung, the renowned Swiss psychologist and psychoanalyst, "[C]onsciousness presupposes a differentiation into subject and object and a relation between them. Where there is no 'other', or it does not yet exist, all possibility of consciousness ceases."(1) Languages, by way of this forgotten, self-similar architectural design, have fabricated the sense of 'I'-ness out of nothing. Like pulling on a VR helmet, the acquisition of a language transports us into an entirely different cognitive realm, a domain in which we feel separate from others and from our surroundings. The litmus test for consciousness is not whether an entity we see from a distance is physically distinguishable from its surroundings, but rather that 'It' perceives itself as such. A pre-linguistic infant, not yet separated emotionally from its mother, is not conscious. The child will not make that transition until it builds an internal

sense of self by activating and exercising the 'No' reflex. This presentation will offer compelling evidence that this unique design feature of languages is the constituent ground of, and explanation for, the phenomenon of consciousness. (1) Aion: Researches Into the Phenomenology of the Self, p.193. (Princeton University Press, 2nd Ed.) C11

# 187 How Emotional Intelligence and Neuronal Microtubules May Unlock the Scientific Explanation of Consciousness and the Secret Back Door to Enlightenment. Sean Webb <seanewebb@gmail.com> (Mooresville, NC)

From a science-of-the-nervous-system perspective, it turns out that the operations of our minds are much simpler than we had ever imagined. So much, that our human emotions can now be easily modeled and even predicted in humans (which we personally do everyday). This, of course, opens the door to our emotions being programmed into software to create emotional AI for computers, and even potentially a model for creating artificial consciousness itself. As scary and exciting as that is, it turns out this new understanding of our human emotions processing also opens the door to some powerful and practical mind hacks which can be consciously employed to change our brain thought patterns, so that emerging alternative wave patterns can arise during our waking awareness. This new approach not only provides for a more refined control of our waking minds as proven in studies, but it also opens the door to higher intelligence, greater creativity, better problem solving and even heightened levels of inner peace and well being. Taking that one step further into a way to understand consciousness, since we all typically agree our waking consciousness exists, and the science of split brain patients and other psychological disciplines show us that multiple levels of consciousness exist in our brain at lower levels, the question must be asked; just how far down the ladder does consciousness go before the line of demarcation between conscious organic activity and seemingly dumb organic molecules? To help answer that question, evidence suggests our cells themselves are conscious (as we will discuss). Next, with the recent discovery in a materials lab in Tsukuba, Japan which proved (confirming a portion of Penrose and Hameroff ORCH-OR) that our cellular microtubules DO indeed interact with quantum vibrations (specifically in the gamma spectrum, which have been highly correlated with altruism and our higher human virtues, and which have also been identified as the most integrative brain waves we humans have, and which are highest in meditating Tibetan monks), a very definable trail has now emerged leading from our waking level consciousness down through multiple levels of our documented subconsciousness, down into the intelligent conscious activity within our cells themselves, and now even potentially out into the quantum field. Come take this fun but grounded-in-science stroll with emotions modeler, complex systems engineer, and science author Sean Webb down the meandering path past emotional AI, following the consciousness bread-crumb trail to expose the neurochemical mechanisms that explain personal consciousness expansion, and maybe even lead us to the back door of the ancient elusive unitive mind experience called Enlightenment. P2

**188** Perceptual Mechanisms and Synergetic Cognitive Development. Ashley Willis <ashley.willis@wge.com.au> (Perception Theory, Melbourne, VICTORIA Australia)

My knowledge comes from introspection. I found out that the body has perceptual mechanisms, which syncopate with external stimuli and give the body an internally generated representation of external reality. The first perceptual mechanism is that reverberations in the eye syncopate with audition. Sound waves reverberate within the vitreous humour and send electro-cortical signals up the optic nerve to the brain, which would obviously stimulate the brain and generate preferential growth and development. The second perceptual mechanism has entities travelling over the cortex, that are generated exactly in time with external beats and rhythms. Both mechanisms are doubly-bifurcated systems, left side conscious, right side silent. These form the starting point for an 'Introduction to Perception Theory', whereby internal perceptual mechanisms syncopate with external stimuli and operate and grow in synergy with the brain, leading to cognitive development. 'Perception Theory' is 'study of the mind'. It is the mind that feels. Perception Theory is the juncture of external stimuli, internal representation & prediction and cognitive development. Perceptual mechanisms also offer a platform for computers to directly interface with our perception systems. I wish to find collaborators to develop Perception Theory. 1) prove that the eye houses an auditory perceptual mechanism, which makes the synesthesia of sound & color

pretty simple to explain given they both travel up the optic nerve, and both systems stimulate the rod & cone neurons.; 2) discover what the entities are and re-conceptualise electromagnetic theory to suit; 3) Work with cognitive neuroscientists to explore how the perceptual mechanisms interact with the greater CNS and influence its growth and development. 4) Promote 'heaven' as being akin to 'baseline visual consciousness' the moment in evolution and personal development when one first experiences the grandeur of experiencing light. Mentally when two fuzzy golden splotches of light overlap they extrude into a tunnel of light (stereoscopic vision) that generates the feeling of bliss - this experience links an internal perceptual act with emotion. 5a) If consciousness physically exists, then it can be written into physical theory, which is currently completely void of "experience". Carrying on from "timelessness", I would like to explore whether consciousness can be written into physical theory by treating time "t" as a variable, in that different species and varying mental states have different conceptions of time which then gives the experient a variable view of physical reality based upon their conception of time. 6) build computers that interface with the perceptual mechanisms giving a direct digital link to consciousness. 7) promote 'perception theory' as a stand-alone scientific endeavour that nonetheless interlinks with all of science, and indeed sits at the centre of experience & all our own interactions with external reality. 8) study internal visualisation. 9) study brain waves & internal stimulation of various perceptual mechanisms. 10) make film clips of the tunnels & try recording them direct from visualization. 11) work out how to record visuals and dreams, 12) make video games that you control with your mind. P2

#### 3.20 Miscellaneous

189 Inner Speech: Features and Myths as Investigated by Descriptive Experience Sampling. Russell Hurlburt <russ@unlv.nevada.edu> (Psychology, University of Nevada, Las Vegas, NV)

Inner speech is widely believed to play an important practical and theoretical role in a broad range of psychological and consciousness processes including memory, executive function, and development, as well as in psychotherapies, in skilled functioning (e.g., public speaking, sport success, music performance), in the etiology of psychiatric conditions (eating disorders, depression, anxiety, etc.), and so on. Descriptive Experience Sampling (DES) is the attempt to describe the phenomena of inner experience in high fidelity. Using DES for 40 years, we have seen many instances of inner speech. This talk will summarize what we've found, much of which is at odds with commonly held views. Here's a True/False test. Hint: At least half of the answers are False. The talk will provide the answer key and explanations, and in so doing will provide substantial insight into inner speech and its role in conscious processes. True or False: 1. Inner speech is better considered to be a phenomenon than a process. 2. It would be better to refer to 'inner speaking' rather than to 'inner speech.' 3. It makes sense to refer to inner speech as 'auditory imagery.' 4. There is an important distinction between inner speaking of one's own voice and inner hearing of one's own voice speaking. \_\_\_\_ 5. Human beings talk to themselves nearly every moment of the waking day. \_\_\_\_\_6. Inner speech is usually 'condensed,' the result of eliminating the grammatical subject of sentences. That is, as Vygotsky would say, inner speech is usually 'predicated.' 7. Inner speech is usually 'condensed,' the result of eliminating unimportant words including predicates, subjects, articles, and adjectives. 8. When silently reading, most adults innerly speak the text that is being read. 9. All thinking processes involve inner speech. C11

**190** Computational Cognitive Enhancement. Pattie Maes <pattie@media.mit.edu> (MediaLab, MIT Media Lab, Fluid Interfaces, Cambridge, MA)

Smartphones and other personal devices have taken a central role in our lives, but they are far from perfect. Their use is disruptive - pulling us away from the present - negatively affecting our social interactions and encouraging short attention spans. Their effect on our lives, especially on our cognitive abilities and well-being, is questionable. It is time to radically rethink the devices we rely on 24/7. My research group at the MIT Media Lab designs personal devices that are more closely aligned with the goals of their users with the aim of enhancing their cognition. While today's phones and personal devices are focused on putting the world's information at our finger-tips, these designs go beyond that, helping a user with more personal issues such as mindfulness,

attention, memory, and emotion regulation. This emerging research area of "Cognitive Enhancement" lies at the intersection of Cognitive Science and Human-Computer Interaction. Inspired by findings from Neuroscience and Psychology, we build wearable, immersive systems that augment and alter a user's experience of reality to help them accomplish goals and personal growth. These systems make use of real-time sensor data about the user's context, body, and mind, including heart rate, breathing rate, EEG, EOG, EMG, and more. Using a variety of modalities, including visual, auditory and olfactory stimuli, our designs provide real-time, minimal interventions that augment and alter a user's experience of reality. Prototypes that will be discussed include an immersive VR system that helps a user learn to be mindful, a system that interfaces with a user during Hypnagogia to enable inception and recording of dreams, systems that give subconscious feedback in the form of scent and fake breathing rate to support emotion regulation, and an augmented reality system that uses the principle of the Memory Palace to help a user with one-shot learning of factual information. **PL4** 

# **Physical and Biological Sciences**

#### 4.01 Quantum physics, collapse and the measurement problem

**191 Representation of Russelian Acquaintance in Quantum Mechanics.** Seyyed Bahram Borgheai , Mehdi Golshani <borgheai@uri.edu> (University of Rhode Island, Narragansett, RI )

Bertrand Russell (1910) has made a distinction between two kinds of knowledge: "knowledge by description" as a/the so-and-so description of some object which is absent from the observer; and "knowledge by acquaintance" which is a "direct awareness" when the object is before the observer. Henry Bergson (1908), similarly, has suggested that there is a unity relation between the subject and the object in the pure perception where still no mental scheme is imposed on the sense data. More recently, Langsam (2011), has stated that the phenomenal property is determined by both the act of consciousness and observational properties. All these suggest that, in the direct observation, there is a specific way of knowledge in which both mental and external properties are involved and somehow united or acquainted with each other. Here, we investigate whether this unity relation can be represented in the quantum mechanical framework. As Von Neumann (1932) has proposed in his quantum measurement model, before the interaction happens between the measuring instrument and the measured system, there is an entangled relation between the basis states of both systems. Replacing the measuring instrument with mind and accordingly the instrument's basis (states) with mental basis (states) in his model results in an entangled relation between the mindful observer and the observed states at the initial stage of direct observation. This Observer-Observed Entangled Relation (OOER) can be construed as quantum mechanical representation of aforementioned Russelian acquaintance or Bergsonian unity. However, there is a need to see whether this representation can address any other problem in the philosophy of mind. Here, we have discussed that OOER conception can shed light on the mental Intentionality or aboutness in the direct observation. Following the Russelian distinction, first we have distinguished between acquainted and descriptive types of aboutness. Then, inspired by the higher order theories of consciousness, we have introduced "higher order (quantum) states"(HOS) which is a meta-state that can be represented by different basis states. Now, suppose that there is an objective system represented by some superpositional relation hs1 as a member of a higher order state hsn. When a mindful observer directly observed this system, as explained, first an OOER relation is formed between the mental states of the observer and objective states of the system. This entangled relation is suggested to explain acquainted aboutness of mental state. Then, in a higher order, somehow this entangled relation breaks in the mind. Different theories can provide different interpretations for this OOER breakdown. The decoherence theory would interpret it as being decohered into mixed states while the Orch-OR theory interprets it as collapses into proto-conscious instances. In the next stage, we have suggested that the mind re-constructs the initial objective state but with mere mental basis (states) (hs2). As both the ultimate re-constructed mental product of the observer (hs2) and the initial observed system (hs1) belong to the same HOS, i.e. hsn, thus the former is about the latter in the descriptive sense. C22

**192** Towards a Dual-aspect, Neutral-monist, Quantum-physics-friendly Ontology of Free Will. Thomas Brophy <tgbrophy@gmail.com> (Integral Health And Sciences, California Institute for Human Science, Encinitas, CA )

Philosophical and biophysical theories of consciousness, traditionally and often still, hold as axiomatic the notion the physical universe is causally closed (e.g. Brophy 2017 TSC, San Diego). That axiom obviously restricts theories of consciousness to the domain only of materialist monist theories, and thus to the impossibility of free will. However, the consensus of modern physics is causal closure is not necessarily entailed in the foundations of modern physics (e.g. Rosenblum and Kuttener Quantum Enigma: Physics Encounters Consciousness, 2011; and Brophy 2017 TSC San Diego). This release from causal closure of the physical liberates us from materialist monist theories of consciousness, and allows the possibility of free will. Textbook quantum mechanics involves two fundamental processes: a time evolution process in which quantum states evolve in time according to a deterministic Schrodinger equation; and a nondeterministic state reduction (or "collapse") process. A fundamental postulate of quantum mechanics is collapse occurs according to probability distributions called the Born Rule. All empirical observables, anything that actually happens physically ("events" in Reality space) are post-collapse, because observation/knowledge itself absolutely collapses the quantum state. The approach of this paper is to consider the state reduction/collapse process as the locus of free will enacting physical events. This could be called "quantum event theory" or "Actual theory" (A-theory). This paper compares A-theory with three other categories of related theory, particularly relative to three aspects:: collapse trigger; collapse result; and panpsychism: M property theory (e.g. Kelvin McQueen and David Chalmers) where a M-property triggers collapse; Orch OR theory (e.g. Stuart Hameroff and Roger Penrose) in which Platonic ideals guide the collapse result; GRW theories in which the Born Rule is an approximation to a more detailed theory. This paper also explores the necessarily radical and bizarre nature of A-theory. For example, because Bell's Theorem and The Strong Free Will Theorem (John Conway and Simon Kochen, 2008) are relativistically invariant, even superluminal mechanisms cannot explain actual results. Thus A-theory mechanisms, any mechanisms involved in the operation of free will, must include transtemporal operations as well as nonlocal operations. Possible experimental tests of A-theory are also considered. C21

**193** Language, Symmetry, Possibility and Meaning. Simon Burton <simon@arrowtheory. com> (Department of Physics, The University of Sydney, Sydney, NSW Australia)

Language is inherently ambiguous. Mathematicians have a name for this: symmetry. It is the way form shifts and changes while also staying the same; patterns, shape. Physicists study the shape of nature, or reality. And mathematicians study the shape of shape itself. The language used for both of these is similar, it is essentially algebraic. But even with simple things like numbers, fractions, negative numbers, etc. the semantics becomes ambiguous. A theory of "three things" is ambiguous in six different ways. And what is a negative number anyway? If you push the idea of number just a bit further you get complex numbers. These have a famous ambiguity known as the "Galois group". Another word to describe this ambiguity is possibility. For example, negative numbers are waiting around for some bigger number they can subtract from. As in debt. Fractions are waiting for the numerator to inflate in value so that the division can happen. The story of the Galois group is even more subtle, as it involves a kind of choice (of the square root of minus one.) This is in stark contrast to determinism, where you get out what you put in. The language of quantum physics is built on complex numbers, and this algebra describes possibilities that can become entangled (shared), swapped and teleported. This is the physics of meaning. **C22** 

**194 Is Non-physical And Causally Efficacious Consciousness Compatible With The Core Theory?** Maaneli Derakhshani <m.derakhshani@uu.nl> (Department Of Mathematics And, Universiteit Utrecht, Netherlands)

The "Core Theory" of physics refers to "the quantum field theory of the quarks, electrons, neutrinos, all the families of fermions, electromagnetism, gravity, the nuclear forces, and the Higgs" [1]. A key claim about the Core Theory is that it entails "the laws of physics underlying

everyday life are completely known" [2]. Granting this claim, it will be shown that two conceptions of non-physical and causally efficacious consciousness - Russellian panprotopsychism [3], and property dualism with strong downward causation [4] - are compatible with the Core Theory. In the case of Russellian papprotopsychism, this compatibility will be shown by illustrating how protophenomenal properties can be consistently incorporated into the fundamental microphysical entities of the Core Theory, given a Bohmian reading thereof. In the case of property dualism with strong downward causation (SDC), it will be shown that consistency with the Core Theory can be established if: (a) the SDC influences arise only in spatiotemporal regions occupied by information processing physical systems that are known be accompanied by consciousness (e.g., human brains); and (b) the SDC influences are typically smaller in 'magnitude' than the "upward" physical causal influences in the information processing systems, and are typically "drowned out" by the upward physical causal influences. It will then be suggested that (a) and (b) together yield an in principle testable prediction: SDCs from non-physical (i.e., property dualistic) consciousness, if they exist, should entail minute violations of local physical conservation laws (such as local energy-momentum conservation) in information processing physical systems accompanied by consciousness. Thus, precision tests of local physical conservation laws in information processing physical systems accompanied by consciousness, such as human brains, might reveal evidence of minute violations of those conservation laws hence evidence of SDC. [1] http:// www.preposterousuniverse.com/blog/2016/05/10/big-picture-part-three-essence/ [2] http://www. preposterousuniverse.com/blog/2010/09/29/seriously-the-laws-underlying-the-physics-of-everyday-life-really-are-completely-understood/ [3] http://consc.net/papers/pappsychism.pdf [4] http:// consc.net/papers/emergence.pdf C22

**195 Meaningful History Selection: An Equation for Synchronicity.** Sky Nelson-Isaacs <theskyband@gmail.com> (Theiss Research, El Cerrito, CA )

A process called "meaningful history selection" is proposed within the quantum formalism which defines "meaningful outcomes" and predicts the phenomenon of meaningful coincidence, or Jung's "synchronicity." Information Space (Faggin) and the Interface Theory of Perception (Hoffman et. al.) are naturally integrated into the theory by proposing that both measurement actions and future outcomes can be written in a common hilbert space basis, called the "symbolic-felt-experience." Symbolic-felt-experience is closely related (or possibly equivalent) to qualia. This approach bypasses the hard problem of consciousness by proposing qualia as a postulate of the theory, i.e. that gualia (symbolic-felt-experiences) are the fundamental symbolic reality, from which the quantum formalism for fundamental particles can (in principle) be derived as a special case. Having written both the Conscious Agent's measurement action and the available outcomes in the qualia basis, we find that the action "post-selects" future outcomes to the degree that they match the action. Using the standard tools of projective and weak quantum measurement, with minimal extra postulates, one can calculate the change in probability of an event in the near future based on the Conscious Agent's action, which post-selects specific outcomes in the future. Simply put, synchronicities are causally improbable events that become more probable because of their causal relationship with a future, post-selected symbolic state. An equation is presented which formalizes this relationship, along with an intuitive "apple tree" model. This research is supported by the Federico and Elvia Faggin Foundation. C25

**196** Consciousness First: Why The Decoherence Program Entails Copenhagen Interpretation. Javier Sanchez-Canizares <a>(interpretais.canizares@unav.es>(ICS. Mind-Brain Project, University of Navarra, Pamplona, Navarra Spain)</a>

After more than a century of quantum physics, the measurement paradox (MP) still remains unsolved. As is well-known, MP can be stated as follows within the standard interpretation of Quantum Mechanics (QM): there are two irreducible processes in the physical description of nature; the deterministic and unitary evolution of the wave-function of a system according to the Schroedinger equation, once the boundary conditions have been established (U-process), and the indeterministic and non-unitary collapse of the wave-function into one of the possible outcomes after some specific measurement (then becoming an actual event) (R-process). The dualistic flavor of such state of affairs has spurred many different interpretations of QM throughout the last

century. MP directly hints at deep epistemic and ontological questions about whether and how nature determinates itself. The overarching issue is how to reconcile that physical systems cannot, in general, be assigned an exhaustive set of premeasurement values of physical quantities with our intuitively felt need for an objectively existing world around us to which we wish OM to pertain in some way (Schlosshauer 2007). Whereas the standard interpretation remains as a set of instructions which allow for ascertaining the empirical adequacy of the theory without committing to any particular ontological stance, the Copenhagen interpretation (CI) is generally deemed to embrace a strong ontological position regarding classicality of (some parts of) the world; classicality ought to be viewed as an irreducible element of a complete description of the world and considered as prior to OM itself. From Bohr and Heisenberg's times, CI posits the existence of macroscopic apparatuses with well-defined and well-determined possibilities for measuring the relevant system according to the experimenters' will. By contrast, many other subsequent interpretations of QM aim at describing the emergence of classicality from process U, getting rid of process R or at least making it irrelevant and, most interestingly, ruling out the long-lasting dualistic flavor of CI itself and its ad hoc introduction of observers and observations as an inevitable presupposition of physics. Non-Copenhagian interpretations trust in decoherence as the proper mechanism to obtain a well-defined, observer-free transition from a unitary quantum description of the universe to classicality. Even if not fully achieved yet, the decoherence program, together with some refined ontological interpretation, should eventually hit the target. The aim of this contribution is to show why all these approaches are doomed to failure. Classicality and, particularly, consciousness, are not just an emergent upshot stemming from QM but a necessary condition for scientific activity and cognition of quantum processes. Moreover, classicality can be shown to be a priori present, in explicit or implicit form, in all interpretations of QM providing tentative accounts of an a posteriori emergence of classicality through decoherence. This work extends Tanona's view (2013) on the inability of decoherence to derive classicality without assuming it in some other form by considering the ultimate role of observers and observations in the Copenhagen cut and the epistemic non-pertinence of the predictive sieve. C23

**197** Feasibility of Relativistic Quantum Computation in Human Neurons. James Tagg <james@taggs.com> (The Penrose Institute, La Jolla, United Kingdom)

A proposal by Sir Roger Penrose and Stuart Hameroff is that human brains compute, not by way of a regular classical computation, but rather by a process that incorporates a relativistic modification to quantum computation. Quantum computation is well understood - or at least most people would agree on the general formulation. Relativistic computation is neither well understood nor broadly agreed, however, it is now without a formalization. Quantum gravity computers are described by Lucian Hardy of the Perimeter Institute in his 2007 paper On the theory of computation with indefinite causal structure. We should, at once, mention that Penrose dislikes the term quantum gravity as it implies the quantization of gravity to most modern physicists. The formalization Penrose uses is more balanced between the two theories and indeed Hardy is also looking at a mixture of the two theories without proposing any solution to unification problems. Assuming that 1) Penrose-Hameroff is needed to solve the consciousness problem and 2) Hardy gives us a theory of computation that is more general than a Turing complete system - even one of a quantum nature - then we should be able to look at the structures and scale of a human brain to see whether it could in principle implement such a computer. Recent work by Craddock et al. Anesthetics Act in Quantum Channels in Brain Microtubules to Prevent Consciousness gives us information about the scales of proteins and the frequencies of excitation of such structures. It is, therefore, possible to consider the scales and structure and determine whether Hardy's model of computation could be mapped, in principle, to structures within the human brain. Orch-OR would then be the process by which a computation was read out of the structure. In this talk, I will bring together current thinking on computational power in different structures and the feasibility of constructing a non-Turing computer within human brain structures and potential experiments that might shed light on this problem. C8

#### 4.02 Quantum field approaches

**198** Using humans to switch the settings in a Bell experiment: An alternative to the Turing test. Lucien Hardy <a href="https://www.enablest.com">https://www.enablest.com</a> (Perimeter Institute for Theoretical Physics, Waterloo, ONT Canada)

In a Bell experiment pairs of entangled quantum particles are subject to measurements. I discuss how we might go about about performing such an experiment in which humans are used to decide the settings for these measurements at each end. To get a sufficiently high rate of switching at both ends, I suggest an experiment over a distance of about 100km with 100 people at each end wearing EEG headsets, with the signals from these headsets being used to switch the settings. The radical possibility we wish to investigate is that, when humans are used to decide the settings (rather than various types of random number generators), we might then expect to see a violation of Quantum Theory in agreement with the relevant Bell inequality. Such a result, while very unlikely, would be tremendously significant for our understanding of the world. In particular, I will argue that it would provide strong evidence for Cartesian mind-matter duality (as well as suggesting that the universe is local and superdeterministic). In a Turing test, interrogators make subjective judgments as to whether they are interviewing a human or an artificial intelligence device of some sort. In this version of Bell's experiment we could compare having humans to having some sort of artificial devices (random number generators for example). Since we are simply measuring certain correlations between the outcomes of measurements at the two ends, we have a completely objective test. Possible radical implications aside, performing an experiment like this would push the development of new technologies. The biggest problem would be to get sufficiently high rates wherein there has been a human induced switch at each end before a signal as to the new value of the setting could be communicated to the other end and, at the same time, a photon pair is detected. It looks like an experiment like this, while challenging, is just about feasible with current technologies. PL6

**199** The Emergence and Evolution of Life Beyond Physics. Stuart Kauffman <stukauffman@gmail.com> (The Institute for Systems Biology, Seattle, WA )

The emergence and evolution of life is based on physics but is beyond and not reducible to physics. First, evolution is an historical process arising from the non-ergodicity of the universe above the level of atoms. Most complex things will never get to exist. But human hearts exist. How comes this to be? Prebiotic chemistry on the early earth probably saw the evolution of many organic molecules in complex reaction networks, and the formation of low energy structures such as micelles and bilipid membranes. The latter could have served as constraints, or boundary conditions, on the release of energy by the same chemical non-equilibrium reaction processes. Atkins notes that "work" is the constrained release of energy into a few degrees of freedom, as in the cylinder, piston and working gas expanding to do thermodynamic work on the piston, pushing it down the cylinder. The cylinder and piston are the constraints or boundary conditions on this non-equilibrium release of energy. Newton does not tell where the boundary conditions come from. Physicists "cheat" and merely put in fixed and moving boundary conditions to solve for the work done on the piston. But it takes WORK to construct the cylinder and piston and assemble them. Thus something new: It typically takes work to construct constraints on the release of energy into a few degrees of freedom, which then constitutes work. No work, no constraints. No constraints, no work. The work done in such a process can itself be used to construct further constraints, or boundary conditions, on some further non-equilibrium process achieving still further work that can construct yet further constraints. A living cell achieves what Mael Montevil calls a "constraint closure". Here a set of coupled and constrained non-equilibrium processes harnesses both these constrained non-equilibrium processes to do work that thereby constructs constraints, into a feedback system where the total system literally does work to construct its own boundary conditions on the non-equilibrium processes that construct those very constraints. A collectively autocatalytic set of peptides, such as the nine peptide set of G. Ashkenasy, achieves this closure. Constraint closure is something new: Biological organization. It is not matter alone, energy alone,

entropy alone, or non-equilibrium process, such as dissapative structures, alone. None of these involves a system that does work to construct its own constraints, or boundary conditions. Such systems are fundamentally living, and can propagate their organization with heritable variations, hence can be subject to Darwin's natural selection. In this evolution, these proto-organisms emerge unprestatably, and afford novel niches enabling, not causing, yet further types of proto-organisms to emerge. With this, new functions arise unprestatably. The ever-changing phase space of evolution includes these functionalities, such as hearts pumping blood. We cannot prestate these ever new functionalities, so can write no laws of motion for this evolution, which is therefor entailed by no laws at all, and thus not reducible to physics. Beyond entailing law, the evolving biosphere literally constructs itself and is the most complex system we know in the universe. **PL8** 

200 Complex Space-time and Complex Quantum Mind: A Unified Platform to Explain the Mysteries of the universe and consciousness. Si-Chen Lee <sclee0813@gmail.com> (National Taiwan University, Taipei City, NA Taiwan)

The large scale universe is full of mystery, the dark matter and dark energy amounts to respective 23% and 73% of the total energy of the universe, whereas the rest 4% of the total energy is attributed to the normal material world. In the nano-scale quantum world, the quantum mechanics albeit its great success in explaining the atomic world to an extraordinarily high precision is still full of mysteries such as unmeasurable complex wave-function, superposition of wave-functions, quantum entanglement phenomenon with information transmitting between two entangled particles exceeding the velocity of light, apparently violating the special relativity. Even more serious is the philosophical problem why a deterministic Schrodinger equation describing a particle gives rise to a probability interpretation of the particle. In order to explain these large, medium and nano-scale bewildering phenomena in the universe, I propose two hypotheses in this paper. (I). The real universe is a complex universe which consists of an 8 dimensional (8D) space-time. In addition to our well known 4D real space-time (- Yang), there exists another 4D imaginary spacetime (information field or - Yin) full of consciousness and information websites which are part of the dark matter. (II). When an object is in a quantum state, the imaginary part i of its complex wave-function represents the consciousness of the object (quantum mind). The complex quantum state indicates an unification of the matter (real part) and its mind (imaginary part). The real part determines the contents of the mind. This concept is supported by various psychokinesis experiments that were clear to suggest that everything has a soul. C25

#### 201 Non-equilibrium Quantum Field Theory of the Brain: Towards Numerical Simulations of Memory Formation Processes in Open Systems. Akihiro Nishiyama <akihiro@ ualberta.ca> (Department of Oncology, University of Alberta, Edmonton, AB Canada)

Quantum field theory(QFT) of the brain with water electric dipole fields and evanescent photon fields is one of the hypotheses expected to explain the mechanism of memory. It is originated from the work by Ricciardi and Umezawa in 1967 with spontaneous breakdown of symmetry (macroscopic order). The advantages of OFT, which is distinguished from quantum mechanics, are that it can describe an infinite number of unitarily inequivalent vacua (diverse coherent states), the phase transition from one vacuum to another and the macroscopic quantum phenomena of the system. The QFT of the brain can describe diversity, long-term but imperfect stability, and non-locality of memory. However, the preceding research is based on two-energy-level approximation for charged Bose fields with single-energy-mode photon fields and lacks non-equilibrium multi-energy-mode numerical analyses in open systems(the relevant system and the reservoirs) to describe memory formation processes (equilibration). The aims of this study are to investigate non-equilibrium phenomena of quantum fields numerically in open systems and to compare an isolated system and open systems. We investigate the dynamics with phi4 interaction in open systems as a toy model of QFT of the brain. We adopt the Klein--Gordon(KG) equation for coherent fields and the Kadanoff--Baym(KB) equation for quantum fluctuations (incoherent particles) to describe non-equilibrium multi-energy-mode dynamics. We demonstrate numerical results where the decoherence (field-particle conversion), the entropy production and the chemical equilibration occur in time evolution. We describe the dynamics in both an isolated system and open systems to compare time scales of the decoherence. Finally we make a conclusion with respect to differences

between an isolated system and open systems. C7

**202** Why Algorithmic Systems Possess No Understanding. Sir Roger Penrose <rouse@ maths.ox.ac.uk> (Mathematical Institute, University of Oxford, Oxford, United Kingdom)

Many examples of highly effective algorithmic systems, such as AI devices, have been constructed in recent years. We have computer-controlled machines like self-driving cars and algorithmic systems that play chess and GO at levels that can out-perform even the best of human players. But do such devices actually "understand" what they are doing, in any reasonable sense of that word? I argue that they do not, and as an illustrative example I present a recently composed chess position that a human chess player, after briefly examining it, would correctly conclude that it is an obviously drawn position. Nevertheless, when it is presented to the top-level chess-playing program Fritz, set at grandmaster level, Fritz incorrectly claims that it is a win for the black pieces and eventually Fritz blunders dreadfully (though "correctly" according to its algorithm) to be soon check-mated by white. This demonstrates Fritz's remarkable lack of any actual understanding of the game of chess, despite its vast computational abilities.

More sophisticated examples come from mathematics, most particularly with human understanding of the infinite, and it can be shown that this quality cannot plausibly be encapsulated by any algorithm arising from the processes of natural selection. I argue that the quality of understanding is a feature of consciousness, and that consciousness can come about only through physical processes not yet properly understood, most likely at the boundary between quantum and classical processes, as argued for in the Orch-OR proposal. **PL9** 

**203** The Physical Nature of Subjective Experience and its Interaction with the Brain. Fredric Schiffer <fschiffer@mclean.harvard.edu> (Department of Psychiatry, McClean, Harvard Medical School, Newton Highlands, MA)

I present a novel and innovative way to understand consciousness. Following Penrose and Hameroff, I assert that conscious experiences exist as real physical entities and that they profoundly affect the brain and behavior, perhaps much more than is generally appreciated. All experience is of or about brain information, broadly meaning certain brain states. Specific kinds of experiences are associated with specific brain areas and/or networks, including brain chemistry, electromagnetic fields and DNA and microtubule activity. There is a continuous interplay between brain information and experience. Experiences profoundly inform the brain and alter brain structure and function, and local and integrated brain function induces experiences. I will introduce the term subjective fields as a concept to relate experience to quantum field theory and brain information processing to address the hard problem of consciousness. I argue for my speculations that much brain activity becomes brain information that affects different areas of microtubules and/or DNA of the brain that can go into an integrated superposition as suggested by Hameroff. This would be a transient area of brain information in superposition, which upon reduction excites local areas of an as yet undiscovered fundamental quantum field, the subjective field, which then interacts with brain information to initiate subjective experience. This interaction is continuous and dynamic. The content of the experience is determined entirely by brain information, but the subjective quality of the experience comes from the interaction of certain brain information and the subjective field. I will also introduce the concepts of non-conscious experience and the awareness field, which together with the subjective field will address the hard problem of consciousness. C7

**204** "Brain-mind Entanglement -- Part I". Karen Shanor, Giuseppe Vitiello <drkarenshanor@gmail.com> (Adj Prof Georgetown University, Washington, DC, )

"Brain-Mind Entanglement" Karen Shanor a and Giuseppe Vitiello b a Georgetown University, Washington, DC, USA b Salerno University, and INFN, Fisciano (Salerno) - 84084, Italy Abstract: In his last research activity, at the culmination of more than six decades of groundbreaking neuroscience research, Walter J. Freeman concluded [1] that the neuronal oscillation patterns, which form in the brain in its interaction with the environment, implement the action in the forward time (the arrow of time), while the process of the perception implies the recovery, "going backward in time" of past experiences (remembrances). Brains thus form hypotheses and test them by intentional action into the environment. The brain action-perception cycle is

therefore at the basis of the knowledge of its world. The balance of energy fluxes between brain and environment implies that each energy source of the brain system has a corresponding energy sink in the environment, and vice versa. The environment, as seen from the brain, is thus like its own image, its Double; where, however, sinks replace sources and vice versa, in other words the time-reversed image. The Double is the brain time-reversed image. "A subject engaged in search recalls from memory a landscape of superimposed attractors, the forms of which predict the several probable outcomes of each intentional sampling." Intentional actions, naturally pointing to the forward in time direction, in order to be successful rest on the mind activity of recovering experiences from the past, whose copies in the reversed time (mirrored time) are in the Double activity. Mental activity thus comes from the Double. The Double is the mind. In the intricacy of the continual going forward and backward in time, consciousness is the "present", the contact point on the surface of the time mirror between the two opposite time arrows. In such a permanent and persistent "dialogue" with the Double, brain activity and mind activity are entangled dynamical functions. "The brain-mind is not a dual-aspect manifestation of a basic underlying reality. [...] Brain and its image in the mirror of time cannot be separated. The existence of one independently of the existence of the other is a meaningless notion." This view leads to the metaphor "The brain is like an orchestra. Better yet, it is like a jazz combo, which doesn't need a conductor. [...] the combo creates a field to which every player listens, adapts and contributes, so that every player is melded into the unity of sound and rhythm. Global and instantaneous." The "field to which every player listens" is the dialog between the subject and the Double, "it doesn't need a conductor [...] it is the consciousness. It integrates all of it. The result is the sound and rhythm of the jazz combo, the symphony played by the orchestra, without the director. [1] Walter J Freeman and Giuseppe Vitiello, Matter and Mind are entangled in two streams of Images that Guide Behavior and Inform the Subject through Awareness, Mind & Matter (2016) C14

205 The Mathematical Unity and Reality of the Topological Quantum Computing and "Dissipative Brain" on the Coalgebra of the Quantum Field Theory in the Theoretical Computer Science. Cheng Shouhua <1020809953@qq.com> (The Department Of Maxism, The Tai YuanUniversity of Science and Technology, Tai Yuan, SHAN XI China)

Topological Quantum Computing comprises Quantum Field Theory, Neural Science, Logic and Computer Science. It aims for a unity mathematical model based on the category theory. The philosophical significance for this is from the unity we can find answers for the old measurement problem, renormalization and the assertion to the reality. The methodological significance is we use the contextual views strong example dependence for sustainability and variability of the reality. **P2** 

**206** Could Photons and Entanglement Play a Role in the Brain? Christoph Simon <csimo@u.calgary.ca> (Institute for Quantum Science, University of Calgary, Calgary, ALB Canada)

Many fundamental questions in neuroscience are still open, including what in our brains gives rise to subjective experience. It therefore seems justifiable to explore unorthodox possibilities. Could it be that quantum effects are important in the brain? At first sight, this may seem unlikely, because the brain is warm and (seemingly) messy, whereas quantum experiments often have to be cold and well controlled. But quantum technology is progressing quickly, teaching us, for example, that quantum effects can be robust at high temperatures under the right conditions [1,2], so a closer look is warranted. One interesting possibility arises from the experimental observation that neurons emit photons. Is it imaginable that these photons could be used for signaling? Even more speculatively, could they be used to transmit quantum entanglement, a task for which photons are uniquely suited [3]? For any kind of signaling (quantum or not) to be targeted, the photons would have to be confined in waveguides, similar to the optical fibers used in telecommunications. My collaborators and I have theoretically explored the possibility that axons could serve as optical fibers [4,5]. We developed a detailed theoretical model, including many potentially relevant (detrimental) features such as the presence of Ranvier nodes, bends, and various inhomogeneities. Our conclusion is cautiously optimistic - axons, in particular myelinated ones, could indeed serve as photonic waveguides. Experimental tests of this idea seem possible and are currently being discussed. Other promising systems in the context of quantum effects in the brain are electron and

nuclear spins, based on both theoretical considerations and some experimental results. Man-made quantum networks typically involve interfaces between spins and photons [2,3]. We are now exploring whether similar interfaces could exist in the brain. [1] S. Wein, N. Lauk, R. Ghobadi, and C. Simon, Towards room temperature indistinguishable single-photon sources using ultra-small mode volume cavities and solid-state emitters, arXiv:1710.03742 [2] R. Ghobadi, S. Wein, H. Kaviani, P. Barclay, and C. Simon, Towards a Room-Temperature Spin-Photon Interface based on Nitrogen-Vacancy Centers and Optomechanics, arXiv:1711.02027 [3] C. Simon, Towards a global quantum network, Nature Photonics 11, 678 (2017). [4] S. Kumar, K. Boone, J. Tuszynski, P.E. Barclay, and C. Simon, Possible existence of optical communication channels in the brain, Sci. Rep. 6, 36508 (2016). [5] P. Zarkeshian, S. Kumar, J. Tuszynski, P. Barclay, and C. Simon, Are there optical communication channels in the brain?, arXiv:1708.08887, Front. Biosci., Landmark, 23, 1407 (2018). **PL6** 

207 "Brain-Mind Entanglement" (part I Presented By Karen Shanor - Part II Presented By Giuseppe Vitiello). Giuseppe Vitiello, Karen Shanor Georgetown University, Washington, DC, USA <vitiello@sa.infn.it> (Department of Physics, University of Salerno, Fisciano (SA), Italy)

In his last research activity, at the culmination of more than six decades of groundbreaking neuroscience research, Walter J. Freeman concluded [1] that the neuronal oscillation patterns, which form in the brain in its interaction with the environment, implement the action in the forward time (the arrow of time), while the process of the perception implies the recovery, "going backward in time" of past experiences (remembrances). Brains thus form hypotheses and test them by intentional action into the environment. The brain action-perception cycle is therefore at the basis of the knowledge of its world. The balance of energy fluxes between brain and environment implies that each energy source of the brain system has a corresponding energy sink in the environment, and vice versa. The environment, as seen from the brain, is thus like its own image, its Double; where, however, sinks replace sources and vice versa, in other words the time-reversed image. The Double is the brain time-reversed image. "A subject engaged in search recalls from memory a landscape of superimposed attractors, the forms of which predict the several probable outcomes of each intentional sampling." Intentional actions, naturally pointing to the forward in time direction, in order to be successful rest on the mind activity of recovering experiences from the past, whose copies in the reversed time (mirrored time) are in the Double activity. Mental activity thus comes from the Double. The Double is the mind. In the intricacy of the continual going forward and backward in time, consciousness is the "present", the contact point on the surface of the time mirror between the two opposite time arrows. In such a permanent and persistent "dialogue" with the Double, brain activity and mind activity are entangled dynamical functions. "The brain-mind is not a dual-aspect manifestation of a basic underlying reality. "Brain and its image in the mirror of time cannot be separated. The existence of one independently of the existence of the other is a meaningless notion." This view leads to the metaphor - The brain is like an orchestra. Better vet, it is like a jazz combo, which doesn't need a conductor. [1] the combo creates a field to which every player listens, adapts and contributes, so that every player is melded into the unity of sound and rhythm. Global and instantaneous. The "field to which every player listens" is the dialog between the subject and the Double, "it doesn't need a conductor", it is the consciousness. It integrates all of it. The result is the sound and rhythm of the jazz combo, the symphony played by the orchestra, without the director. [1] Walter J Freeman and Giuseppe Vitiello, Matter and Mind are entangled in two streams of Images that Guide Behavior and Inform the Subject through Awareness, Mind & Matter, 14(1), 7 - 24 (2016) C14

# 4.03 Space, time and the nature of reality

**208** Quantum Pan-Protopsychism - A Scientific Approach to the "Hard Problem" Stuart Hameroff <a href="https://www.englight.com">https://www.englight.com</a> (Anesthesiology, MD; Psychology , University of Arizona; AHSC, Banner-UMC; Dir., Center for Consciousness Studies, Tucson, AZ )

Neuroscientists and philosophers pursuing the "hard problem" of conscious experience are turning from ideas about emergence and complexity of brain neuronal activities to panpsychism, the notion that "qualia", phenomenal experience, feelings and awareness are somehow funda-

mental properties of matter. But panpsychism raises other scientific problems: 1) At what level of matter would experiential qualia occur, e.g. molecules, atoms, nucleons, quarks, or the underlying structure of spacetime geometry? 2) How do myriads of micro qualia combine into full, rich conscious experience (the "combination problem")? 3) How is matter to be considered? The laws of quantum mechanics reign at micro-levels, and particles behave as wave-like superpositions of multiple possibilities which then apparently "collapse" ("reduce") to definite states ("quantum state reduction"). Penrose has suggested superpositions undergo reduction ("collapse") to definite states at an objective threshold ("objective reduction", "OR"), accompanied by experiential qualia. Such events are proposed to occur ubiquitously in the general environment (equivalent to decoherence), ubiquitous, random, evanescent, devoid of memory and meaning, and deemed "proto-conscious" (similar to Whitehead's "occasions of experience" ("Orch OR") by biological microtubules (or other systems), and combined and bound together by quantum entanglement, full, rich moments of conscious experience occur. References: Hameroff & Penrose (1996) JCS 3(1):36-53, Hameroff and Penrose (2014) Phys Life Revs 11(1):39-78 PL11

209 The Nature of Reality and Consciousness In Complex Eight Space. Elizabeth Rauscher , James J. Hurtak, PhD; D.E. Hurtak, PhD <br/> <br/> <br/> Sbvr1001@msn.com> (Tecnic Research Laboratory, Apache Junction, AZ )

The EPR (Einstein, Podolsky and Rosen) paradox and the Bells formalism, and its experimental test demonstrate that there is an intrinsic nonlocality present in the quantum world. To apply this to our understanding of the nature of reality, we examine several contemporary models of entanglement, nonlocality and superposition by the use of complex eight space. In Rauschers theory, eight-dimensional space is the domain of action that accommodates quantum entanglement. We further consider that consciousness, like particles, can be accommodated by this complex geometry. If the brain and consciousness occupy an entangled whole, as revealed in quantum brain dynamics (QBD), then the brain is constantly entangled with the consciousness field through resonance and coherence. Consciousness is an integral part of the nonlocal all-prevalent field which intrinsically alters the concept we have of space and time and, in turn, of the randomicity of particles. The apparent randomicity of the Copenhagen quantum theory appears to be in opposition to classical physics. The Copenhagen view is the observation determines the state of the system. The practical view is to shut up and calculate. However, in our understanding, randomicity arises primarily due to a lack of information about the complete quantum system. Quantum entanglement uses protocols to generate quantum bits, or qubits, that are supposed to also be random, unless we incorporate complex eight-dimensional space. The resolution of the Bohr Einstein debate regarding determinism and randomicity and the Schroedinger Cat paradox moves us towards the power behind consciousness and entanglement within an eighth-dimensional reality. Addressing a nonlocal understanding of complex eight space, gives rise not only to nonlocal correlations in space, but also in time. It presents a formalism of nonlocality at the macroscopic, as well as the microscopic level. Specifically, we introduce the four real dimensions of spacetime and four imaginary dimensions, in such a manner that locations or events, which are distant in four-space or spacetime allow for nonlocal events to appear to be juxtaposed in our multidimensional complex eight space. We will present this formalism to show the possible ways of mixing space and time dimensions in which we create complex dimensional eight space invariant which accommodates Bells theorem formalism. Essentially we complexify the usual four-space metric to mathematically construct an eight-dimensional space, which is the most simple or fundamental of the expanded space beyond four dimensions that is consistent with Lorentz invariance and the structure of Minkowski space. C14

210 Linear Perception of Time: The Fundamental Blunder of the Mainstream (Classical) Physics Institute Of Spiritual Science. Mohsen Sarfarazi <sarfarazifamily@aol.com> (Institute of Spiritual Science, Palm Coast, FLORIDA)

An overview of the true nature of time is presented that includes a discussion of the non-local and local characteristics of time. It is explicated that the former has its roots in the first cause of creation attributed to the Prime Creator, while the latter pertains to us as sentient consciousness

generating co-creators. With reference to the author's space-time theory, the former pertains to the main 356 dimensions of consciousness, while the latter spearheads the parallel dimensions of our reality. Moreover, being a tensorial quantity, time may be depicted by a freely rotating vector with one end fixed at the SOURCE and the other sweeping the dimensional time-space, where space is none other than congealed time. The concept of directionality of time proposed by the author has been discussed that stipulates time can proceed in either positive or negative direction. And, with the phenomenon of time epitomizing rotation about the SOURCE, time may either proceed in a clockwise or counterclockwise manner. Thus, time is a curvilinear (circular) phenomenon and not linear, repudiating the erroneous notion of the past-present-future. Furthermore, always opposite dimensional space-times are simultaneously generated in a conjugate or mirrored fashion. This phenomenon has been articulated by a new law by the author dubbed as the Cosmological Law of Entanglement of the Conjugate or Mirrored Dimensional Space-Time. Thus, contrasting worlds may be created that occupy the same space yet run in opposite timelines (reminiscent of the Fundamental Essential Law of Spatial Cohabitation) effectuating their fabrics (matter-antimatter) simultaneously spinning opposite to one another. The author's quantum consciousness theory stating that the flash of consciousness occurs due to the conversion of matter to antimatter and vice versa is discussed. This inspires the proposition of a corollary, which is referred to as the Conservative Law of Cyclic Constitutional Conversion, stipulating the point that the whole operation occurs without any energetic dissipative sink (e.g., damping or friction), and in a purely repetitive manner. This forms the basis for the Law of Non-linear Toroidal Field of Flashing Pulse of Quantum Consciousness that states the conversion of matter to antimatter and vice versa leads to the collapse of one conjugate dimensional space-time to the point of zero energy followed by the rejuvenation of its entangled mirrored space-time effectuating quantum conscious vibration. In essence, this asserts that as a sentient being, our universe undergoes a harmonic pulse of exhalation and inhalation not unlike our very own, in which the cyclic conversion of matter to antimatter and vice versa create the flashes of consciousness, epitomizing sentient or conscious vibration. Furthermore, the energetics involved is of highly non-linear nature, which is referred to as the Torus Effect, not unlike the electromagnetic energetic field of our very heart. P2

# 211 Space-time Intervals Underlie Human Conscious Experience, Gravity and a Theory of Everything. Richard Sieb <siebr@shaw.ca> (relativisticconsciousness.com, Edmonton, Alberta Canada)

Space-time intervals have been largely overlooked in scientific study. When one looks at them more closely, however, one is struck by how ostensibly they explain scientific phenomena. Space-time intervals appear to be the fundamental components of our observed physical reality (conscious experience), gravity, and basically all physical aspects of the universe. A space-time interval is the shortest distance between two points (events) in space and time (space-time). Space-time intervals are fundamental in that they are invariant relationships that are established universally between events. There are three basic types of space-time intervals: light-like intervals carry electromagnetic information, time-like intervals carry temporal information, space-like intervals carry spatial information. There is abundant evidence showing that the brain processes space-time intervals for the creation of human conscious experience (Sieb RA. Human conscious experience is four-dimensional and has a neural correlate modeled by Einstein's special theory of relativity. Neuroquantology 2016; 14(4): 630-644). Conscious experience is our observed physical reality and all aspects of this reality basically arise from the processing by the human brain of the three basic types of space-time intervals (Sieb RA. The what, where, and when of consciousness and psychology research. Advances in Psychology Research, AM Columbus (Ed.), Nova Science Publishers Inc., New York 2017; 122: 19-57). Space-time intervals are the fundamental components of human conscious experience. Einstein's special theory of relativity precisely models human conscious experience. This is not surprising in that Einstein analyzed his own conscious experiences (thought experiments) to construct his special theory. Einstein's general theory of relativity is our current description of gravity; gravity is described, not as a force, but as the curvature of space-time by the local distribution of mass, momentum, and energy. An analysis of the Einstein field equations, which engender this relationship, show that these equations essentially define the three basic types of space-time intervals; space-time intervals are

actually the source of gravity in general relativity. There are three known fundamental interactions or forces in quantum mechanics (electromagnetic, strong nuclear, weak nuclear) which may be considered quantized manifestations of the three basic types of space-time intervals (light-like, time-like, space-like, respectively); quantum space-time interval fields are essentially the source of quantum gravity. General relativity seamlessly merges with quantum mechanics to provide a unified concept of gravity. Space-time intervals consequently compose a single, all-encompassing, coherent theoretical framework of physics that fully explains and links together all physical aspects of the universe-a Theory of Everything (this includes our observed physical reality). It is interesting to note that the human brain has elected to process space-time intervals for the creation of our observed physical reality (conscious experience). This might be taken as an indicator that space-time intervals are more fundamental than imagined. They appear to be the fundamental basis of all physical phenomena (everything). Space-time intervals not only explain the creation of space-time and its properties, but lead to a long-sought quantum theory of gravity, which merges general relativity and quantum mechanics, providing a Theory of Everything. You can't get more fundamental than that. **C14** 

212 Ontological Motivation In Obtaining Certain Quantum Equations: A Case For Panexperientialism. Juan Carlos Villacres Bolanos <jvillacresb@gmail.com> (Physics, Universidad Regional Amazonica Ikiam, Tena, Tena Ecuador)

In this work I argue for the existence of an ontological state in which no entity in it can be more basic than the others in such a state. This is used to provide conceptual justification for a method that is applied to obtain the Schrodinger equation, the Klein-Gordon equation, and the Klein-Gordon equation for a particle in an electromagnetic field. Additionally, it is argued that the existece of such state is incompatible with indirect realism; and the discussion suggests that a panexperientialist view is a straightforward means to embrace it. **P2** 

#### 4.04 Cosmology and integrative models

**213** Consciousness and Cosmos. Daniel Beal <dmbealmd@msn.com> (Psychiatry, Palo Alto VAHCS; Stanford University, Clinical Associate Professor (Affiliated), Scotts Valley, CA )

The question "why is there anything?" can apply equally to cosmos and consciousness. It is both a simple and profound question and a touchstone in considering how consciousness and the cosmos can or should relate. If we consider our plausible relationship with cosmos and consciousness in prehistory, there is evidence that there was no separation between cosmos and consciousness. Gobekli Tepe is a 12,000 year old temple to Orion on the Turkey-Syria border; the temple was rebuilt multiple times to follow Orion's precession. There is evidence of brewing Einkorn beer, which likely included psychedelic herbs indicating altered states of consciousness associated with star worship. The Egyptians had a complex cosmology in which consciousness and cosmos were intertwined. The appreciation of the linkage of consciousness and cosmos lasted into the Renaissance. Leonardo Da Vinci (1452-1519) understood that the earth had a "vegetative soul", Gilbert (1540-1603) and his peers considered that the entire universe was animated, Copernicus in 1543 thought that the Sun was the light and the soul of the world. It wasn't until Kepler 1605 that the universe was likened not to a divine organism but rather to a clockwork mechanism. A Big-Bang universe is the current conventional model of the cosmos, the hypothesis started in 1927 in a paper about a "primeval atom" by Lemaitre, a c Catholic priest, his universe consisted of the Milky Way and some nebula. The Big Bang is a peculiar hypothetical construction, a religious creation myth but without conventional religion content, an apparent Deity, or a related religious theory of consciousness. Two years later, Hubble discovered the Andromeda Galaxy (1929), and the cosmos was suddenly much larger than the Milky Way. Observational astronomy with better telescopes, now finds an immense universe with huge structures older than 100 billion years dwarfing the cosmos of the Big Bang. Also, if life is needed for consciousness, then an older steady-state Hubble universe or a newer conception, an electric and filled with huge plasma structures make more sense, since the 13.5 billion years of the Big Bang is not enough time for life to evolve even if it arises on planets primed with a universal panspermia. If Neo-Darwinism is correct and genetic change is random, then our proteome of 19,000 proteins with average or 375

amino acids each, have only one chance in 10^1.418E+51214 to have their current form. To arrive at these biologically active proteins by chance would require a universe of unimaginable age with universal panspermia. If life required trillions of years of development, in advance of life were there other complex or subtle energy forms or complex structures capable of consciousness? Or with immense age needed in the universe for life to evolve, are consciousness and cosmos simply coexistent? And if that is the case is the consciousness that we take for granted as biological entities a more limited and prosaic state, compared to what exists in the cosmos as a whole. **P2** 

**214** Falsification Experiments for Cosmological Theories from the Science of Consciousness. Ronald Gruber, MD, Ryan P Smith ; Department of Physics; California State University East Bay; Richard A. Block, Montana State University <ronaldpgruber@gmail.com> (Clinical Assoc. Professor, Stanford University Medical Center; UCSF, Stanford, CA)

The science of consciousness moves forward with the help of new experiments from the physical sciences. We explored the reverse situation. Physical science such as cosmology may actually move forward because of experiments from the science of consciousness and neurological sciences. Because the brain-as-observer is justifiably a part of quantum mechanics (QM) and therefore an obligatory part of many cosmological theories we identified falsifications experiments from the neurological sciences and the science of consciousness that are applicable to cosmology. We examined six different cosmological theories. Temporal Naturalism in the Cosmological Natural Selection theory claims that the flow of time (FOT), including motion, is real. However, a review of neurological evidence suggests otherwise. We provide two new falsifications tests. One test involves discrete stimulation of the recently discovered consciousness center, the claustrum, to remove the illusory FOT during normal visual observation. The results are expected to contradict Temporal Naturalism but not other cosmological theories. The other test involves the use of Hartle's Information Gathering & Utility System (IGUS) for an observer. It consists of a virtual reality apparatus with a split screen that allows observation of past (right screen) and present (left screen) simultaneously. It is expected to remove the illusory experience of the FOT in which 1) objects appear to move into the past and 2) the observer believes he/she persists as "same." The latter falsification test is applicable to theories involving an expanding or evolving universe, and expected to be supportive. Conversely, it is expected to falsify the Temporal Naturalism theory. C25

**215** Universal Definition of Intelligence and Thermodynamic Bounds in Intelligent System Design. Kirill Popov, Aamod Shanker; Debanjan Bhowmik cpopkir@berkeley.edu> (Materials Science And Engineer, UC Berkeley, Berkeley, California)

We live in the era of yet another technological revolution. If the previous one was associated with the development of energy conversion tools to produce work, harnessing increasingly vast resources over the course of history, the world nowadays is being rapidly transformed by the information processing tools. Starting with arithmetic devices that support conditional clauses and store intermediate results, we have arrived at machines emulating major functions that have before typically been attributed only to living beings or specifically to humans, such as learning, knowledge management, pattern recognition and control. Artificial intelligence is a major source of hopes and fears for humans, possessing natural intelligence of their own. Despite the massive effort in the field, the big question remains standing in the background: What is intelligence? We propose a universal definition of intelligence of a physical system and discuss its implications on design of intelligent systems. The intelligence of any 4-dimensional object M at an given event is defined it terms of prediction capability of the most predictive observer worldline L accommodated by M. Quantifying the prediction capability is done by calculating the mutual information between the internal state of the observer and the state of the part of the boundary of M that is able to causally influence the future of the observer. For simple dynamical systems, the intelligence can be calculated explicitly. We discuss the relationship of intelligence to energetic properties by invoking recent results in inequilibrium thermodynamics and computational mechanics. When the information content of the boundary is larger then internal state space of the observer, we suggest reformulating intelligent system design as three natural problems: selective forgetting, memory maintenance and self-recording. Selective forgetting refers to the property of extracting meaningful information out of incoming stream and discarding the rest. Memory maintenance refers to protection of

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memory states from the environment when they are useful, and choosing when they are to be reset. Self-recording refers to redirecting a part of the output to be recorded in the internal states. Given requirements on minimum useful energy dissipation, we explain how intelligence arises naturally in systems undergoing spontaneous dynamic order organization. Reflecting on the empirical data on neural systems and cognition, we propose the principle of time-scale separation in internal memory states, with faster degrees of freedom exhibiting light-like character and slower ones being associated with mass. The coupling between the two is administered via two-dimensional features in the system, establishing the design principle of boundary access computation. C14

216 Parallel Universe are Quantum States of Big Bang at Macrocosm? A Validation of Hameroff - Penrose Tubulin Consciousness Model at Microcosm. Soam Prakash prakashso-amdei@gmail.com> (Department of Zoology, Dayalbagh Educational Institute, Agra, India)

Quantum Theory has led to quantum biology, however as such the model proposed so far at microcosmic level of consciousness which can be difficult to be validated. Therefore, Hameroff - Penrose (1996) proposed quantum coherence aspects of quantum theory and a proposed a phenomenon dealing with quantum wave function of "self-collapse" which generally is known as objective reduction (OR - Penrose 1994). It is essential for consciousness to occur in cytoskeleton microtubules suitable for information processing. They assumed macroscopic, coherent superposition of quantum - coupled tubulin conformational states. Penrose (1994) argument for -OR - where the superposition states having their own space-time geometries. Mass-energy differences leads to separation of space-time geometry then "system" must choose and decay or reduce and collapse to a single universe state. This self-tuning or processed in microtubules are orch or leads to calculations or estimation and instantaneous events in brain microtubules is most specific and plausible model for consciousness yet proposed in scientific community. At "Microcosmic" level it needs experimental validation. However, recent developments and findings of "Parallel universe" can validate it at "Macrocosmic" levels. Both theories: (i) Gravitational waves based as well as presence of (ii) Parallel universe has now been observed, scientifically, therefore could lead to a validation for consciousness model proposed, as we all accept now "Macrocosm" and "Microcosmic" level of consciousness (Satsangi, 2015), considering man as a microcosm and entire creation as macrocosm, since relativity theory of Einstein refers to the relative nature of reality. This actually leads to body, mind and spirit theory(Prakash, 2017a, 2017b.) which sciences could accept up to body and mind only but excludes "Spirit" force which is actual unit of spirituality as they can't see "soul" with the help of physical instrument. It needs experiential science of east as well inner science doctrine. An effort needs towards integrating and intersecting eastern as well as western philosophy of consciousness to make a complete explanation. We will discuss it with the help of recently developed theories and observation in outer space as well as in the inner space and "the sanctum-sanctorum". A schematic rudimentary model with the help of recent findings of parallel worlds could lead us to more accurate and scientifically tuned model of consciousness wave collapse theory with newly found gravitational wave which may be attributed to the real reason of collapse at Eigen states at both Micro and Macro level in the universe. References: 1. Hameroff S and R. Penrose. 1996 in Towards a Science of Consciousness - The first Tucson Discussion and Debates. Hameroff, S.R., Kagzniak, A.W. Scott, A.C. Cambridge, M.A., MIT, PP-507-540. 2. Satsangi, PS and S. Hameroff. 2016 in Consciousness Integrating Eastern and Western Perspective. New Age Books, New Delhi (India) 3. Won-Newmann J .1966. Theory of self-reproducing automata A.W. Buski (Ed.) University of Illinois. 4. Prakash S.2017a. A new 'Soul' theory of Consciousness. Towards the Science of Consciousness. Concurrent sessions, 2017. 5. Prakash S.2017b. The Macrocosm and Microcosm. TSC2017. Concurrent session. 2017 C7

**217** Dark Energy and Consciousness - Where are we now? Gavin Rowland <gwrow-land72@gmail.com> (School of Medicine, Monash University, Castlemaine, Victoria Australia)

Dark energy research is a dynamic and fast moving area of physics, and as dark energy comprises approximately two thirds of all energy, consciousness studies should keep in touch with the improving understanding of this entity. In recent years consciousness studies has been increasingly accepting of a role for quantum mechanics. Biological systems, once considered causally closed, are now seemingly subject to quantum effects via sustained quantum coherence. At the same time our view of quantum physics is increasingly cognisant of quantum nonlocality. Where free will seems to be at odds with determinism, quantum nonlocality provides a home for the freely willed decision. A decision may remain 'in potentia' until made, at which point the wave function collapses. There is, however, a major problem with this as a completely satisfying explanation. If quantum systems are entirely material in nature, then quantum nonlocality stands at odds with relativity. Our observations of nature do not contradict this view because never is the nonlocal behaviour observed as a material entity. For example, light is said to have wave/particle duality with waviness being the nonlocal phenomenon. But waviness can only be inferred - it is never measured directly. It is generally accepted that dark energy permeates all space. This presumably includes the subatomic space of atoms. Dark energy is not material and therefore no known physics prevents it from possessing the ability to transfer information nonlocally. It remains a distinct possibility that quantum mechanics signifies an interaction between matter and dark energy. Sentient life forms may represent a spectrum of increasingly sophisticated interaction between dark energy and matter. Since 2015 I have favoured a view of consciousness where our minds are comprised of not one but two dark energies. On cosmological scales, dark energy is responsible for the accelerating expansion of the universe. I predicted that improved analyses of this expansion would support the existence of a second, contracting, dark energy. Imagine this as a model of two balloons, one expanding and one contracting, both at constant rates. The net volume of the two balloons represents the volume of the universe, which can be plotted over time. Pretty soon the contracting balloon starts to run out of volume change, while the expanding balloon can keep on going. This is indeed the pattern of expansion that has emerged from the data. The early universe has a much slower rate of expansion than the late universe, to the extent that cosmologists can now state with a 99.9% certainty that the two do not align with a single dark energy operating at constant strength. It is unlikely that expanding dark energy is gaining strength as this contradicts conservation of energy. Says cosmologist Wendy L Freedman "a recent tension has arisen that is either signalling new physics or as-yet unrecognised uncertainties." (Cosmology at the Crossroads. Nature Astronomy 1, 0120 (2017)) C25

218 Physics of Consciousness and Awareness - A New Paradigm Resolves The Hard Problem and Paradoxes of Science and Reality. Avtar Singh <a shows a straight a straight (Center for Horizons Reseach, CUPERTINO, CA)

This paper demonstrates the common scientific basis as well as link between the well-known hard problem of consciousness within the context of neuroscience and unresolved paradoxes of contemporary physics. An integrated model is presented that provides a direct relationship between the physics concepts of space, time, mass, and energy, and the consciousness concepts of spontaneity and free will. The neurobiological consciousness or awareness of the human mind is represented as a lower order manifestation of the higher order universal consciousness evidenced by the observed spontaneity or free will in natural phenomena such as the spontaneous decay/birth of quantum particles, wave-particle complimentarity, spontaneous expansion of the universe, and spontaneous change of state or evolution in time etc. The approach of the scientific research is two-fold. First is to complete the picture of universal reality via integrating consciousness into a physical model and explain the observed empirical universe behavior resolving the current paradoxes, singularities, and inconsistencies of the mainstream scientific theories. Second is to develop a framework for an integrated universal model of matter, mind, and consciousness founded on the wholesome reality including consciousness. Universal consciousness or awareness is shown to be the eternal fundamental state of existence depicted as the Zero Point State. The neurobiological or brain-mind processes and qualia (emotions, thoughts, intentions etc.) are shown to be a subset of the relativistic states of universal consciousness or the universal mind represented as one wholesome continuum of space-time-mass-energy - an orderly physical phenomenon governed by the universal laws and not a brain generated neuro-biological imperative. The model is vindicated by the empirical observations of the universe such as the Hubble data and the accelerated expansion (dark energy) evidenced by the far-field supernova data. It also leads to testable and falsifiable predictions of mature galaxies far beyond the currently observable universe indicating an infinite eternal universe. In addition, the model also vindicates empirical as well as subjective meditative experiences providing a scientific approach to meditation and a physical basis for authentication of the spiritual laws. The model thus constitutes a scientific bridge between subjective

(relative) and objective (absolute) reality. P2

## 4.05 Emergence, nonlinear dynamics and complexity

219 The Primacy of Consciousness in the Universe: Are "Funda-mental" Theories of Consciousness Being Over-emphasized? Mathew Gendle <mgendle@elon.edu> (Psychology, Elon University, Elon, NC)

Within the field of consciousness studies, the notion of panpsychism appears to be gaining ever-increasing support. Chopra, Hameroff, and many others have posited that consciousness is "funda-mental" to the universe. In particular, Hameroff has argued that vibrational resonances in neuronal microtubules function as a sort of "quantum orchestra, tuned to the universe", wherein simple and random "proto-conscious" moments of awareness happen everywhere, and some of these moments are "orchestrated" by the brain into consciousness. Without question, Hameroff and colleagues have generated an elegant hypothesis (and supporting data) indicating that quantum activities in neuronal microtubules are critical in the generation of individual conscious experience. Yet, their assertion that consciousness is fundamental to the fabric of the universe and independent of biology is not particularly parsimonious. Although purely computational models of neural networks have failed to account for consciousness, these models often over-simplify how neurons function and overlook critical emergent and non-reductive aspects of systems-level neuronal behavior. Theories of consciousness that focus on radical emergence (Clayton, 2004) and physiological nonduality (Gendle, 2016) must first be fully investigated and empirically refuted before the notion of consciousness being a "funda-mental" part of the universe should be considered the best theoretical explanation. It is both parsimonious and likely that consciousness emerges from the physical, chemical, and biological actions of complex organized systems. Much like digestion is the emergent and irreducible product of physiological activities in the gastrointestinal tract (Searle, 2000), consciousness is the emergent and non-reductive result of complex cellular and sub-cellular mechanisms that process informational inputs and recursively interact with these inputs. Consciousness was not "always there" in the universe--rather, it came into being when it emerged from sufficiently complex biological systems. The growing field of consciousness studies risks much if it continues to speculate upon and emphasize the potential "funda-mental" nature of consciousness over more parsimonious explanations, such as physiological nonduality based in radical emergence. At present, a continued focus on hypothetical theories of quantum consciousness is not an effective and productive way to move the science of consciousness forward. C22

# 4.06 Hierarchies, scale-invariance and 1/f systems

# 4.07 Logic and computational theory

220 Non-classical Entropy Gain of Quantum Neural Networks of Human Brain as a Neural Correlate of Consciousness. Luis Javier Camargo Perez , Daniel Muñoz-Jimenez <camargo@cifro.org> (Center of Frontier Research and Philosophy, Tlalpan, CDMX Mexico)

In classical physics and canonical neuroscience conceptions of the overall function of the sentience and cognition, when stimuli enter the Central Nervous System follow a series of deterministic pathways within the neural network with leads to a causal response to the environment. With the development of Artificial Intelligence, several challenges need to be addressed such as the extensive and unattainable computational cost of minimizing the loss function at the training/learning process. This problem halted the development of complex neural networks until the implementation of algorithms such as Stochastic Gradient Descent, which allowed the creation of deep layer networks resembling the architecture of the human brain cortex. Even these substantial developments, these models are still orders of magnitude behind the performance of human capabilities even though the speed of most modern computers are millions of times algore the theoretical processing speed estimations of the human brain. The learning/training of a digital or biological neural network is a process which calculates a weight or transmissibility ratio that allows an n-dimensional array of nodes due to a progressive reinforcement whilst the entropy is increased from an empty network to a fully trained theoretical maximum of accuracy.

Digital neural networks demand an enormous amount of time and energy to achieve an optimal state that biological neural networks do not seem to require. Even with the apparent low speed of biological neural networks vs the current computational capabilities, biological settings seems in fact more efficient at learning. With these bases, we roughly estimated that the thermal efficiency of the training/learning process of the neural networks of the human brain is above their digital counterparts. In such case, the human neural networks should benefit from quantum mechanics to minimize the loss function at no energetic expense. With the current theoretical framework of quantum effects on biology, we devised the following model: When stimuli enter the central nervous system as a wavefunction from a sensorial input and is propagated to all different network nodes and pathways in diverging multiverses (or conversely interpreted as the massive propagation of superposed among all the network becoming progressively coherent). From all the coexisting multiversal pathways, the most efficient will allow the wavefunction to arrive earlier to the conscious state collapsing the superposed wavefunction propagated to all the network into a single objective pathway which will always be the more efficient. Following our previous theorizations of consciousness/free will symmetry, we hypothesized that the efferent/generative neural networks will achieve the probabilistic but non-deterministic outcome of the brain interaction which we interpret as material free will. Having these, we conclude that consciousness collapses the superposed multiverses into a single deterministic pathway which results on a supra thermodynamic efficiency while increasing the entropy of the network above the thermal conversion limit, or likewise, consciousness arises or perceives only the single multiverse where the network entropy-vs-energy conversion is maximal. C20

221 A Possible Scheme for Microtubules to Act as Cylindrical Waveguides as the Basis for Logical Operations. Saatviki Gupta <saatviki@gmail.com> (Dayalbagh Educational Institute, Delhi, India)

This paper examines the possibility of microtubules (MTs) acting as cylindrical resonant waveguides and this configuration would allow logical operations to be performed within MT networks using photons as the medium for information processing. The phenomenon of the transport of surface plasmon polaritons (SPPs) along waveguides in the subwavelength dimensions has been used to form nanoscale photonic circuits that use novel structures to implement logical operations. It has been shown that SPPs can concentrate electromagnetic energy into nanometer scale volumes which allows light to be maneuvered and manipulated even beyond the diffraction limit. In devices based on branched nanowire networks, plasmons travelling through them meet at the junctions and interfere with each other causing a modulation in the near field distributions. It is seen that as the phase difference between the two colliding plasmons is varied, the near-field distribution of the output changes. By configuring different input sources of varying phases and by assigning '0' and '1' to different intensity values by deciding some threshold cutoff, interaction of these signals at decided junctions can lead to logical operations. Using this same idea, it is proposed that MT networks within the neuron act in the same manner as the nanoscale waveguides discussed above. Light travels through them by total internal reflection and behaves in the same manner as it would in nanowire networks. In this scheme, the interconnections between MTs in the form of MAPs (MT associated proteins) would be the junctions where interaction between different inputs would take place and the output would propagate along the MT until it once again collides with another input and so on. In such an arrangement, the position of the MAPs would decide the overall computational cascade and would allow fluidity in channeling the "information" (in this case photons) into the branch that would allow it to interact with any other incoming signal to give the logical output. The use of light, coupled with the extremely high density of logical operations possible per-unit-area in this scheme, would theoretically allow ultra-fast calculations and information processing even at the scale of a single neuron. P1

## 4.08 Quantum brain biology

222 Photon Quasiparticle Probes Quantum Processes In The Brain. Robert Alfano, Dr Lingyan Shi. Columbia University; Prof.Enrique Galvez, Colgate College; Prof. Bidyut Das, Southern Conn Unversity <ralfano@ccny.cuny.edu> (Electrical Engineering, CUNY IUSL/

#### CCNY, New York, NY )

The presentation will focus on amazing photon quasiparticle as it enters and excites quantum processes in brain tissue. The salient properties of the photon quasi particle will be described. The Photon quasi particle consists of energy, spinon and orbitons components. Four topics based on the underlying Quantum processes in the brain will be discussed. 1. Label-Free Fluorescence Spectroscopy for Detecting Key Biomolecules in Brain Tissue from a Mouse Model of Alzheimer's disease; 2. Time resolved Fluorescence Spectroscopy of Alzheimer mouse brain tissue measured using single- and multi-photon excitation of label free native molecules; 3. Transmission of photon's polarization, spin and orbital angular momentum in brain; and 4. Propagation and transmission of Polarization-Entangled Photons through brain tissue. **PL6** 

#### 223 How the Consciousness Essence Can Live Through Real Life Quantum Reality Like a Virtual Reality (VR) Actor Lives Through VR Hard- and Software. Gerard Blommestijn <gblomm@gmail.com> (Amstelveen, Netherlands)

First I would like to explain in my presentation how Science had to banish the notion of an ontologically independent Consciousness Essence (Self), due to its classical physics way to understand nature. But a 100 years ago, physics developed the extraordinary quantum mechanical way to understand nature. It will be shown that as a result of this, the banishment of the independent Self is no longer forced on us. Then we can keep to the other view, namely that the pure consciousness Essence or Self lives through a living being, more or less like a virtual reality (VR) actor lives through his avatar or robot. The (VR-like) technology of reality, namely quantum mechanics (QM), shows us two types of processes: 1) the observation process or measurement process whereby from a so-called superposition of possible outcomes, one outcome becomes real, without any (hidden) variable predicting which outcome that will be, 2) the automatic, deterministic changes of the state of an isolated system in the absence of any observation. Process 1 is the so-called reduction of the wave function or state vector. This process has precisely the right (weird) properties for the purpose of connecting the ontologically independent Self to the particles and fields of space-time. These QM reduction processes in a (large) subset of neurons in the brain then allow the Self to experience the qualia of the senses, emotions and intelligence in a living being. This may happen by means of grand entangled QM reductions in a substrate such as microtubules. To get an idea of how the Self is immersed in a living being, we can look at how a living being can be immersed in a virtual reality (VR) situation. I would like to use the example of a person with a VR helmet connected to for instance a flight simulator program. This person experiences himself as being seated in the cockpit of a plane instead of in the more mundane (but real) situation of sitting in a chair at home. In the same way the Self experiences itself as residing in the living being instead of in the more detached and silent perennial-now where it really is. The technology in the VR case is electronics (software and hardware) to show in the helmet how the world looks in and from the cockpit of the plane. In the real life situation the presentation technology is formed by the final QM reduction processes in neurons in the brain at the end of chains of brain processes. Thereby they bring the experiences of the senses (and of feelings, dreams, understanding, memory etc.) to the Self in its perennial-now realm via a reduction boundary in a living matter substrate of for instance microtubules. A1

**224** Self-correcting Topological Quantum Memories. Shiroman Prakash, V Gurucharan <shiroman@gmail.com> (Physics and Computer Science, Dayalbagh Educational Institute, Agra, Uttar Pradesh India)

In this talk, we will ask the question, what are the minimum requirements that any form of topological quantum error-correction in microtubules must meet in order to protect quantum information from decoherence for sufficiently long periods of time to be functionally relevant in brain biology? Penrose and Hameroff have long advocated that some form of topological quantum computation arises in microtubules -- an idea that was ahead of its time when the theory was first proposed because the theory of quantum error-correction as well as topological quantum error correction were barely developed at the time. We will update arguments surrounding Penrose and Hameroff's ideas by taking into account the developments in topological quantum computing over the decades since they originally proposed their theory. In particular, we will point out another

objection to the idea of topological quantum computing in microtubules, namely that conventional models of topological quantum error correcting codes (such as the toric code and its variants), although extremely powerful at low temperatures, are not very resilient to thermal noise. The reason for this is that large errors with the capability of changing the ground state of the system have the same energy as small, correctable errors, so both are equally probable at finite temperature. Self-correcting topological quantum memories are a possible solution to this problem. In these systems, the quasiparticles associated with the errors are attracted to each other, and therefore the advantages of topological error protection can be extended to thermal noise. Given various estimates in the literature of decoherence times and other relevant physical quantities (specifically well-known papers by Tegmark, 2000 and Hagan Hameroff Tuszinski, 2001), we will also attempt to characterise the requirements any self-correcting topological error-correcting code must meet in order to preserve quantum information in the brain, subject to various assumptions. We may also discuss some of the technical challenges associated with constructing self-correcting transition error-correcting topological error-correcting topologic

**225** Topological Quantum Chemistry of Tubulin Molecule. Pushpa Sahni <a href="https://deipushpas-ahni@gmail.com">deipushpas-ahni@gmail.com</a> (Chemistry, Dayalbagh Educational Institute, Agra, Uttar Pradesh India)

Several graph-theoretic approaches have been proposed to predict the functions of proteins based on their shared neighborhoods (Samanta and Liang, 2003; Vazquez et al., 2003) or on their closeness in the protein-protein interaction network. Graph-theoretic approaches show that the topological characteristics of proteins complement their sequence and structural characteristics and enable transfer of their functional annotation (Sharan and Ideker, 2006; Yook et al., 2004). Protein function, such as enzymatic catalysis, ion channel opening, cell movement and information processing, depends on regulated changes in protein shape, or conformation. Each topological atom is a quantum atom and vice versa, a property that enables the construction of a topologically inspired force field called Quantum Chemical Topology Force Field (QCTFF). Biological information processing can be explained by using topographic indices of biomolecules which signify the process of signal transmission that leads to the synchronized regulatory unit. Topological advanced information processing systems will lead to the advent of super intelligence era. Current neurological explanations of consciousness suggest that it is a manifestation of emergent firing patterns of neuronal groups involved in specific networks. In human brain, microtubules are present in neurons and have been implicated to play an important role in function of neurons and the brain, and are purported to gives rise to cognitive brain functions such as memory and consciousness (S J. 2007). Quantum hopfield network model of the brain explains five levels of neural interaction for learning and association (Srivastava et al., 2016). Graph theoretical applications in chemistry have undergone a dramatic revival lately. Constitutional (molecular) graphs have points (vertices) representing atoms and lines (edges) symbolizing covalent bonds. It is used to explore complete set of all possible monocyclic aromatic and heteroaromatic compounds by a combination of Pauli's principle. Polya's theorem, and electro-negativities. Reaction graphs and synthon graphs differ from constitutional graphs in their meaning of vertices and edges and find other kinds of chemical applications. Microtubules are the largest cytoskeletal filaments in cells, with a diameter of 25 nanometers. They are made out of subunits called tubulin. Each tubulin subunit is made up of one alpha and one beta tubulin that are attached to each other, so technically tubulin is a heterodimer. An Orch. OR gubit based on topological quantum computing specific to microtubule polymer geometry was suggested by Hameroff et. al. in 2002 (Penrose and Hameroff, 2011). Conductance along particular microtubule lattice geometry, e.g. Fibonacci helical pathways, were proposed to function as topological bits and qubits. Bandopadhyay (2011) has preliminary evidence for ballistic conductance along different, discrete helical pathways in single microtubules. Protein topology refers to mutual orientation of regular secondary structures, such as alpha-helices and beta strands in protein structure. Recent work towards addresses how secondary structures determine protein topology. Our effort has been to combine secondary structures of protein, chemistry and graph theory to provide a frame work for topological quantum chemistry of tubulin molecule. C3

226 Simulating Quantum Information Processing in Biological Molecules. Runjhun Saran

Narayan , Apurva Narayan <r.saran.narayan@gmail.com> (Waterloo Institute of Nanotech, University of Waterloo, Waterloo, Ontario Canada)

Biological molecules are capable of preserving information and evolving it with time. In some cases, the information processing speed of the systems involving biological molecules is exceptional, compared to that achieved in artificial computational systems. The paradigm that proposes to process information reliably at an extremely fast speed has its roots in "Quantum Mechanics," which is a field of physics that determine laws for very tiny sub-atomic particles such as protons, neutrons, electrons, and others. In this work, we extend the analysis of the underlying quantum phenomenon in certain biological molecules such as DNA and microtubules, by simulating the theoretical models on classical and quantum computers. Our results reinforce the idea of quantum behavior in biological molecules. The simulation studies validate the theoretical models of biological quantum transport in a variety of relevant parameter regimes. C3

# 4.09 Biophysics and coherence

227 Investigating the mechanism of charge transport in microtubules. Aarat Kalra, Piyush Kar; Jack Tuszynski <aarat@ualberta.ca> (University of Alberta, Edmonton, Alberta Canada) Microtubules are long, cylindrical polymers of the protein a,b- tubulin that are known to play a variety of roles in the cell. They are crucial for cell-division, serve as tracks for the transport of various molecules and maintain cell shape and rigidity. While such biological roles are well

understood, potential electric roles of microtubules, have also been modelled, and calculated to be relevant in cellular conditions and dimensions: They have been modelled as the targets of Tumor-treating fields (TTFields), which are low intensity (1-2 V/cm), intermediate frequency (100-300 kHz) electric fields that have been shown to reduce the spread of cancer. Microtubules have also been modelled to act as electrical transmission lines for the transport of ions across the cell, via the counter-ionic cloud present at their surface. More controversially, microtubules, as opposed to neurons, have been proposed as the fundamental units of information processing in the brain. Due to the high dipole moment (~1750 D) and negative charge (23e) of the tubulin dimer, microtubules have been shown to re-orient themselves in the presence of external electric fields. The mobile counter-ionic cloud around microtubules has been modelled to respond to electric fields, and transport ionic species across cellular dimensions. In addition to such ionic charge transport, intrinsic electronic transport also has been modelled through the microtubule circumference. Protonic transport through the cylindrical lumen of a microtubule has also been hypothesized. We determined the response of microtubules to 1kHz-1.5 MHz, 32 mV rms AC electric fields, and found that while microtubules increased solution conductance, unpolymerized tubulin had the opposite effect. To determine the contribution of the hollow microtubule cylinder (the lumen) to overall increase in solution conductance, we synthesized cylindrical tubulin polymers with a lumen measuring 300-500 nm in diameter, termed macrotubes. We then polymerized two-dimensional zinc-induced tubulin sheets, that do not have a lumen. The presence of these polymers was validated using Transmission Electron Microscopy (TEM). By comparing the conductivity of solutions containing different tubulin polymorphs, we could shed light on the mechanism of conduction in microtubules. To determine the thickness of the solvation shell around tubulin, we used Dynamic Light Scattering (DLS), and observed the effect of increasing temperature, ionic concentration, pH and nature of solvent on the thickness of solvation shell. We have also performed measurements on the solvation shell of tubulin in silico, altering various parameters such as pH to determine its thickness. The effect of microtubule binding ligands such as microtubule associated proteins (MAPs) and anesthetics is presently being performed. By determining feasibility and mechanism of charge transport along microtubules, our work will determine the viability of various models on their electrical roles at the cellular scale. C3

# 228 Haptic Singularity: Nested Tensegrity Distortions Consolidated Into Oscillatory Resonance. Mark Valladares <a href="mailto:scilladares@yahoo.com">mark</a> (Overland Park, KS)

Haptic Perception is the contextual grasp of the environment from mechanosensing distortions in the Tensegrity structure of the Haptic Medium. The medium is the continuum of the connective tissue net in conjunction with the muscular/skeletal domain in which proprioceptors read the tension (Turvey 2014). Nested Tensegrity is the conformational metastability derived from pre-tensile stresses and discontinuous compression in a multifractal geometry that imbues holism and gives shape to biological structures from cells to their assemblies on up to the whole body. Mechanosensing trasnsduction into subcellular processes is in evidence via Tensegrity such that the surface tension of the Extra Cellular Matrix is shown to determine cell destiny (Ingber 2006). Such Macro to Micro conversions suggest that sensory information is processed at the fine scale. While Haptic Perception is directly coupled with mechanosensing feedback, Haptic Singularity is the delayed experiential realization of it as Qualia. It is the point of induction of a non-linear bifurcation of some indeterminate trajectory. Haptic Singularity, though indeterminate and non-computable is derived from fine scale processing in the multifractal medium. Realization (Singularity) of Haptic feedback (stimulus) is correlated with the onset of Gamma synchrony (Ross 2013). Microtubulin (MT) polymers serve a dual purpose as the mechanosensing sub-cellular struts of the Haptic Medium as well as the processing conduit of oscillatory flux. That the MT polymers are both scalar (base of 13) and tensor (flex and relax) suggest an information processing topology (Bandopadhyay). Haptic Singularity then can be defined as a function of Nested Tensegrity distortions consolidated into Oscillatory Resonance. The consolidation of vibrational signatures is the harmonization (algebraic summation) of sets of potential subjective states (or sets of constrained synergies). Induction from sets of constrained synergies drives functional adaptivity (Van Orden). This connects the Hard Problem to a definable physical process that yields an evolutionary mechanism. The Oscillatory Flux clocks to dissipative Fractal Noise. The onset of Beta synchrony (10 ms) correlates with basic Haptic Perception as a response to Feedback, while the delayed onset of Gamma synchrony which is slower to reach a steady state (400 ms) implicates it with Haptic Singularity events or moments of Qualia in which the binding of sensory information for higher order processing is realized. C23

# 4.10 Origin and nature of life

229 Centrioles, Geometry Waves and DNA: A New Inroad to Understanding Biological Evolution. Carl Johan Calleman <cjcalleman@swipnet.se> (Chemistry, Northern New Mexico College, Espanola, NM )

Ever since the elucidation of the structure of DNA in 1952 and the genetic code in the subsequent decade this macromolecule has come to be seen as the "Code of Life" or "Blueprint for our bodies". While there is no doubt it codes for the structure of proteins, evidence of the role of DNA for the evolution of morphogenesis and the anatomy of metazoa is however virtually missing. That the human genome project's estimate of the number of genes (20,488) is lower than that of a sea urchin (23,300) and barely more than a nematode (19,427) hardly supports the idea that DNA holds the blueprint for life. The fact that the DNA sequence of a Chimpanzee is practically identical (99.4%) with that of a human being warrants the same conclusion. Moreover, the information content in the human DNA of 3.5 billion base pairs is clearly insufficient to define the knitting pattern of 40 trillion cells of around 260 different types. These quantitative considerations together with several others raise the question as to how the biological evolution of differentiated multicellular organisms actually takes place. Considering that both the anatomy and morphology of multicellular organisms are functions of their cellular knitting patterns, and that the information content of the DNA is insufficient to explain this, it then seems reasonable to recognize that the role of DNA in development is limited to synthesizing proteins in co-ordination with the knitting process, which is determined by another mechanism. In the past decade it has for instance been demonstrated (Feldman et al, 2007) that the knitting pattern of cells is established through the connections and relative positioning of mother-daughter pairs of centrioles. Given that the centriole is the only rectilinear lateralized organelle in the cells of multicellular animals it becomes a hot candidate for explaining the anatomy of the bilateral bodies of all higher life forms. To provide a complete novel model for biological evolution it then also needs to be pointed out that there are several facts consistent with the idea that the basic blueprints for the anatomy of multicellular animals are developed by low frequency geometry waves for which the centrioles serve as "antennas". Most notably the evolution of the major classes of animals over the past 800 million years essentially follows a sine wave function, where emergences alternate with mass extinctions

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in a rhythmic pattern. Secondly, there are several examples, for instance from the human body, of geometries of the golden mean, which is also a significant trait of the geometry of the centriole. Thirdly, the centriole only emerges as a rectilinear antenna at fertilization, which indicates that it plays a crucial role for development through resonating with the blueprint for the anatomy from the geometry waves. Given that all higher forms of life and consciousness require self-mirroring left-right bilateral brains and bodies for their expression, it will be argued that the understanding of the function of the centriole is critical for understanding the evolution of consciousness as expressed through different biological species. **P1** 

#### **230** A Novel Hypothesis for The Origin of Life: Implications for Science, the study of consciousness and a re-centering of human civilization. Bruce Damer <bdamer@ucsc.edu> (U.C. Santa Cruz, Boulder Creek, CA)

The origin of life is one of the central mythological and scientific quests of human history. In 1871 Charles Darwin intuited that life may have started in a "warm little pond". Today science is zeroing in on a specific sort of little pool with the first full model for biogenesis, the "Hot Spring Hypothesis" proposed with David Deamer at UC Santa Cruz. Evidence emerging from the laboratory and the rock record suggests that we may be within a generation of chemically recreating the Progenote, the earliest "boot-up phase" of life. Progenote research could bring tremendous intellectual insights in chemistry and astrobiology but also in physics and information theory, artificial intelligence, and even political economy. Identifying the Progenote's "boot up instructions" will consciousness. Ultimately, solving the riddle of life's beginnings could initiate a second Copernican revolution, re-centering our civilization and giving humanity a new spiritual conception of our place in the universe. **PL8** 

231 Is the Arrow of Complexity Driven By An Non-algorithmic Curiosity Inherent in Matter and Can We Design An Experiment To Check? Stephen Waldon <waldon311@yahoo. com> (Center for Quantum Artificial Intelligence, Evanston, IL)

Throughout time, the need for revolutionary ideas has had very little to do with their creation. In fact, these ideas seem to arrive prior to the existence of a need for them. The arrival of the fittest phenomena in evolutionary biology provides many examples. Stuart Kaufman makes a significant case as to why this may even be an acausal phenomena. Similar arguments apply to the origin of life and the creation of human knowledge. Most of what we have created and know results from innovation driven not by need but by our underlying curiosity. Could the parallel be more than coincidence? Could it be that our curiosity is driven by the same fundamental properties of matter that created life and its diversity? Said in reverse. Could it be that the feeling inside that drives us to create also drove nature to create life and all its diversity? Starting with the Penrose Interpretation as the basis for the existence of quantum hypercomputation and hence the non-algorithmic properties of matter, I propose an experiment to detect the effect of the collapse of quantum coherence on complexification. Although by its very nature a non-algorithmic process defies description, its effect does not, and I exploit this notion in the design of the measurement apparatus. Building on an idea I presented in the 2010 Science of Consciousness Conference, I describe a system that could be "plugged" and "unplugged" from the underlying quantum effects of the universe and provide a sandbox to study the magnification of quantum phenomena to the classical world. In this latest system, an algorithm capable of generating novel structures is "guided" both by an algorithmic random noise simulator and an inverse quantum zeno state transition loop. The expected behavior is that the system coupled to the physical quantum world will show behaviors not displayed in the fully algorithmic system. P2

## 4.11 Consciousness and evolution

**232** On the Subject of Evolution: Towards a Biological Basis of Subjectivity, Selfhood, and Agency Mel Andrews <amelia.andrews@tufts.edu> (Philosophy & Psycholog, Tufts University, Medford, MA)

The social and scientific revolutions of the twentieth century have moved the life sciences

from a focus on static factors, both within the individual organism and relative to characteristics of the individual's broader ecological or sociocultural context, to a dynamical, procedural view. The individual is no longer conceptualized as an unwitting subject of God-given fate or genetic determination, a hapless victim of chance or circumstance, or a wholly self-determining agent of inexplicable omnipotence. The individual of today is bound into a complex causal web of biological and historical predetermination, chance and fortuity, circumstantial and experiential mediation, and his or her own emergent agential power. It is this emergent agency that most ostentatiously lacks a robust biotic or physiochemical explanation. Only the provision of a sufficiently rigorous scientific account of the existence of the self-determining subject stands to explain the phenomena of consciousness and agency such that they no longer appear anomalous within a material and deterministic universe. This project promises a unification of the physical sciences with the life sciences and a unification of the life sciences with philosophy. **C19** 

**233** Of Octopuses and Us: Independent Evolution of Conscious Experience? James Beran <jberan729@gmail.com> (Montara, CA )

Octopuses engage with humans in ways that provide evidence of continuing, time-extended conscious experience. (See, e.g., Montgomery, S., 2015) But nervous systems of octopuses and other cephalopods are remarkably different from ours. If we were unrelated, with no common ancestors, it would follow that the different nervous systems had independent origins, e.g. through truly independent evolution. On the other hand, due to similarity of genetic code, biologists conclude that all organisms evolved from a common ancestor (Alberts et al., 2015); for example, our last common ancestor (LCA) with octopuses is described as a "flattened worm-like creature" that lived about 600 million years ago. (Godfrey-Smith, 2016) Accordingly, octopuses are our distant cousins, presenting a fascinating evolutionary puzzle: How could two different lines descending from a worm-like LCA both lead to animals with sophisticated conscious experience? Under the principle of parsimony, presence of a characteristic in two different descendants of an LCA implies that both descendants inherited the characteristic from their LCA (Hall, 2011); if parsimony held, our LCA with octopuses also would have had conscious experience. Godfrey-Smith believes, however, that the octopus-human LCA lacked conscious experience, and instead proposes that evolution of nervous systems proceeded independently in different lines descending from the LCA; "independent evolution", also known as "convergence", is a recognized exception to parsimony. (Hall, 2011) To test Godfrey-Smith's proposal, we examine several hypotheses of "independent evolution". For example, one could hypothesize that the LCA lacked neurons, so that neurons evolved independently in our ancestors and in ancestors of octopuses; this hypothesis is implausible, however, not only because our pre-LCA ancestors apparently had neurons but also due to similarities between proteins in our neurons and cephalopod neurons. (See, e.g., Nomaksteinsky et al., 2013) We also consider hypotheses of independent evolution of other features, such as nervous system complexity, brains, action potential propagation in neurites, etc. Because we find all these feature level hypotheses unpersuasive, we turn to evolution at the polymer level, i.e. the level of DNA, RNA, genes, proteins, etc. We previously proposed that conscious experience involves the axon initial segment (AIS) (Beran, 2017), a subcellular structure that, in vertebrate neurons, is organized by a giant variant of the Ankyrin G protein. (Jegla et al., 2016) We now examine whether AIS-related genes and proteins differ between octopuses and humans in ways that provide evidence of independent nervous system evolution; this leads us to compare the meaning of "independent evolution" at the polymer level to its meaning at the feature level. Finally, we propose how further study of octopus nervous systems might shed light on evolution of human conscious experience. C26

# **234** Can Consciousness Influence Our Epigenetics And Can Epigenetics Influence Our Consciousness? Ingrid Fredriksson <ingrid-f(@telia.com> (Arjang, Sweden)

Epigenetics is a mechanism for regulating gene activity independent of DNA sequence that determines which genes are turned on or off: in a particular cell type, in a different disease states or in response to a physiological or even psychological stimulus. There is a microbiota-gut-brain axis communication in health and disease. Under healthy conditions, the predominance of symbiotic bacteria, an intact intestinal barrier, a healthy innate immunity controlling pathobiont

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overgrowth inside the intestinal barrier. The molecules that constitute epigenomes have no resemblance of DNA. While DNA is a double spiral, similar to a twisted rope ladder, the epigenome is a system of chemical markers that sits on the DNA. The molecule markers either engage or disengage the genes depending upon the cells needs and environmental factors, such as diet, stress and poisons. Of late, the discoveries surrounding the epigenome have caused a revolution in the field of biology now being able to prove a connection between the epigenome and certain illnesses, including aging. **C23** 

#### 235 Our Future Brains - A Story of Unnatural Selection and Non-Random Mutation.

Steven Gullans <sgullans@excelvm.com> (Excel Venture Management, Boston, MA )

Human consciousness, intelligence and behavior have been shaped throughout evolutionary history. Studies of inheritance show the human mind is shaped by both nature and nurture. However, it continues to be a challenge to identify the specific genes or environmental factors that underlie many of our cognitive abilities. At the same time, we are seeing changes in rates of autism, IQ scores, and other brain functions that are unexplained. The world we live in today is completely different from our prehistoric ancestors -- modern living provides too many calories, continuous mental stimulation, pharmaceuticals, a longer life span, manmade chemicals, high childhood survival rates, jetlag, and many other unnatural stimuli. At this juncture, it is apropos to consider whether and how the human brain is adapting, for good and for bad. Furthermore, with access to new technologies, how will we begin to reengineer our minds? **PL4** 

# 236 The Blind Mindmaker and the theory of Position Selecting Interactionism (PSI).

Colin Morrison <csdm1@hotmail.co.uk> (Cupar, Fife United Kingdom)

The potential for a Darwinian explanation of human consciousness has, in my view, been grossly underestimated. This is mainly because (1) Most have renounced interactionist substance dualism on grounds of causal closure, and (2) Most have concluded that there cannot be a straightforward structural identity-theory (isomorphism) between our experiences and some direct neuro-physical substrate. (Such isomorphism is essential for an evolutionary explanation of their design-like structure because the only alternative, a functionalistic identity-theory, "explains" their form via fundamental psycho-physical laws, rather than as a direct result of positive natural selection). I believe (1) is justified. However, I think (2) is a mistake. It is based, firstly, on the irrelevant fact that the neural correlates of consciousness (NCCs) evident in brain-scans show no isomorphism, and secondly, on the popularity of the groundless brain-scan-based conclusion that 'there's no place in the brain where it all comes together.' That conclusion is groundless because the brain is way more complicated than brain-scans suggest. Since our experiences contain only fully-processed sensory data, there must be plenty of processing that is perfectly correlated with them, but which doesn't directly generate them. To assume that the non-isomorphic-with-consciousness nature of brain-scan activity precludes the existence of a physical structure that is isomorphic with our consciousness is therefore flawed. We do not know which part, or even if any part, of that brain-scan activity is our consciousness, so its form tells us nothing about the form of that direct physical correlate of consciousness. And for the same reason, we should not conclude that the widely-distributed nature of these NCCs means that consciousness is widely-distributed. The subjective evidence suggests it isn't. The perfect timing of subjective representations of simultaneous sensory stimuli is problematic if these are the outputs of widely-separate systems; and I suspect that drugs and brain damage would obliterate consciousness entirely, rather than selectively alter it, if it were widely spread-out across the brain (and thus more likely to be affected directly). The fact that they often have creative effects suggests they are not affecting consciousness directly at all, but merely interfering with the processes that inject it with information. And of course, the binding problem would not seem so insurmountable if all our experiences were generated in the same small part of the brain. Having rejected the very popular "widely-distributed-consciousness" fallacy, and accepted the evolutionary importance of structural isomorphism, we now find that there is only one science-respecting theory of consciousness - Position Selecting Interactionism. Our consciousness is the reality that underlies the position probability-density distribution for a single particle, most-probably confined to a single neuron. My book explains how accidentally-occurring measurements of that particle's position became adapted to introduce

randomness into a creature's focus of attention, and how surrounding structures evolved to manipulate that particle's position probability-density distribution (and hence its experience) in ways that improved the system's efficiency. The result is the wonderful experience of humanness that it now enjoys. C26

237 Creative Evolution of the Casteless and Classless Society-homo Spiritualis- highest Achievement of Nature and a Novelty in Creation. Annual Saran , Achal Srivastava; Neha Srivastava <anmolsaran2501@gmail.com> (Technical College 1st Year, Dayalbagh Educational Institute, Noida, Uttar Pradesh India)

I went for my consultation to the surgeon and saw him operating patients. The same day I saw him working in the fields, singing prayers, doing social service, making cut flowers and standing as security guard on the colony gate at night. I thought how is it possible for a professional to be so versatile? But then this was not a single example. Most of the people of this community of Dayalbagh were doing the same routine. Are these Superhuman with higher consciousness? Commonly every human effort is done with a chief motive of earning profit or material success in life. The present study was undertaken to understand how a community is gradually advancing closer towards a superhuman race by discharging the duty of four Varnas(caste and class) e.g. Brahmin(spiritual preacher and practitioner, higher socio economic class), Kshattriya(community protector), Vaishya(businessman and entrepreneur, middle socio economic class), Shudra (serviceman, lower socio economic class) willingly by performing community service. The Plato's dream of an ideal republic, Sir Thomas More's Utopia exists only in dreams but the Casteless and Classless society of Arya, an ideal place on earth has come into existence. For this study a random population age 20-90 years was distributed the questionnaire describing their routine and activities in daily life n=150 the data was analyzed. Those following the Casteless and Classless way of life are encouraged by the example set before them by their Spiritual Head and are motivated by each other with the aim of attaining Grace of Supreme Lord. People of this community dedicate more than 2 hours daily in community service and spend most of their time post job for some kind of social cause rather than spending time in other activities like watching TV, shopping etc. Some take voluntary retirement at an early age to serve the community. Most of them reported to be closer to attain their life's ideal .In this survey I found that almost all the inmates of this community satisfy all the conditions of being a Superhuman with higher consciousness. P1

**238** The Role of The Hand in the Evolution of Consciousness. Joseph Sheppard, MD, Deborah L. Perry, PT, DPT; Phyllis Goldstein <shep1952@icloud.com> (Tucson, AZ )

The purpose of this presentation is to explore numerous elements of hand structure and function, and make the connection to the science of consciousness. Although Ernst Haeckel's Biogenetic Law (1866) which states "Ontogeny Recapitulates Phylogeny" is controversial and considered invalid by many, it offers an insight into the comparative anatomy and, therefore, function of many structural variations of the human body. Few structures offer a more compelling contribution to elements of this theory than the hand. The interface between evolution and spirituality. arguably human's initial evidence of consciousness, is notably expounded in Carin Berkowitz's article, (Charles Bell's seeing hand: Teaching anatomy to the senses in Britain, 1750-1840. History of Science 2014. Vol. 52(4):377-400), in which he details many aspects of Sir Charles Bell's Bridgewater Treatise "The Hand, Its Mechanism and Vital Endowments as Evincing Design". Here Bell asserts, "We ought to define the Hand as belonging exclusively to Man -- corresponding in its sensibility and motion to the endowments of his Mind". Within this context, sophistication of sensibility (touch), possibly as relevant as vision, and mobility, particularly prehension (grasp), have been critical and potentially essential to the progression of human development. One only consider the graphic interpretation of the homunculus wherein the contribution of the hand and more specifically the thumb demonstrate the relative role in the brain to cortical and therefore, hand function. Comparing hand function in primates, prehension is unique to humans and chimpanzees, though handedness appears unique to humans. In world-renowned hand surgeon Adrian Flatt's fascinating article, (The sinister handed. Baylor UMC Proceedings 1999;12:267-271), several interesting points are made. Sinister derives from sinus or pocket side as the Roman toga always had the pocket on the left. The term ambidextrous is a misnomer, as it actually means two

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right hands. Archeological evidence suggests that throughout the Stone Age, no preference for handedness existed, however, during the Bronze Age a significant increase in right-handedness was noted based on tool use evidence. We started fires, created and handled tools, knives and eventually, the capacity to write. The French sociologist Robert Hertz stated in his book, Death and the Right-Hand, "We are left brained because we are right-handed". Homo sapiens developed a connection between our hands and our brains to such a sophisticated degree that we were then allowed the opportunity to reflect on consciousness. Thoughtfulness, mindfulness, and intellectualization require no physical activity. Upon conversion of these important and essential elements to existence, action is necessary. Upon action, technical physical skill is required, and the hand is essential to superior performance. Many consider that the several ancient hand gestures or Mudras aid in the actualization of higher states of consciousness. Each of them involves a variety of thumb and finger positions to realize different effects including knowledge, patience, life, mental clarity and other states. The Pranum Mudra or Prayer Mudra pose extensively used in yoga, is believed to neutralize the positive and negative polarities of the electromagnetic field between right and left, yin and yang, female and male. C13

#### 4.12 Medicine and healing

239 Health and Healing Processes. A Holistic Approach to Hypothesizing how the Human Physiology uses Information in Health and Illness. Sylvia Ekman, Sylvia Ekman, Degree In Economics And BA; Laura Forsberg M.D.; Elisabeth Johansson PhD; Anna-Karin Gullberg PhD; Eva Friman PhD <sylvia.ekman@nordicmt.com> (Riala, Sweden)

When research has grown into a giant of specialized knowledge, special attention must be paid to the kind of science which puts all the pieces back together. In biology this is particularly valuable, as we yet have to discover what brings health, or even life. The hypothesis builds on the assumption that physiological information is available in the vacuum, and that the vacuum interacts with energy, such as electromagnetic fields, and matter. Together these interactions create a human management information system. In the presentation aspects of health and healing processes based on the assumptions above are discussed from the following hypothesis: The information system of the body needs to be: aligned to the environment, sufficiently energized and able to distribute information freely. When the information system works properly, the body knows how to organise processes correctly and find its way back to health. This presentation will combine the hypotheses above and stage a holistic approach that includes knowledge from different disciplines such as quantum physics, biology, medicine and chemistry. The theory is based on the perspective that living humans have an innate capacity to heal and that these processes can be studied using the hypothesis of an integrated information system which originates in space, that is, the vacuum. Project planning and interpretation of outcomes will be conducted within a trans-disciplinary network of researchers and academics in quantum physics, medicine, biology and music. P2

240 A Shift of Focus Towards Health and Healing in Medicine and Healthcare; An Initiative by a Transdisciplinary Research Network for Academic Compassion. Laura Forsberg, Sylvia Ekman <laura.forsberg@icloud.com> (44448, STENUNGSUND Sweden)

Within allopathic medicine and healthcare we have long nurtured a tradition where body is separate from mind, and humans are separated from their environments, the universe included. For centuries, we have focused on dissecting the body into ever smaller separate components in an attempt to understand ourselves and the concept of health. Never the less the fact remains, that neither physiology, or biochemistry alone can fully explain our creation or functioning. For matter to be created or reorganized, seen from a quantum biology perspective, space, energy and information associated with awareness must exist and interact. We hypothize that movement of information, energy and matter can govern our physiology, biochemistry and health. More over it can govern our perception of ourselves, the world around us and our interaction with it. We represents a trans-disciplinary network in Sweden for studying and researching modern society challenges from diverse perspectives. The network aims to advocate paradigm advancements in healthcare and higher education and in developing sustainable cultures and societies. It explores post-materialistic theoretical perspectives as well as transformative technological and clinical

practices. The network aims to democratize science and offer awareness of alternative paths to health, knowledge expansion and conscious development. It shares a focused intention to stage compassion in a conscious and sustainable manner when studying, researching, exploring and sharing scientific outcomes. Within this network is an initiative to shift focus towards health and healing in medicine and health care. Our vision is to work and support the work of others, to create this through; - Connecting theoretical research into holistic frameworks - Creating comprehensive models for holistic physiology - Performing clinical trials regarding Bioenergyinformation (BEI) medicine - Developing peer-reviewed forum - Creating an open-source platform for knowledge sharing - Promoting implementation of BEI-based therapies in healthcare - Enhancing BEI-based methods and skills for professional and personal use Scientific areas involve quantum biology in a broad sense. Preferred theoretical approaches are chosen where quantum physics, biology and/or bio-chemistry intersect with ancient theory and practise, like qi-gong and meditation. Quantum biology as a scientific frame demonstrates our ability and responsibility to influence health in a positive way. We seek to self-empower people to move towards health, thus generating it to their environment by means of resonance. **P2** 

241 Reclaiming the Language of Spirit Through the Application of Quantum Concepts to the Behavior of The Shen of Traditional Chinese Medicine. Todd Jones <toddjones.tv@gmail. com> (Springfield, MASSACHUSETTS )

Philosophers, theologians and scientists have wrestled with the question of consciousness for time immemorial. We have been handicapped in this new century by prejudice against the language of the Spirit, which was once an essential component for the consideration of being. Traditional Chinese Medicine contains one of the very few extant practical definitions and descriptions of Spirit and its behavior. It is the purpose of this work to use these classical descriptions of the Spirit's transformations to reconstruct and/or rehabilitate language around the Spirit for the new century. At the vanguard of science in the discipline of quantum physics there exists new language describing consciousness and the mechanics of consciousness. In many significant ways these mechanics closely resemble the mechanics of the spirit as described in TCM. The proposed project will take advantage of these correspondences by designing a therapy aimed at accessing the Spirit (Shen/Hun/Po) through measures of consciousness with the dual purpose of: a) providing patients with Spirit Tonification (Rooting/Calming Shen) with the expectation of a reduction of anxiety, memory loss, enhancement of neurological function, ideation and cognition and, b) the acquisition of precise language, through detailed post-therapy survey, of language coding for the conscious experience of the Spirit. **P1** 

#### 242 Vibrational Creation of Reality: A Holographic Mind Model Explaining an Individual's Selection of Life Experiences, Repetitive Behaviors and Patterns and the Manifestation of Physical Ailments. Tara Meyer-Robson <tara@tarameyerrobson.com> (The Flow Method, LLC, Denver, CO)

For highly observational people, it's clear that there is a connection between the kinds of beliefs we hold, the kinds of life experiences we choose, the types of repetitive behaviors we employ, and the specific ailments we manifest. But what is the connection? Building on a holographic model of the mind and universe, this paper presents a new model for the interaction of unconscious beliefs in the creation of all aspects of an individual's life, and explores the mind and body as a holographic prism which sorts experiences, thoughts, beliefs, and physical ailments into seven distinct frequency bands. By identifying the frequency band which is programmed with problematic unconscious beliefs (something I call a "preset" [1]), an individual can shift the reality they choose in extremely significant, specific ways. In order to facilitate this process effectively, the core of this paper showcases the diagnostic assessment developed as part of this research. The diagnostic assessment, called the Flow Factor Test (FFT), pinpoints the specific preset mental frequencies which are causing the creation of undesirable outcomes in an individual's life and outlines a distinct process for the retuning of that frequency into one that allows for the creation of desirable outcomes. The working frequency bands are defined as: (1) the Commanding Influence of Groups (CIG), which deals with all issues related to how the individual engages with the groups in life, from family to co-workers to society at large; (2) the Energy of Individual Dynam-

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ics and Creative Power (EID-CP), dealing with the individual's one-on-one relationships as well as their creative power, including creating businesses, manifesting income (or lack) or birthing physical children; (3) the Force of Positive Self-Image (FPSI), dealing with the individual's relationship to the self; (4) the Emotional Connection to Life (ECL), which deals with the individual's ability to feel and express emotions; (5) the Strength of Positive Communication (SPC), dealing with the individual's ability to express him- or her-self effectively as well as their ability to take actions in alignment with their goal; (6) the Power of Mental Creativity and Intuition (PMCI), which deals with the individual's ability to connect with mental intuition and solve problems from a mental perspective; (7) the Energy of a Higher Purpose (EHP), which deals with the individual's likely to exprese as a predictor for the types of life experiences and health issues an individual is likely to experience, if he or she does not retune the underlying preset frequency of unconscious belief. Included in this paper are specific case studies for individuals who have used the model and their outcomes. 1. T. Meyer-Robson, The Flow Method, 40 Days to Total Life Transformation, Happy Peacock Media, Jacksonville, Florida (2007-2017). **P1** 

243 Is Consciousness Coming Back to Psychiatry: The Implications of New Research on Ketamine, Mdma and Psychedelics. Scott Shannon <scottshannon@cowisp.net> (Psychiatry, University of Colorado, Fort Collins, CO )

Consciousness may be returning to modern psychiatry. Over the last thirty years the biochemical paradigm progressively eliminated consciousness and internal experience from consideration in a drive towards focused psychopharmacology. The chemical imbalance theory behind our theories of depression is now seen as failing. This pseudo science has no solid research to support it and is widely seen as overly simplistic and not reflective of the true complexity found in the human brain. In its place we have witnessed an explosion of interest in ketamine, MDMA and the classic psychedelics such as LSD and psilocybin. These evocative agents profoundly alter consciousness and open new doors of experience. The induced shift in consciousness allows insights and perspectives that can be a catalyst for deep personal transformation. Neurologically, this induced shift in consciousness also coincides with a dramatic reduction in our default mode network and other key neural networks responsible for our personal narrative and sense of self. Given this ability to induce profound ecological disruption in brain function, it seems counterintuitive that these agents would be a tool for enhanced mental health, but this is the evidence found in current research. What does this tell us about the nature of the human mind and consciousness? What does this foretell for psychiatry? In this presentation, Dr. Shannon will start with a general review of the research on these three new agents in psychiatry over the last decade. From here he will reflect on his current clinical work with MDMA and ketamine. He will review the protocol from the current Phase III study of MDMA assisted psychotherapy for severe PTSD that was just awarded Breakthrough Therapy Designation by the FDA, reserved for those agents with the promise to represent a significant advance over all other existing treatments. The presenter will briefly explore the literature concerning near death experiences and highlight the psychological commonalties of this experience with those documented with ketamine, MDMA and psychedelics. This presentation will explore the concept of mental health and consider how this ties to consciousness in general. As the current research on these transformative agents unfolds it will usher in a new era of friendliness to consciousness and experiential modalities. In turn, this will speed the movement from our current paradigm of consciousness suppression to an evocative model that honors the power of these tools to foster growth and personal exploration. C15

#### 4.13 Brain stimulation techniques

244 OM Within - Neurotheology of Symbol OM. Amitabh Divakar <a mitabhdivakar@ icloud.com> (OM Within, N.Delhi, India)

OM Within: Hypothesis - The pattern of flow of energy inside the human head, in pristine Yogic state resembles the shape of OM. Symbol OM traces the anatomy of brain (4 stages of brain and 7 levels of consciousness) thus offering a visual tool for Non-invasive Brain Modulation that is available to every human being at all times. Prior Art: The scriptures state - "OM embraces

the state of waking in which the gross elements of existence are perceived, the state of dreaming in which the subtle elements of existence are perceived, the state of [dreamless] sleep in which the gross and subtle elements of existence are dormant, gathered up into their potential state, and the state of pure consciousness which reveals the presence or absence of the experiences of the waking, dreaming, and sleeping states. Observation-The scriptural explanation of OM (as above) also relates to measurable Brain waves in modern Neurology. Viz. Beta, Alpha, Theta, Gamma, Delta etc. Validation- My tests in sleep labs and qEEG records reveal a distinct shift in brain frequencies as visualisation on the shape of OM along with the sound of OM is carried out in awareness and consciousness. The effect of mind control on breathing pattern is instantaneous and breath would switch from 3 cps to 16 cps as the mind change gears instantaneously. Video link(4min) demonstration of control on brain waves while visualising the Shape of OM. https://www.facebook.com/ amitabh.divakar/videos/10205218106466249/?hc ref=PAGES\_TIMELINE Test for compassion: While experimenting with horses, a test for compassion, using Shape of OM as a tool and transcending the awake state or beta/alpha waves and activating theta and gamma waves or stepping into subconscious, the horses begin to bond and help release delta waves in awareness as a state of jagrat-susupti or awakened sleep or Turiya (as stated in Vedanta literature). In experiments while recording live QEEG and mediating on Shape of OM, Horses would respond when Theta waves appeared, thereafter Horses helped me raise Delta waves in awareness. When Theta/ Beta ratio or TBR crossed 3.5 the horses responded affectionately. High TBR is medically ADD or ADHD. This validates (a) Healing power of horses and (b) Universality of OM. https://m.youtube.com/ watch?v=7JtRLLmJGy0&feature=share . Method of enquiry- The method of Enquiry is structured on a Vedic format as follows-1. Subject, 2. Curiosity or query, 3. Prima facile view or prior art, 4. Proposed theory or Hypothesis 5. Evidence from 5a. Ancient texts, 5b. Personal experience, 5c. Neurology 6. Synthesis and summation. Refinement by further query ensuing on the same thread. Application- "Energy flows where thought goes". We can now measure neurobiological changes. Can we modulate our brain just like we can modulate the fingers on our hand? The answer is Yes, the tool is Visual OM. This offering of 'OM Within' is confluence of science and spirituality towards oneness and betterment of humanity. P2

## 4.14 Quantum theories of consciousness

Roger Penrose, Prof. Sir Roger Penrose FRS <rouse@maths.ox.ac.uk> (University of Oxford, Mathematical Institute, Oxford, U.K.)

350 Why Algorithmic Systems Possess No Understanding. Penrose, Roger University of Oxford Publishing rouse@maths.ox.ac.uk Many examples of highly effective algorithmic systems, such as AI devices, have been constructed in recent years. We have computer-controlled machines like self-driving cars and algorithmic systems that play chess and GO at levels that can out-perform even the best of human players. But do such devices actually "understand" what they are doing, in any reasonable sense of that word? I argue that they do not, and as an illustrative example I present a recently composed chess position that a human chess player, after briefly examining it, would correctly conclude that it is an obviously drawn position. Nevertheless, when it is presented to the top-level chess-playing program Fritz, set at grandmaster level, Fritz incorrectly claims that it is a win for the black pieces and eventually Fritz blunders dreadfully (though "correctly" according to its algorithm) to be soon check-mated by white. This demonstrates Fritz's remarkable lack of any actual understanding of the game of chess, despite its vast computational abilities. More sophisticated examples come from mathematics, most particularly with human understanding of the infinite, and it can be shown that this quality cannot plausibly be encapsulated by any algorithm arising from the processes of natural selection. I argue that the quality of understanding is a feature of consciousness, and that consciousness can come about only through physical processes not yet properly understood, most likely at the boundary between quantum and classical processes, as argued for in the Orch-OR proposal.

**245** The Cause of Entanglement in Microtubules. Shantilal Goradia <sg@gravityresearchinstitute.org> (Gravity Research Institute, Mishawaka, Indiana )

We say that (A). Our probabilistic theory of gravity put on arXiv.org, 10/2007, presented in

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TSC 2011 and elsewhere, published in our book, 5/2011, and in a journal, 7/2012 can explain the needed entanglement by combining it with Euler-Algebra, devoid of faiths, as we did so for dark matter, making an electron exist at multiple places instantaneously, and making us step into biology starting 2007, and (B). Boltzmann Equation, we used to link biology (ATP/ADP) with physics, involving electrons and informatics, has Vedic/Biblical conjectures other than those in our abstract for TSC 2016 [published as a full paper, QUANTUM CONSCIOUSNESS-THE ROAD TO RE-ALITY, Journal of Life Sciences 10 (2016) 1-4], in THE EMPERORS MIND IN A NUT SHELL, Journal of Life Sciences 11 (2017) 249-253. C23

**246** Computer Simulations of a Toy Universe and its Observer. Jianfeng Li <lijf@fudan. edu.cn> (Macromolecular Science, Fudan University, Shanghai, China)

In 2013 and 2016, I proposed a pre-spacetime quantum theory of consciousness. The basic idea of the theory is as follow: a quantum system D with a large inner freedom is decomposed into two subsystems M and W, and the state |D> can be seen as superpositional state of the entangled states of these systems. By ordering these entangled states in several sequences, it is possible to find some specific sequence satisfying certain conditions (maximum information principle), based on which we call this sequence a conscious experience, M the conscious entity or a valid observer, W the accompanied world. For a given D, there might be several ways to decompose D into M and W, but only for some decompositions, M will be conscious or will become a valid observer that can experience the time flowing. However, it is difficult to provide a criterion to access when M will become conscious or a valid observer in theory. Therefore, a series of computer simulations is performed in this work for a toy universe D represented by a vector in a 5100 dimensional Hilbert space. This universe is decomposed into a 51 dimensional M and a 100 dimensional W and there are numerous ways to decompose it. I studied the dependence of the lifespan of M on the quantum entropy S (or correlations) between M and W. It is found that only when the quantum entropy between M and W is not too large or not too small, the lifespan of M is maximized. In other words, M becomes conscious or a valid observer, only when the correlation between M and W is not too strong or not too weak. C7

247 Modeling Observers as Physical Systems Representing the World from Within: Quantum Theory as a Physical and Self-referential Theory of Inference. John Realpe-Gomez <john.realpe@gmail.com> (Quantum Artificial Intelligenc, The University of Manchester, Moffett Field, )

In 1929 Szilard pointed out that the physics of the observer may play a role in the analysis of experiments. The same year, Bohr pointed out that complementarity appears to arise naturally in psychology where both the objects of perception and the percieving subject belong to `our mental content'. Here we argue that the formalism of quantum theory can be understood from two related intuitive principles: (i) inference is a physical process performed by physical systems, observers, which are part of the experimental setup---this implies non-commutativity; (ii) experiments must be described from a first-person perspective---this leads to self-reference, complementarity, and a quantum dynamics that is the iterative construction of the observer's subjective state. We argue that Planck constant can be determined from available data on conscious-access experiments carried out within the framework championed by Nobel laureate Francis Crick. We discuss how this approach can be understood from information-theoretic principles. **P2** 

#### 248 Proposed Consciousness Mechanism Utilizing Quantum Coherence of Neuromelanin "Quantum Dot" Arrays in the Substantia Nigra and Locus Coeruleus, and Falsifiable Semiconductor Circuit Model. Chris Rourk <crourk@jw.com> (Dallas, TX )

Quantum dots (QDs) are semiconductor devices that can create controllable quantum mechanical effects, although ferritin has also been proposed as a template for quantum dots. QDs can range in size from less than 10 nm to greater than 50 nm and have been extensively studied. The existence of electron mini-bands that can facilitate the transfer of energy between QDs in three dimensional arrays has been demonstrated. Generation of free radicals by energized QDs has also been observed. Neuromelanin (NM) molecules are approximately 30 nm diameter spherical structures that are disposed in large quantities in the dopaminergic A9 neurons of the substantia nigra

pars compacta (SNc) and neurons of the locus coeruleus (LC), regions of the brain associated with consciousness. Bulk melanin has been observed to exhibit semiconductor-like electrical characteristics, but the electrical characteristics of NM have not been studied as thoroughly. However, the existence of a free radical in NM molecules has been observed using EPR. Ferritin is also present with NM, as well as in intercellular fluid. The shape, size and semiconducting properties of NM molecules/ferritin might thus be similar to QDs, and while the evidence that would establish whether NM/ferritin in SNc and LC neurons has suitable semiconducting properties to cause quantum mechanical effects to occur is incomplete, the existing evidence strongly suggests that NM/ferritin might have those material properties. It has also been shown that combined electrical and strain fields can generate coherence in QDs. The coherent application of electrical and strain fields within the neurons of the SNc and LC could likewise facilitate the localization of electrons in electron minibands. In that regard, neurons of the SNc and LC have been observed to have pacemaker modes of operation that could facilitate the generation of coherent electric fields, and it has also been observed that mechanical surface waves accompany the generation of action potentials in neurons. These combined electrical and mechanical fields on the NM molecules of the SNc and LC could cause the localization of electrons in NM/ferritin array minibands. The distribution of NM/ferritin within these neurons forms a three dimensional array-like structure. The neurons of each region also form an array-like structure, and this array of arrays may be suitably configured for coherent energy transfer between SNc and LC neurons, such as when those neurons have internal voltage levels that are below the action potential trigger voltage. Based on an electrotonic model of the axonic potentials, coherent electrons of NM/ferritin molecules of SNc and LC neurons could be conducted to the respective SNc or LC neuron that is best configured to trigger a subsequent action potential in downstream neurons and could trigger the action potential of that SNc or LC neuron, corresponding to conscious action. To this end, a QD circuit is proposed that is based on this electrotonic model of SNc and LC neurons that could be used to experimentally verify whether energy transfer between coherent NM/ferritin in these neurons could be a quantum biological mechanism associated with consciousness. C25

249 Embodied Consciousness as a Bound-state in an Open Quantum System and Experiential States in Meditation. Sukhdev Roy <sukhdevroy@gmail.com> (Physics and Computer Science, Dayalbagh Educational Institute, Agra, Uttar Pradesh India)

In eastern experiential traditions, consciousness is not only considered to be a fundamental aspect of our existence, but also the basic building block of nature. Consciousness is universal and all entities in the universe, down to the elementary particles, are manifestations of its various degrees. Hence, consciousness embodied in an organism is in a bound state. Embodied consciousness in the human form is considered to possess three bodies in a nested hierarchy, namely, the gross physical frame, the subtle mental frame and the causal spiritual frame. The objective of human life is thus to get free from the bound state, by attaining higher vibrational states of consciousness that is only possible through yoga-meditation. No system in nature is absolutely isolated or closed, as it interacts with the environment and hence constitutes an open system. In this paper, we examine the human form as an embodied consciousness in a bound state and analyze its functions based on the theory of open quantum systems. We extend the non-Hermitian consciousness operator framework presented in TSC-2017. Embodied consciousness can be effectively considered to exist in nested mental and physical potential fields, akin to multiple quantum-wells of the mind and body. A consequence of bound quantum system is the existence of discrete energy states, with higher states having higher energy or frequency. At energy greater than the potential of the well the quantum system becomes free. Hence, embodied consciousness experiences and exists in various conscious states that can also be considered as fundamental quantum excitations in the generalized non-physical Hilbert 'mental' space. We consider embodied consciousness to comprise a localized region (Q) that is embedded in a well-defined environment (P), such that the complete function space (Q + P = 1), is described in terms of a Hermitian Hamiltonian, whereas, the subspace Q is non-Hermitian, having complex eigenvalues. The eigenvalues are coherently coupled to each other via an interaction mediated by the environment, comprising a continuum of states. Fluctuations caused by the interplay of gain and loss of energy with the environment excite resonance states and consequently internal degrees of freedom. This has excellent correlation

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with the properties of general open quantum systems and recent experiments with mesoscopic quantum systems and light harvesting in photosynthetic organisms, wherein exceptional points in the spectra of open quantum systems influence the rigidity of the wavefunction phases and initiate dynamical phase transitions [H. Eleuch and I. Rotter, Phys. Rev. E 95, 062109, 2017]. Although conscious states can be tuned by resonances with the environment, such as music, controlling the environmentally-mediated coupling through focused attention can also lead to transitions to higher states of consciousness. Hence, yoga-meditation helps in controlling the senses and mind for embodied consciousness to resonate at higher frequency transcendental states, enabling transitions from the confined sensory-based existence, to the continuum and potentially unbound free state. This is experienced as widely reported expansion in consciousness that includes parapsy-chological phenomena as well as healing. C6

**250** Wave Mechanics of the Mind . Aamod Shanker , Kirill Popov, Cale Madsen, Nivarti Girish <aamod@berkeley.edu> (UC Berkeley, Berkeley, CA )

Starting with the principle that the laws of the universe must be the laws of the mind, the dynamics of the mind are considered using the equations of fluid mechanics and optical propagation. At its most coherent, the mind must flow like a fluid - hence the structure implicit in light fields, also reflects in mental processes, and vice versa. Concepts in light propagation such as constructive and destructive interference, bilinearity, phase space projection and coherence are hence used to describe the emergence of conscious experience as local substance manifested by a global field. Additionally, the topology of turbulence in flowing fluid allows insights into the topology of mental states and physical experience. The primary mathematical tool for a quantitative analysis of flows entangled over large spectral scales comes from catastrophe theory, where the singularities in a field completely describe the distribution of energy in space - time. The local nature of singularities, or nulls in a flowing field and its derivatives, unfolds to create the morphological structure of energy distribution in the space in between the singularities. Using physical ideas of inertia and angular momentum, the stability of the boundaries of conscious experience through the fluctuations of the environment surrounding it can be equated to the stability of vortices in turbulent fluid. The vortices are null hypersurfaces in the phase space of a dynamic field, where energy goes to zero. These vortices are interlocked in the 8 dimensional space-time phase space, giving rise to morphological stability despite rapid dynamics and evolution. Since the nature of truth is essentially experiential, it is proposed that observation of the flow of elemental fluids in nature, such as in water, fire or light, can only occur due to the ability to have the same qualities in mental states that can interfere and observe physical phenomena. Hence a model of consciousness, based on the ability to mathematically represent physical processes is fundamental in representing and understanding the rise of subjective experience - as suggested by the revolution in physics ushered by the theories of quantum mechanics, where the entanglement of the observer's mind is essential for giving reality to the probability waves in nature. C7

#### 251 Towards a Holistic Integrative View of Quantum Consciousness and Collective Hu-

**man Socio-Economic Behavior.** David Smolker <dsmolker@aol.com> (Apollo Beach, FL) Penrose/Hameroff's Orch OR theory coupled with the dissipative quantum field model of the brain pioneered by Pribram, Umezawa and others provide a promising physical explanation of consciousness. However, experimental proof is lacking. Henri Poincare observed that sometimes the only breach through which we can penetrate what was thought impregnable is to look to cyclical phenomenon. Scientists and economists over the last 200 years have observed that collective human socio-economic behavior cycles from extremes of optimism to pessimism driven by waves of emotional social mood. If, as Orch OR suggests, the brain's biomolecular processes are linked quantum mechanically by gravity to fundamental space-time geometry, and, if, as the dissipative quantum field model of the brain posits, the brain is an open system embedded in and constantly exchanging energy with the external environment, then periodic changes in the external gravitational forces experienced on Earth may affect the character of human conscious behavior. Evidence supports this speculation. The brain's structure and function appears fractally

hardwired to detect and amplify very slight external inputs. The energy contributions from tiny changes in the lunisolar tidal gravitational forcings are within the operative range of those that influence quantum-level cell function. Vital functions of plants and animals appear synchronized with lunisolar tidal cycles. The periodicities of a wide variety of economic cycles correspond to those of various solar, lunar and planetary cycles. Statistically significant correlations between financial markets and lunisolar tidal cycles have been demonstrated. Comparison of the spring low, summer high, fall high and crash phases of the 1929 and 1987 stock market--a social mood proxy--occurred 58 years apart on almost precisely the same lunar calendar days. Comparison of the stock market and the rate of change in the angular momentum of the Sun's orbit around the center of mass of the Solar System (i.e., its overall gravitational pulse) reveals that many major turning points, including the 1929 stock market top, are coincident. However, correlation does not prove causation: a mechanism is required. Tidal forces are transmitted by gravitational waves. The gravitational waves generated by the Sun, Moon and planets along with a stochastic background of all gravitational waves coming from all sources and directions within the Universe should generate a composite spiraling subtly vibrating four-dimensional standing wave through which life on Earth continually passes. Because tidal forces are additive, they are strongest when three or more celestial objects are the most proximate to and aligned with each other. Thus, the configuration and amplitude of this gravitational standing wave front as experienced by life on Earth should fluctuate as the Sun, Moon and the major tide-raising planets come into and out of alignment with Earth. Gravitational waves squeeze and stretch space-time itself while carrying energy and angular momentum. This suggests that tiny cyclical changes in this gravitational standing wave front could influence Orch OR beat frequencies and the collective vibratory modes of the brain's coherent Nambu Goldstone condensate thereby altering the character and intensity of the collective social mood that drives human socio-economic behavior. P2

#### 4.15 Miscellaneous

**252** Tackling the Global Climate Change and Health Through Green Consciousness. Siddharth Agarwal, MD , Tamanna Agarwal; Ansh Agarwal <siddharthsatsangi@yahoo.com> (Medical, Dayalbagh Educational Institute, Agra, Uttar Pradesh India)

Damage to the climate is real and it's happening now. Human activity emits green house gases (CO2,CFC,ozone), particulate matter etc, causing global warming and climate change. It could pose a catastrophic threat to the planet and human health. Does cumulative Consciousness of the residents of a particular area has any effect on the climate change? We have tried to explore and answer this important global problem by a study on residents of a particular eco-village colony in Taj Trapezeum Zone of Agra district. A particularly significant impact of meditational practices, over and above the measures to control climate changes, in evolving green consciousness as reflected by measurement of environmental pollutants and climatic conditions in and around the colony(study group) in Taj Trapezium Zone (near Taj Mahal) and at distant places(control group) in the district of Agra, has been evaluated in this pilot project. It has been observed that concentration of emitted particulate matter is lower (significantly) at the TTZ area (study group), in comparison to other places in Agra. It may be due to low emissions of particulate matter as residents of this TTZ area consume less energy, prefer bicycles and perform Yoga and Higher Consciousness Spiritual Practices (meditational practices). Yoga and Meditation by the residents of TTZ area evolve a cumulative Consciousness Cloud, which in a direct measurement as performed experimentally, produce a local climatic pattern as desired (akin to Tiller's Intention Experiment on pH of water ). It also helped the study group in controlling their materialistic desires and luxury life, hence reduced demand of energy consumption and low carbon emissions .Impact of thus evolved green consciousness is reflected in the terms of health protection and disease cure rates, the outcome of which were published in the Journal Psychology Research, USA (August 2016, vol.6,-No.8), in the study on 217 hospitalized patients over 18 months, titled "Esoteric Healing Touch-A Preliminary Report" (Vijai kumar, D A Rao, P Agarwal, S Agarwal). The TTZ area colony(study group), which has residents population of approximately 3000, is like a model eco-village where "Green" facility have been adopted via green transportation strategies, energy efficient lights, turned down thermostats, upgraded energy-efficient equipment, power generated from renewable

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sources like wind and solar. The green building principles have been incorporated by using day lighting, natural ventilation and green roofs. Planting of trees and vegetation have reduced heat island effect, thus acting as carbon sinks. The impact of corporate social responsibility and selfless community services is indispensable for evolution of green consciousness. Eliminating fossil fuel combustion and zero meat consumption in favor of more fruits and vegetables has contributed to an improved physical, mental health and increased spirituality. Climate change can harm the water supply, increase vector-borne diseases, respiratory disorders, mental health disorders, including post-traumatic stress disorder and depression connected to natural disasters and heat-related disorders. This study emphasize that the effects of climate change and risk to health can be minimized by evolving Green Consciousness. **P1** 

**253** On the Location of Consciousness in the Universe. Daniel Asimov <asimov@msri.org> (Phloochie.com, Berkeley, California)

We consider the question of which collections of matter might be conscious. Candidates include elementary particles, atoms, molecules, viruses, plants, animals, planets, stars, and galaxies. (We refer to any agglomeration that is ultimately composed of elementary particles - including just one of them - as "matter".) Consciousnesses may be hierarchical and/or spatially overlapping. We are concerned above all with which kinds of blobs of matter possess consciousness. We We are not especially concerned here with the quality of consciousness but rather with the yes-no question of whether it exists for a given blob. We view the three fundamental (and sometimes \*overlapping\*) magisteria of absolute truth, and therefore existence, as a) matter, b) conscious experience, and c) mathematical truth. As we survey the physical world, it seems quite continuous in both time and space. An elementary particle at one point in spacetime can have an influence on any other particle inside its light cone. There is a time delay between cause and effect, but every bit of the universe is causally related to every other bit. If the spatial universe is infinite, each elementary particle itself extends without limit in all directions. Contrary to our everyday experience with solid objects, which are separate and finite, elementary particles are coextensive with one another: they each fill the universe. And if our piece of the universe is infinite, then elementary particles are infinite as well. Suppose on the other hand we survey the loci of consciousness where it is often assumed to exist, say in other human beings and in at least some animals, consciousness seems to be both fragmented and discrete. Each person seems to have direct access to only their own experiences. This discrepancy between the apparent continuity of the physical world and the apparent discontinuity of the experiential world suggests to me that it would be worthwhile to seek a reconciliation between these apparent extremes. Yet as an initial attempt to resolve this discrepancy, we try to develop a conjectural picture of \*where\* conscious experience tends to occur. We base our conclusions in part on the proposition that the assignment of each conscious event as that of some \*individual\* is an error of mismatched categories. We consider a possible consciousness that is \*not\* experienced in the same succession of instants that constitute the flow of time, unlike everyday life. Our reasoning often involves considerations of continuity, but also questions some common assumptions about where conscious awareness can occur. Our most striking conclusion is this: \* There is at present no reasonable basis for excluding atoms, molecules, viruses, plants, planets, stars, or galaxies from the likelihood of possessing consciousness. \* P2

254 Microtubule as a Time Crystal: Working with the Knots of Darkness. Anirban Bandyopadhyay <anirban.bandyo@gmail.com> (Advanced Scanning Probe Micros, National Institute for Materials Science, Tsukuba, Ibaraki Japan)

In the 1970s came the concept of time crystal. The beauty of time crystal is that it enables creating information architecture of a material and it is possible to tune material structure as information changes. Microtubule is an insulator, and its very high insulating property makes any electron transmission impossible. A massive barrier for the movement of charge does two things. First, it enables communication between stored charge clusters by phase change without moving any particle. This phase change based communication exchange spin state, we get magnetic flux. Thus, magnetic flux is produced without flowing current, only from noise. Critical insulation helps regulating magnetic flux with stored charge. Superconductivity is a critical state of matter, so, is super non-conductivity. It enables electromagnetic field to interfere and create knots of darkness

in and around microtubule. I will talk about the mystery with the knots of darkness. PL9

**255** Is General Anesthesia a Solo, a Chamber Group or a Symphony? Roderic G. Eckenhoff <roderic.eckenhoff@uphs.upenn.edu> (Anesthesiology, University of Pennsylvania, Philadelphia, PA )

A couple decades ago, I adapted the approach of photoaffinity labeling to general anesthetics. This powerful methology could address several hypotheses, not only where in an accepted molecular target anesthetics "did their thing" but also what other molecular targets for these drugs exist in macromolecular space? We now have evidence that a very large number of binding targets exist for the commonly used anesthetics, but we do not yet know which or how many contribute to hypnosis or amnesia (or any of the myriad side effects), and how they harmonize to produce the desired state, or whether, some in fact introduce dissonance. I will show evidence for all these possibilities from a combination of photolabeling and proteomics, as well as to show examples of unexpected molecular targets whose function is altered by general anesthetics, and whose altered function could plausibly contribute to one or more endpoints associated with general anesthesia. **PL12** 

256 Microtubules as Subcellular Memristors: Modeling and Measuring Electrostatic and Conductive Properties of Microtubules. Jack A. Tuszynski <jackt@ualberta.ca> (Physics; Oncology, University of Alberta, Edmonton AB,, Edmonton/Alberta Canada)

Microtubules (MTs) are cylindrical protein filaments that play crucial roles in eukaryotic cell functions. They are particularly important in both axons and dendrites of neurons, hence their prominence in biophysical models of consciousness. I will provide an overview of the many interesting biophysical and biochemical properties of microtubules, especially their electrostatic and conductive behavior. The building block of microtubules, the heterodimer of alpha and beta tubulin has been well characterized crystallographically, which allowed us to build atomic-level models of tubulin and microtubules. These models reveal complex electrostatic properties of microtubules, molecular mechanics, structural stability, hydrogen-bond interactions as well as conductive properties in ionic solutions. Here, we report on the recent experimental results, which the effects MTs, tubulin dimers have on ionic solution's AC conductance. Using a microelectrode system we have measured the AC conductivity and capacitance in a number of tubulin and microtubule solutions between 1 kHz and 1 MHz range of electric field frequencies. At 42 nM, MTs in a low ionic solution increase solution conductance by 6% at 100 kHz, and this effect increases as the concentration of MTs increases. We model the possibility that this effect is due to ions being able to use MTs as a low-resistance cable as predicted in earlier publications. Conversely, tubulin dimers decrease solution conductance by 5% at 100 kHz under similar conditions indicating that a transformation from depolymerized to polymerized tubulin corresponds to an insulator-conductor transition with major implications for cell division and the function of neurons. We model these effects as being due to tubulin attracting counter-ion charges and lowering their mobility when depolymerized and directing their flows when polymerized. We also report the results of AC capacitance measurements under similar conditions. MTs show their ability to modulate the buffer solution's conductance and capacitance and act as low resistance pathways for ions. This has significant implications for biological information processing, especially in neurons, and for intracellular electrical communication in general. A particular effect observed in our experiments shows that microtubules function as memristors. Memristors represent the fourth element of the electrical circuits complementing resistors, capacitors and inductors. Hallmarks of memristive behavior include pinched and frequency-dependent I-V hysteresis loops and most importantly, a functional dependence of the magnetic flux passing through an ideal memristor on its electrical charge. In this talk I will provide both theoretical and experimental evidence that microtubules act according to the definition of a memeristor. Their biophysical properties lead to pinched hysteretic I-V dependence as well a classic dependence of magnetic flux on charge. Based on the information about the structure of microtubules I will give an estimate of microtubule memristance and discuss its significance for neuroscience. Jack A. Tuszynski1,2,3 1. Department of Oncology, University of Alberta, Edmonton, Alberta, T6G 1Z2, Canada 2. Department of Physics, University of Alberta, Edmonton, Alberta, T6G 1Z2, Canada 3. Politecnico di Torino -Department of Mechani-

cal and Aerospace Engineering, Corso Duca degli Abruzzi 24, IT-10128, Torino, Italy. C23

**257** Bio from Bit. Sara Imari Walker <sara.i.walker@asu.edu> (Beyond Center, Arizona State University, Tempe, AZ )

Identifying general principles of governing life, if they exist, remains a deeply stubborn problem, with important implications for solving the origin of life and for guiding our search for life elsewhere. While it is widely argued "information" is the key distinguishing property separating the living and non-living realm, what exactly is meant by "information" in a biological sense is subject to intense debate. Many of the most significant challenges stem from the apparent relationship between information and causal structure in living things: information seems to, somehow, be calling the shots. Here I discuss new approaches to understanding the causal structure of living systems, how this may differ from traditional physics and the implications for our understanding of how such systems emerge in the first place, and how the problems of life and consciousness are similar and different. **PL8** 

# **Experiential Approaches**

## 5.01 Phenomenology

258 Is the Self/Other Reflex of Conative-mind Evolutionarily Obsolete or Can It Be Repurposed? A Phenomenal Perspective. James Guy , Lampkin <jamesguy@mac.com> (Avataric Allusions Publishing, Veguita, NM )

Where the science of consciousness seems most at ontological odds with the philosophy of consciousness is when the phenomenologist's point-of-view is ignored, preventing the triadic synthesis of these arts and sharing of data, analysis, conclusions, and prospects that would feedforward a synergy between personal and clinical practice, as well as needed feedback to each of these arts separately, providing to the culture at large wider accessibility to the newest approaches and prospects. Workshop facilitator is James Guy, author of the book "What Always Comes to Mind: The Visualist's Guide to a Metaspheric Perspective on Reality," who contends that it is observation in the phenomenal space of "mind" itself where a KISS approach to that synthesis, synergy, and accessibility can most easily be demonstrated. Consciousness is the most familiar and at the same time most mysterious aspect of our lives, and certainly needs to be considered something more than waking, sleeping, and deep sleep, especially in light of conscious exploration into so-called altered states. Ordinarily most of us experience consciousness in the same way, and some would agree there is no alternate workspace in which to explore mind than in the space of mind itself, with its three modes of intellection: the cognitive, affective, and conative. Yet somewhere along the way the idea of "conation," even the word, has fallen out of common use, perhaps because its Latin derivative "conatus" is obscure; meaning natural tendency, impulse, action, or as we will define it, the evolutionarily unavoidably predisposed self/other reflexive mind. The conative reflex put into perspective: Whereas the ideas of tendency, impulse, and action are lumped together as the stuff of behavioral psychology, ours is not at all that type of exploration, but rather a paradigmatic shift in focus to the wider mechanics of "conative" mind, which almost falls into the category of physics. Our attempt will be to codify our familiarity with the self (the I) and the other (the not-self) into a simple yet surprisingly workable "model" of how mental-objects come to mind in a predictable, pre-patterned, lawful order, that we'll call "metagraphic rendering" of those objects in "metaspheric perspective." The phrase "Put into perspective" is casually used merely as a synonym for an "opinioned view," without any actual intention to apply the phenomenal or optical laws of visual perspective. In this workshop, participants are asked to hold in mind the idea of "laws" but substitute mental for optical, since we will be discovering how to render mental objects in perspective from the point-of-view of "the I," not spatial objects from the pointof-view of "the eye." P2

# 5.02 Meditation

**259** Inhibition of Prepotent Responses at Different Stages of Meditation Sona Ahuja <sonaahujadei@gmail.com> (Pedagogical Sciences, Dayalbagh Educational Institute, Agra, Uttar ABSTRACTS by Classification

#### Pradesh India)

Attention is the key feature of most of the meditation practices. Studies also suggest that meditation improves attentional performance and response selection. The regular practice may condition the ability to selectively attend relevant stimuli modulating task irrelevant stimuli. The improvement in cognitive control may be subject to the stage of meditation. The present study examines the ability to inhibit conflicting irrelevant information at different stages of meditation. Sixty participants were assigned to three strata of meditators (novice, intermediate and advanced). The experimental group practiced yoga and meditation (Surat-Shabd-Yoga) for 20 weeks under the guidance of expert yoga instructor and an experienced meditator. The meditation practice Surat-Shabd-Yoga is based on Oriental Philosophy of Saints and is prevalent for more than 150 years. It involves sequential three stages: pre-initiates (novice meditators) practice mantra meditation, first initiates (intermediate meditators) practice the contemplation of form alongwith mantra meditation and second initiates (advanced meditators) practice contemplation of form and sound simultaneously with mantra meditation. Twenty participants of control group practiced the relaxation technique i.e. sitting quietly for the same duration. The participants performed the Stroop task on 20 normal and interfere trials which were presented in random order. The performance on Flanker task was assessed for 20 congruent and incongruent trials. The results reveal significant differences in response time and task errors for the four groups. The Stroop effect and Flanker effect as function of age and stage of meditation is also discussed in the study. C6

260 Does Meditation have a Shape to It? Exploring the Subjective Experience of Meditation. Denice Basnett , Dr Beate Von Krosigk <denice.basnett@live.com> (English and Liberal Studies, Seneca College for Applied Arts, Thornhill, ON Canada)

Meditation is an activity that produces an altered state of consciousness. While the regular practice of meditation has been shown to reduce stress and increase well-being, there is limited information on how meditation feels or is subjectively experienced by the meditator. This study explores the subjective experience of meditation with novice meditators taking part in a four-week introductory meditation program. Nineteen college students were divided into 4 groups. Each group met once a week for a 30-minute guided mindfulness meditation session. Each meditation session was immediately followed by a 30-minute focus group during which the research participants shared their meditation experiences. Analysis of the transcribed data revealed 12 key experiential constituents that occur in a somewhat predictable sequence over time as deepening relaxation occurs during meditation. The findings from the focus groups provide valuable information on the experiential characteristics of this important self-induced, adaptive altered state of consciousness. **C6** 

261 The Effect of the Practice of Yoga Asanas and Ultra-transcendental Meditation (surat - Shabd Yoga) on Spiritual Well-being and its Dimensions. Purnima Bhatnagar, Dr. Ashima Srivastava; Prof. P. Sriramamurty cpurnima.bhatnagar@gmail.com> (Management, Dayalbagh Educational Institute, Agra, Uttar Pradesh India)

There is an increasing interest in studying the well-being aspects related to human existence. Spiritual well-being (SWB), which entails studying respondent perception of issues related to the significance of life and their purpose for living is the focus of the present study. Hence, the SWB scale proposed by Ellison, 1983 has been used in the present study with its twin dimensions of religious well-being (RWB) and existential well-being (EWB). RWB aims to measure well-being related to one's religious faith, and EWB aims to capture a respondent's general sense of satisfaction. The study aimed to understand the effect of the program that teaches yoga asanas and ultra-transcendental meditation to members of the Dayalbagh community. The programme is organised at Dayalbagh, Agra. The programme participants constituted the experimental group. This comprised a group of 33 individuals, out of which 32 respondents had filled the physical copy of the pre-test questionnaire. Nearly 56% of the respondents comprised students of Dayalbagh Educational Institute (DEI). An appropriate control group was selected from amongst students of DEI who were given the questionnaire, both in online form and physical copy. The experimental group received three sessions every week for a period of 5 months. The results of the present study suggest that the experimental group experienced a strengthened association between positive

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statements in the SWB scale, and scores related to spiritual well-being, religious well-being and existential well-being. The correlation co-efficient between positive statements in the scale and SWB scores improved from 0.706 to 0.890. Similarly, the correlation with religious well-being improved from 0.747 to 0.823, and the correlation with existential well-being improved from 0.363 to 0.698. Conclusion: The programme that teaches yoga asanas and ultra-transcendental meditation is found to be significantly effective in improving the religious, existential and spiritual well-being of the practitioners. **P1** 

262 Effect of Yoga-meditation Mudras on Consciousness Using Electro Photonic Imaging. Sant Saran , Sukhdev Roy <santsaran1@gmail.com> (Electrical Engineering, Dayalbagh Educational Institute, Agra, Uttar Pradesh India)

The aim of Yoga-meditation is to draw attention inward and attain higher states of consciousness. Different forms of meditational practices follow different protocols, which involve regulation of both the body and mind. According to the ancient Yoga tradition, the human body is composed of the five elements (space, air, fire, water, and earth) and each of the fingers relates to the energy of one of the five elements. Thus, mudras that are hand gestures, carry specific goals of channelling the body's energy flow during meditation. Many mudras have been practiced for centuries for their efficacy in providing health and empowerment. Research in the past decade, specifically on language, has shown that brain processes gestures and speech in a similar fashion [J. Xu et al., PNAS 106, 2009]. In this paper, we report the results of a pilot phenomenological study on the effect of Yoga mudras on the consciousness state and health of yoga-meditators, using Electro Photonic Imaging (EPI) technique, which is based on Indian Ayurvedic system and traditional Chinese medicine. It involves meridians, energy channels and energy fields, and leads to a psychosomatic assessment. EPI also known as gas discharge visualization, is a technique used to record the human bio-electromagnetic field, i.e., the stimulated discharge of electrons from finger tips captured by a CCD camera. To experimentally assess the impact of yoga mudras during meditation, 30 meditators, both male and female, in the age group of 15-48 years, were selected. Regular sessions involved meditation in different mudras, namely Gyana, Prana, Dhyana and Surva mudras, for 30 minutes. The bio-electromagnetic field glow of the subjects through EPI, was recorded from all ten fingers, before and after meditation, and with and without mudras. The effect on respective energy centres was analysed with respect to various parameters, namely, activation coefficient, integral area, integral entropy and form factor that reveal the physiological and psychophysiological condition of the human body in terms of stress, energy, left-right symmetry, organ balance, emotional pressure, entropy, vin-yang balance and chakra alignment. The subjective responses were also recorded through a questionnaire, by noting the qualitative effect of meditation in terms of feelings, imagination, color, etc. The extensive analysis showed in general, a significant improvement in the integral area, increase in form factor, increase in front energy with decrease in left and right energy, and decrease in integral entropy, indicating the lowering of disorder after meditation. Interestingly, Yoga-mudra meditation improved the balance and alignment of corresponding chakras. The results confirmed that yoga-mudra meditation leads to improvement in health and stimulation of higher energy centres. The pilot study highlights the importance of (i) integration of subjective and objective studies, or first-person and third-person experiential and experimental phenomenological studies on consciousness; (ii) efficacy of Yoga-Mudra meditation, which makes considerable impact on consciousness states in a short time; (iii) provide scientific validation of ancient eastern traditional knowledge; and (iii) utility and reliability of the non-invasive, safe and fast EPI technique, for consciousness and health assessment. C11

263 Implementation of Yoga and Meditation in Education System. Rimple Saxena, Rubina Saxena <rimplesaxena@gmail.com> (Mumbai, MAHARASHTRA India)

In this research, the importance of Yoga and Meditation for the University Students is studied. Yoga, which is understood by most of the people is the traditional exercize taught in Hinduism, the asanas also known as postures. If one can stay in particular posture for some time, it is considered as control on your body. The body wants comforts and pleasure. The mind fulfills the desires and help body achieve the comfort level. And spirit or atman is in delusion that it is the body. Though it is not. As explained in THE ANALOGY OF CHARIOT in Kathoupnishad, it is the spirit which controls everything. It says that the Body is the chariot and the Self (Atman in the

body) is the master of the chariot. Mind and Body are the elements of Prakriti, and they are the coverings or 'gilaaf' on the soul. The sufferings starts when soul considers itself as body and mind and forgets its real qualities, forgets its dharma. Yoga asanas help soul to control senses and divert attention from the outer physical world to inner silence. Hence Yoga and meditation must be used either as curricular activity or as punishments to make students realize their goals in life, to grow awareness, to increase their extra sensory perceptions, and to increase their memory. In this study, students participating, can be from any faith. Till Dhyaan stage they can follow the rules of Ashtaang Yoga. They can remember their own individual God. But since Monotheism is the ultimate reality. Finally the supreme reality will reward the efforts of the student. By meditation, one detaches himself from his own body and mind, which enables him to experience the higher plane of consciousness. Thus after the meditation he realizes the difference of the physical world from the higher planes. The extra sensory perceptions of the individual are enlightened. This results in generating more awareness of the delusion of the physical world, that will help individual to overcome the sufferings, take the path of 'shreyas' and take appropriate decisions for any problems in life. **P2** 

**264 Meditation, Social Support And Attitude Towards Life Among Elderly People.** Sahab P. Sinha , Surat Pyari Sinha <spsinha.dei@gmail.com> (Psychology, Dayalbagh Educational Institute, Agra, Uttar Pradesh India)

Old age is a very crucial age with several threats to the life satisfaction and well being of the elderly people. These threats include the deterioration of bodily functions; expectation that they will become useless on account of their age irrespective of their real life capabilities, stressful life events and non-availability of social support, loneliness and financial problems etc. elderly people's life satisfaction is related to successful aging by meeting the developmental challenges in appropriate manner. It is also related with the quality of life. When one's subjective well being falls below the subjective well being homeostasis depression occurs and impairs the total functioning. There are several types of buffers, internal as well as external which protect elderly's life satisfaction and well being which determine one's attitude toward life. For the present study meditation (internal buffer) and social support (external buffer) were selected as 2 factors which may affect one's attitude toward life leading to successful aging. The categorization of elderly people shows that there are three groups: young- olds (60-75 years): these people are mobile, active and ready for new experiences; old-olds (75-85 years): usually suffer with health and activity restrictions; oldest-old (85 years and above): they are mostly dependent on others for almost everything. Keeping in view this classification we have selected a group of 100 elderly people of 75 years and above age; 50 subjects who practice meditation and 50 non-practitioners. Similarly, 50 having high social support and 50 having low social support. Thus, it is a 2x2 factorial design. Social support questionnaire (Sarason, Levine, Batham and Sarasan) and life attitude profile (Recker and Peacock) were the tools used in the study. The impact of meditation and social support was assessed on attitude towards life. Results revealed that both the variables independently led to more positive attitude toward life. Both variables interacted significantly which shows that even when elderly people do not have sufficient social support the meditation practice helps them to cope the threats of life successfully and give meaning to the life as the meditation is a state of consciousness characterized by deep sense of relaxation and loss of self-awareness. P1

**265** Healing with Meditation - Opening up the heart energy to heal from within. Purnima Sinha spranchi@gmail.com> (Manassas, VA )

Transcendental meditation and inner experiences to connect with Source Mystical experience comes from the Source/Divine Light/Supreme Being. Consciousness and awareness is eternal, and love is only real. Divine experiences have no logic, however, the most powerful energy source is behind it. Affirmations and evidence comes as a whisper to show guidance in life using intuition. Compassion, self-love and forgiveness is a message from the Source. Consciousness is vast and infinite, and healing occurs when heart is open and the shell of our egos has been cracked. Healing pain with self-love changes the frequency of our bodies. When the universe matches our body's frequency, it is beyond amazing. Inner experience of love, healing and light is very different from just beliefs. Gratitude changes our frequency. Practicing to be grateful every day is the best

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medicine for the soul to heal. Let the voice of our hearts be louder than the chatter of our minds, so we can follow our true calling by doing what we love most and by bringing joy to our hearts. We spread joy within the Universe by serving and helping others. The frequency of gratitude attracts the energy of love and light. The path of healing with self-love and gratitude bring that's light to life. Spiritual experiences start when SAT (energy/truth), CHIT (intelligence), ANAND (bliss) and PRAKASH (light) combine, becoming Divine Love and Light. During meditation how sound of certain words in different centers (Navel, heart, throat, and third eye) affects our body. Through ultra-transcendental meditation we develop deeper and higher wisdom or intuition and connect with The Source who guides us to have much more clarity and leads life with higher consciousness. Uniting spirit current with sound current through 'surat shabd yoga' practice and experiencing inner experience with Divine source lead to self-love. Self-love is very different than selfishness. Self-love is the key to begin the healing process, which starts with self-care. Any healing starts with self-awareness, leads to self-care of soul, mind, and body. Our job on this earth to become whole or get fully conscious but we have to clean all the layers of conditioning little by little. Working on self is very hard work however through stillness or dhyan or meditation we can reach to our full capabilities because it develops the consciousness in us to make correct decision at every level which helps to serve others with seva or service with no attachments. And that becomes corporate social responsibility. Energy of Divine love helps healing soul, mind and body with medicine of Love and Consciousness. P2

**266** Measuring The Immeasurable : The Dilemma for Science of Consciousness. P Sriramamurti , Sukhdev Roy <psriramamurti.db@gmail.com> (Sanskrit, Dayalbagh Educational Institute, Agra, Uttar Pradesh India)

Tremendous multidisciplinary scientific effort is directed to understand consciousness, the very essence of our existence. Recent advancements in science and technology offer great optimism for decoding the brain, the neuro-plastic repository of all conscious experience, to gain valuable insights into the nature of consciousness, health and well-being. Although a wide range of theories of consciousness have been proposed, it is generally being accepted that the objective scientific approach is severely limited, as it does not incorporate subjective human experience. This fact is highlighted in the hard problem of consciousness, which emphasizes that physical neural correlates of various human functions can never reveal the inner subjective experiences. Hence, leading neuroscientists are accepting the necessity to follow an integrated approach that takes into account third-person objectivity along with first-person phenomenology. Eastern philosophical traditions on the other hand, provide a detailed account of not only the nature of consciousness and its entire spectrum, but the scientific methodology of attaining the various states of consciousness through yoga-meditation, which are repeatable, reproducible and verifiable. Eastern sages and saints were expert scientists of inner dimensions. According to their accounts, consciousness is the very basis of being. It is described as Sat-Chit-Anand, i.e. truth-intelligence-bliss, the unchanging reality that is highly abstract, immortal, eternal, infinite, extremely blissful and beautiful, incomprehensible, immeasurable and ineffable. The human form is a microcosm of the macrocosm and the true nature of consciousness is spiritual, which can only be experienced by a human being, through the art and science of meditation. The spirit entity acquires covers of the mind and body, as it gets embodied. The various gradations of consciousness result in the admixture of spirit with subtle and gross matter. Hence, for self-realization of pure spirit, it is necessary to transcend the physical senses and mind. The important question then is, how can we measure the immeasurable spiritual experience? The paper attempts to provide a comprehensive answer. An attempt to understand the ultimate nature of consciousness through the mind is futile. It is no wonder that the key to the science of consciousness, lies in the simultaneous conceptualization of the extreme mathematical abstractions of the immeasurable zero and infinity. Atman in Upanishads is described to be smaller than the smallest and bigger than the biggest. It is only by merging with the infinite that one can acquire knowledge of the infinite. Hence, the art of meditation as explained in Surat-Shabda-Yoga, (ultra-transcendental meditation) is the systematic methodology to be in resonance with the sounds of different states of consciousness that correspond to different levels of reality. The paper presents, (i) the details of the characteristics of different states of consciousness, ranging from the most depleted state of hell, to the original infinite source of super-consciousness,

the August Supreme Being - Radhasoami, revealed as, Param-Sat-Chit-Anand-Prem-Prakash-Anahad Nada Swarupam, (ii) the protocol of the advanced Surat-Shabda-Yoga meditation at different nerve centres and apertures in the central nervous system, and (iii) a spiritual scientific approach to measure the immeasurable, resolving the dilemma of the science of consciousness forever. **P1** 

# 5.03 Hypnosis

# 5.04 Other altered states of consciousness

267 Flotation Sensory Reduction and Altered States of Consciousness. Jory Bond <jory-bond@gmail.com<br/>> (Mcgaw, Chicago, IL )

Flotation Sensory Reduction involves lying in a tank saturated with salt so users float atop the water. The water is heated to the temperature of the skin and the tank is virtually light and sound proof. Described as the most relaxing environment on the planet by maximizing the factors involved in the body's relaxation response. EEG Research with dry flotation has shown increased dominance of theta brainwaves, similar to that seen with psychedelics and long term meditators. This unique state of consciousness made easily achievable has a number of implications for health, science, and consciousness. A1

**268** New Insights into ESP, Hallucinations and ASC. Wenge Huang <huangwenge@sino-land666.com> (Chengdu, SICHUAN China)

Altered States of Consciousness (ASC) induced by meditation, mind-altering drugs, hypnosis, or physiological lesion are quite an important, fascinating yet very sensitive field in the study of human consciousness. This paper attempts to make an interpretation of ASC from a unique perspective. On the basis of empirical materials, we summarizes four essential phenomena (hallucinations, paranormal phenomena, the more sensitive awareness and mystical experiences) in ASC after an initial clarification. However, the existence of paranormal phenomena, especially extrasensory perception (ESP), has been disputed for more than one century. Therefore, taking ESP as a breakthrough, we firstly propose a novel hypothesis that ESP happens because there are two pathways to affect perception and the essence of ESP is that internal false stimulations are mistaken as external objective stimulations which enter through various senses and external objective stimulations as perceptions which do not result from various senses when one is in deep hallucinations. To support this hypothesis, which is totally different from "quantum entanglement" and "multidimensional space-time", we then develop an original model of hallucinations: When internal false stimulations and external objective stimulations affect perception together, the changes in the relation of their strength will result in the consistence, breakdown and re-consistence of the five senses, leading to three states of hallucinations (one can distinguish reality from fantasy, one cannot distinguish reality from fantasy, and reality and fantasy are totally reversed). Furthermore, the inconsistence of the five senses, on one hand can also explain the generation mechanism of out-of-body experiences and synesthesia; on the other hand, makes it possible to integrate internal and external stimulations together, thus bringing about various marvelous psychedelic phenomena in ASC, combined with the amplification along with the more sensitive awareness. After that, a new filtering model is presented to explain the more sensitive awareness and its potential value is explored. On such basis, a unified analytical framework will be made to reveal the essence of ASC: The loss of the self results in three mechanisms (the more sensitive awareness, hallucinations and jhana samadhi) and the relation of them is figured out. Finally, this paper also reveals the essence of the Buddhist deep insight and the mystery of cessation and insight. C15

**269** Replication and Extension of a Model Predicting Response to Psilocybin. Suzanne Russ, Robin Carhart-Harris; Geoffrey Maruyama; Melody Elliott <suzanne.russ@dickinsonstate. edu> (Psychology, Dickinson State University, Dickinson, ND)

Extensive recent research has demonstrated the potential uses of psychedelic drugs as treatment for psychological challenges like depression (e.g., Carhart-Harris, Bolstridge, et al., 2016) and death-related anxiety (Grob et al., 2011) and as an enhancement for well-being (e.g., Carhart-Harris, Kaelen, Bolstsridge, et al., 2016). While generally positive, responses to psyche-

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delic drugs can vary by individual according to preexisting traits (e.g., Studerus, 2012; Studerus, Gamma, Kometer, & Vollenweider, 2012), factors within the setting in which the psychedelic drug is administered (e.g., Johnson, Richards, & Griffiths, 2008), and the mental state of the participant at the time of ingestion (e.g., Leary, Litwin, & Metzner, 1963; Phelps, 2017). Most attempts to predict response to psychedelic drugs explain only small to moderate variation, with greatest predictive power related to dosage and establishment of trust in a controlled setting ((Studerus, 2012; Studerus et al., 2012). A recent study by Russ, Carhart-Harris, Maruyama, and Elliott (2017) nearly doubled the explanatory power of previous regression models in a retrospective crowd sourced survey study of participants who had recently self-administered psilocybin, explaining nearly two-thirds of the variance in an optimal mystical-type experience and more than half of the variance in an suboptimal or adverse experience after ingestion. The current study replicated and extended the best-fitting regression model generated by Russ et al., yielding a new model with the same key predictors: As in the original model, a state of surrender at the time of ingestion in conjunction with absorption were the foremost predictors of an optimal experience, and a state of preoccupation with life concerns the foremost predictor of adverse experience. Additional trait, state, and motivation predictors added to the explanatory power in both models. The model also predicted similarly for individuals high and low in spiritual motivations, reducing the likelihood that those with spiritual inclinations are simply more inclined toward mystical-type experiences. Finally, the model illustrated the mediating role of mystical-type experiences on long-term positive change. C15

## 5.05 Transpersonal and humanistic psychology

270 Embodiment, Personal Development and the State of Consciousness: How Do We Hold Past and Present Experiences as State of Consciousness in our Body-Mind Field? Which Influence and Meaning Do They Have. Siegmar Gerken <siegmargerken@gmail.com> (International Institute for Energy & Consciousness, Inc., Mendocino, California)

The mystery of embodiment and the capacity for conscious experiences are important topics in the personal development of a human being. Many conscious and unconscious processes form our body, the way we feel, react, think, form our behavior and develop our personality - influencing our wellbeing, health and how we contribute to and access consciousness. I will introduce my research on the visibility of physical, emotional or mental energy patterns documented with Infrared Analysis and Biophoton-Measurements, which indicate, that we embody our past and present experiences as images in our consciousness, documenting, that consciousness is not just a function of the brain, but of the whole body-mind field. **C13** 

**271** Self-transcendence and Mystical Experience: A Quantitative Investigation. Kimberly McCann <kmmcann@gmail.com> (College of Doctoral Studies, Grand Canyon University, Paradise Valley, AZ )

The study investigated the relationship between Maslowian self-transcendence (ST), the final level of the hierarchy, by gauging ST using the self-transcendence scale (Reed, 2010), with propensity toward/for mystical experience (mysticism as defined by the M-scale). Further, an investigation of transliminality and dissociation, as markers of mysticism and ST were explored. Rationale: No studies to date have measured Maslow's higher need, self-transcendence, with the components of M-scale, transliminality, and dissociation. The Maslowian ST is an area of research that requires empirical exploration. **C24** 

# 5.06 Psychoanalysis and psychotherapy

# 05.07 Lucid dreaming

272 Neural Correlates of Lucid REM Sleep Measured with High Density Electroencephalogram (hdEEG). Benjamin Baird <br/> <br/>ebnjamin.s.baird@gmail.com> (Center for Sleep and Conscious, University of Wisconsin - Madison, Wisconsin, WI )

While some aspects of consciousness remain intact during rapid eye-movement (REM) sleep in the form of dreams, self-awareness, in which one is consciously aware of oneself and one's state, is typically suppressed. However, at times an extraordinary exception occurs, and we are able to regain self-awareness and realize that we are dreaming while continuing to dream. In the last few decades, several EEG studies of lucid dreaming have been conducted and they have identified widely varying electroencephalographic markers of the state. While these studies represent important first investigations into this question, they all have interpretative issues, including limited EEG montages (in several cases fewer than 6 electrodes, and/or covering only part of the scalp) and limited frequency resolution and ranges. In the current study, we evaluated the electrophysiological correlates of the transition from non-lucid to lucid REM sleep using high-density electroencephalography (hd-EEG) coupled with registration to individual cortical anatomy, as this method affords both excellent temporal and spatial resolution, allows for analysis of neural oscillatory activity on the cortical surface. 128-channel hd-EEG and concurrent sleep polysomnography (PSG) were recorded from individuals (N=16) who experience lucid dreams with high frequency (>3 nights per week) for 1-4 nights at the University of Wisconsin-Madison sleep laboratory. Cortical anatomy was obtained with structural MRI and hd-EEG electrodes were registered to the cortical anatomy. Participants signaled when they became lucid using a pair of consecutive full-scale left-right-left-right eye-movements, providing an objective marker of lucidity during REM-sleep dreaming. 4 out of 16 participants succeeded in becoming lucid and making an eye-movement signal in EEG-verified REM-sleep. Our results clarify the local neural oscillatory changes associated with the emergence of self-aware consciousness during REM-sleep. C6

#### 5.08 Near-death and anomalous experiences

273 Bridging The Explanatory Gap: Anomalous Phenomena and Spiritist Mediumistic Healings at Casa De Dom Inacio in Brazil. Milica Zegarac <milizegar@gmail.com> (Global PhD Psychology, Sofia University, Palo Alto, California)

The so-called anomalous experiences defy the conventional consensus reality and often transcend the reified space and time categories. Those extraordinary human experiences are potential causes of consciousness expansion via self-actualizing and self-transcending processes and towards the farther reaches of human nature. Nevertheless, a valid scientific explanation of anomalous phenomena such as telepathy, channeling, precognition, mediumship, unexplainable healings, past-life, out-of-body and other psi-related experiences is still lacking. The investigation and explanation of these phenomena may offer the missing link for clarification pertaining to the hard problem of consciousness, which diverse theories of consciousness have been trying to explain. In this study, we attempt to look at consciousness from a more classical point of view, as an intelligent field of energy (wave and information). Similarly, the explanation of anomalous phenomena by the quantum mechanics, with subtle and micro-scale events (e.g., mental processes) points to them as both the unlimited potentiality and its more mundane manifestation, a spacetime event. This mind-over-matter postulate conforms with the claim that the spiritual, non-local, formless energy being having human experience is the consciousness in which those human experiences occur. We are not our bodies, nor fluctuations of the mind (i.e., emotions and thoughts) as many ancient traditions (e.g., Yoga and Buddhism), and some contemporary thinkers claim. The recycling of quantum cellular memories and mental-emotional bodies (e.g., wisdom, knowledge and skills) indicates that the possibility of spiritual healing by various energies (entities) that cross the boundaries between dimensions is not that improbable. The author of this research has spent many months observing and personally experiencing the ordinarily unexplainable healings taking place at the Casa de Dom Inacio spiritual center in central Brazil. The center is founded by Joao Teixeira de Faria (i.e., Joao de Deus/John of God), and is in the area of strong energy currents and vortices emanating from the underground quartz crystal deposits. Joao de Deus is a full-trance medium who channels the communication with the spiritual world of various entities of light to provide healing on the physical, emotional and spiritual levels. What eludes both medical and scientific explanations is the complete absence of asepsis and the relative absence of pain during and after the physical interventions, done without any anesthesia. Both the relative aspect as phenomenal reality (i.e., the earthly manifestations) and the absolute dimension as a pure consciousness itself (i.e., the world of spirits) intersect here, where the veil between the life and death is thin and permeable. The ongoing consciousness-directed healings at the Casa may be a proof

that the consciousness defined as a substrate or intelligent essence is superordinate to matter. We also hypothesize that most of the anomalous experiences (i.e., the transfer) take place in the field of nonduality, as a unified field of what previously was the subject and the object. The domain of nondual consciousness transcends cognitive realm with a decreasing phenomenal content, to become a nondual Ground-of-Being (non-conceptual absolute awareness of awareness), the field of the healing Spirit. **P2** 

## 5.09 Parapsychology

274 The Nature of Randomness as a Gateway to a Theory of Consciousness. Daniella Caputi </br/>djcaputi@ucdavis.edu> (Atmospheric Science, UC Davis, Davis, California )

In this presentation I will introduce a model that suggests that there are three essential mysteries of consciousness; alleged psi abilities, the hard problem, and the selection problem, speculated to be connected by the nature of randomness. The selection problem is introduced here as a unique extension of the hard problem: while the Hard Problem asks "How does a physical system become conscious?", the selection problem asks "Once conscious, how does the physical system become a particular self?", which is critical for mind uploading, personal identity, and overall survival of consciousness. This takes the viewpoint that the concept of a self, while possibly illusory, still has practical consequences for survival of conscious experience by a particular entity. A series of thought experiments and logical deductions can be employed to show that even if the hard problem were to be solved, an explanatory gap would remain between knowledge about how physical systems (such as brains) become conscious, and knowledge about how specific bodies are mapped to specific experiencers of consciousness (selves), addressed by the selection problem. This mapping process, from our current vantage point, appears as a truly random event (defined as a state or outcome of a physical system with the appearance of ontological uncertainty). Regarding the other aforementioned mysteries, alleged psi phenomena could possibly be interpreted as the ability to influence or predict truly random events, and hence consciousness itself is, at least in part, the mechanism of randomness. This view is partially echoed in quantum theories of consciousness such as ORCH-OR, which in an attempt to address the hard problem, posits that consciousness itself is the collapse of the wave function. Our model thus proposes that the phenomena of true randomness is at the heart of consciousness and further exploration of it, especially experimental attempts to characterize the nature of mental interaction with random events, will lead to insight on all three essential mysteries of consciousness. In many mind-matter interaction experiments, random number generators that take advantage of quantum uncertainty have been used, but we note that turbulence in fluids is a non-linear process that may also be truly random in nature. The non-linearity implies that small effects of mental interaction with turbulence may be amplified to magnitudes that make the phenomena more visible, making turbulence an especially good candidate for a physical system to be used in these experiments. Thus, such experimental results, if positive, would be capable of distinguishing mind-matter interaction from precognition, and easily set the stage for further exploration. Preliminary results from two experiments will be presented here. In one experiment, participants (in an online interface) attempted to influence turbulent wind fluctuations measured by a sonic anemometer in Davis, CA. In another experiment, a random event generator (TrueRNG) is placed on an aircraft operated by Scientific Aviation, Inc. The TrueRNG output was significantly more ordered when flying through regions of convective turbulence (z=3.67, p=0.0002, two-tailed). These findings hint at the possibility of a deep connection between quantum randomness, turbulence, and consciousness. C24

275 Detecting Subaudible Vocalizations from Hypothesized Collaborating Discarnates:three Proof-of-concept Experiments. Gary Schwartz <gschwart@spamarrest.com> (Psychology, University of Arizona, Tucson, AZ )

Research with claimant evidential mediums (CEMs) as well as persons experiencing after death communications (ADCs) indicate that vocalizations are occasionally heard audibly: (1) localized in space and (2) emanating from discarnates. Moreover, CEM and ADC research indicate that the recognized physical forms of discarnates (including facial features, hair, and clothing) are sometimes seen: (1) visually and (2) in three-dimensional space. It is hypothesized that low amplitude, subaudible vocalizations of discarnates may be emitted by discarnates and potentially detected using sensitive technology with associated methodology. The procedure developed for detecting possible subaudible vocalizations of hypothesized collaborating discarnates (HCD) involved the following components:(1)The HCD was instructed to repeat a sentence composed of nine, single syllable words over and over in synch with a slave monitor that displayed in real time the raw wave forms of the nine word sequence as generated by the computer (but not played out loud by speakers). According to three independent CEMs, the specific sentence selected for these proof-of-concept experiments was highly meaningful to the HCD.(2)The HCD was instructed to speak the words into a low noise, high sensitivity microphone mounted in a clear plastic sound collecting dish. The slave monitor was visible through the clear dish. The microphone was housed in a sound deadened environment (Experiment I) and in a professional sound isolation chamber (Experiments II and III). (3) The pre-amplified hypothesized subaudible vocalizations were digitized with a low noise, high sensitivity digital oscilloscope and processed using a specially designed program written in LabView called REAPP (Real-Time Event Averaging Parallel Process). REAPP coordinated (1) the computer presentation of the raw audible signals interspersed with baseline control periods, (2) the rectified the audio signals, and (3) the time-locked averaged the nine word sequence of waveforms and control periods over trials. Experiment I had 200 trials, Experiment II had 100 trials, Experiment III had 80 trials. When a physical person (a CEM) whispered the nine word sequence over and over in sync with the slave monitor, spectral analyses of the averaged waveforms revealed a dominant peak at approximately 1.4 cycles per second (Hz) - the actual rhythm of the whispered words. We predicted that the identical 1.4 Hz peak would be observed in the averaged waveforms when the HDC performed the task. This prediction was confirmed and replicated in the three experiments. Importantly, this dominant peak was not observed during the interspersed silent control periods for either the CEM or the HDC. Furthermore, this peak was not observed for additional no-speech control conditions employed in the experiments - e.g. when the CEM was imagining that she or the HDC were speaking into the microphone. The findings support the hypothesis that it is possible to measure intentionally time-locked subaudible vocalizations in hypothesized collaborating discarnates. C24

# 5.10 Contemplation and mysticism

**276** Perceptual Aspects of Ordered and Disordered States. Cody Kuiack <cosmeffect@ gmail.com> (Chilliwack, BC Canada)

Order and disorder are component mental states our minds can either move towards or away from, which may either ebb or flow and can be rough or calm as one or the other comes about. These states, or directions order and disorder can move through, will either make us feel a wholeness or emptiness of being as they constantly shift from state to state. It is this shifting of multiple properties where our minds make some sense of the world and cosmos we are embedded in and are not all that different from. **P2** 

277 Psychometric Changes Correlate to Degree of Ongoing Non-symbolic Experience In Adults. Jeffrey A. Martin , Ariel Berwaldt <jeffery.a.martin@gmail.com> (Sofia University, Newport, KY )

Non-symbolic experiences have been reported for millennia and are generally attributed to spiritual and religious contexts, although atheists and agnostics also report them. Popular terms for them include: nondual awareness, enlightenment, mystical experiences, peak experiences, transcendental experience, the peace that passeth understanding, unity consciousness, union with God, and so forth. Most are temporary, but some individuals report a persistent form of them. We collectively refer to these types of experience as ongoing and persistent forms of non-symbolic experience (PNSE). All involve a fundamental change in the experience of what it is like to perceive the world. Building on 7 years of foundational research that sought to understand this experience in over 1000 adults who self-reported PNSE (presented at previous TSC conferences), for the past 4 years we have run a series of experiments to obtain near-realtime data on what changes individuals experience before, during, after the transition to these forms of subjective experience. Utilizing a wide range of highly validated self-report measures 12 experimental cohorts comprising several hundred participants, we detected highly significant, beneficial changes

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in various forms of wellbeing, emotion, anxiety, depression, gratitude, relationships, personality characteristics, and more. Differences were also detected at a group level between individuals who claimed to transition to ongoing forms of non-symbolic experience as a result of the experiment and those who did not (also presented at previous TSC conferences). Individuals within the group who claimed to transition to ongoing forms of non-symbolic experience were able to further classify their experience into sub-categories. These sub-categories may report on the degree of depth of non-symbolic experience. The sub-category reports were compared to participants' scores on the previously mentioned psychometric measures, and resulted in highly significant correlations that did, in fact, suggest a deepening. For example, mean well-being scores increased and depression scores decreased in a step-wise fashion from what are believed to be shallow to deeper sub-categories of the experience. Similar changes were seen across most measures. Results from all measures will be reported on, and their implications discussed. **C24** 

278 Peak Experiences, Mystic Experiences and Epiphany: Are These Same? An Analysis of Practitioners of Surat Shabda Yoga. Sumita Srivastava, Anjul Dayal Torrent Power Ltd. Agra India <sumita.srivastav@gmail.com> (Management, Dayalbagh Educational Institute, Agra, Uttar Pradesh India)

This paper presents descriptions of peak experience, mystic experience and epiphany collected from 25 employees practicing Surat Shabda Yoga. These descriptions were compared parallel to the data collected from the control group (n=105). The experience questionnaire (Privette 1987) was administered on both the groups which consisted of a narrative description and a series of Likert type scale questions. Maslow advocated that peak experience universally happen and he did not associate them with mysticism and epiphany. This study was conducted to offer a collection of experiential correlates of such events to examine if the major theoretical descriptions of the subjective characteristics of the event were consistent or not. A multivariate analysis of variance followed by t test indicates a significant difference in the two samples. **P1** 

**279** The Garden Path Burton Voorhees <burt@athabascau.ca> (Center for Science, Athabasca University, Victoria, BC Canada)

As biological beings we are in the world, not only embedded in the world but part and parcel of it, beginning as a fertilized ova and growing into the world in a way not all that different from a growing flower. And yet, as conscious beings, we feel that somehow we may not be entirely of the world. How can this be? In this presentation we present a descriptive journey "down the garden path," as it were, indicating stages of coming into an understanding of this dichotomy of being in the world, but also beyond the world, not of the world. **P1** 

# 5.11 Virtual reality

#### 5.12 Miscellaneous

**280** Cosmic Evolutionary Philosophy and a Dialectical Approach to Technological Singularity. Cadell Last <cadell.last@gmail.com> (Philosophy, Evolution, Cognition and Complexity (ECCO), Brussel, Belgium)

Cosmic evolutionary philosophy constitutes a useful worldview for thinking about the human position and relationship to universal dynamics. This universal dynamic as situated in the local region of observational multiplicity is conceptualized as a network of evolving relations with a singular astrophysical origin (big bang) and an organizational progress from sub-atomic particles to human civilization (complexification). Throughout this complexification of organization key events are identified as representing qualitative phase transitions where new relations form emergent integrated ordered wholes. The hypothesized/anticipated next stage of cosmic evolutionary imminence is often described by futurists as a technological singularity. In this next stage complex organization generated ordered whole beyond any previous known level of complexity. This paper does not challenge this hypothesis/anticipation but rather seeks to reframe the human position and relationship to such processes by approaching technological singularity from an internal subjective

view. The principle tool and method for such an internal approach to technological singularity relies on the triadic logic of speculative dialectics ((1) abstract, (2) transform, (3) concrete) embedded within the conscious ideational landscape of human mind in-itself ((1) imaginary, (2) symbolic, (3) real). Consequently, such a view focuses on the intimate motion of psycholinguistically embodied processes manifesting in socio-historical context. This motion is conceived as a transformation of being stabilized by a multiplicity of psycholinguistic drives oriented towards a central attractor as concrete real. From this perspective the universal dynamics of cosmic evolution becomes fundamentally entangled with the abstract-imaginary desires of observational multiplicity dependent on observation creates a fundamental dualistic (subject-object) constant of antagonism or tension that can be framed between chaos and order, obstacles and dreams, problems and opportunities, and/or presence and absence. Consequently, this dualism is a constitutive determination of any full emergence of the "concrete real" and may only be reconciled by the collective work of observers in history which introduce a higher order symmetry or unity into being. **P2** 

**281** Theoretical Concepts on Sub-Quantum Energy Fields of Matter and Perception of Reality by Consciousness. Jimmy Vigo <jvigo@elp.rr.com> (Research and Development, The HVB Research Foundation, El Paso, TX )

This project applies physicochemical theories to cognitive science by presenting hypothetical mechanisms operating at a sub-quantum level that may clarify unknowns about human conscious awareness to reality, perception of sequences of events, energetic discontinuity of light and vibrational atomic levels, decoherence of electromagnetic transmission, prediction of isotope decay, and the dynamic changes in the solidity of the universe. In Abstract #247 of the 2016 conference, the solidity of the universe moves in Spacetime forward into the future from point A to B through periodic and harmonic cycles of mounted-dismounted-remounted called Teletransportation. The original undisturbed ether or matrix fabric of the universe appears non-dual 100% wave (delocalized) and 0% solid (localized). Transportation is controlled by attenuating the amount of delocalized/localized energy between states of solid and wave duality. A Lorentz force disturbs the ether into the solid-state form of the present time of the universe. This pulsation or heartbeat has unique momentum, wavelength and frequency of vibration represented by tones and overtones analogous to the energy levels of the electron s, p, d and f orbitals in atoms. The motion of the universe in Spacetime resembles the toy 'Slinky' going downstairs, the spontaneous falling of a spring down a ladder upon an initial push, where the steps are energy levels of a hypothetical waveparticle of Time named Timeon, with lower-duality than light and sub-atomic particles. The universe is solid when Slinky is totally closed at a step with zero velocity (point A). The action of falling on the next step (point B) is a transition between solid and non-solid, until it re-solidifies at the lower step, where it is re-mounted more disordered (positive entropy). This was modeled by a hypothetical teletransportation from point A to B of an electron occupying an atomic f-orbital. The 3D 8-petal daisy flower shape of the energy distribution passes through a harmonic and symmetrical series of energy re-distributions that represents states between solidity and non-solidity. They were simulated in 2D by the polar roses r(?)=sin(100 to 140\*?). Solidity is represented in point A by sin(100\*?) and point B by sin(140\*?). The fading of solidity is a gradual re-distribution of energy shape represented by sin(101 to 119\*?). The central point sin(120\*?) represents total delocalization in the form of asymmetry, discontinuity, divergence, non-locality or oblivion that introduces decoherence in the pathway of transportation. The numerical Cartesian data of the roses represents templates of transportation like genetic instructions rebuilding the universe at different points, with the matter present on each point. The new study proposes a sub-quantum level that gives rise to the stationary solid state of the universe at Points A and B, modeled by the splitting of the atomic d-orbitals of a copper atom under the influence of an external magnetic field. The 4D entanglement of Spacetime is simulated by the 5D energy-split of the square-pyramidal geometry of the bonding in copper, representing a hyper-spherical model of localized, continuous, convergent, and coherent state of existence, perceived by consciousness consequence of a universal split of primordial energy fields. P2

# **Culture and Humanities**

## 6.01 Literature and hermeneutics

**283 Representation of AI in Sci-Fi Films** Pranay Bhatnagar spranayBhatnagar43@gmail.com> (Dayalbagh Educational Institute, Agra, Uttar Pradesh India)

In recent years, Sci-fi films have shown the darker aspect of the relation between man and machine. Frankenstein complex as an existential threat or implications of the risk of Artificial Intelligence as a narrative has become a CSP with the writers, directors and producers. Very few films today depict the controlled, value-based, positive, utilitarian or ethical aspect of AI. The paper evaluates the dystopian theme of AI rebellion and AI dominance in the popular culture sci-fi with a view to establish the following arguments: 1. One-sided and narrow depiction of the relation of man and AI affects the imagination of the growing children negatively. 2. The recurrent theme of man vs AI instills the fear of machines in the children which might harm their progressive outlook towards Science and Technology. The concluding segment of the paper discusses the moral and ethical responsibility of the film maker towards building of the consciousness of the children by presenting a positive outlook towards the theme. **C9** 

**282** Consciousness through Works of Literature. Gurpyari Bhatnagar <gurpyari.bhatnagar11@gmail.com> (School of Languages and Cultur, Sharda University, Greater Noida, Uttar Pradesh India)

The universal symbols in literary works convey a vision that transforms and expands the consciousness of the reader. Many literary theories have emerged in the recent times. However, not many Schools of Criticism have come up with beliefs and ideologies that can evaluate the symbols at the centre of the literary works. In order to analyse a literary work, a scholar needs theories which can move beyond the ordinary temporal and spatial dimensions in the works of literature; theories that can capture the inner most meaning which is charged with the 'utmost possible degree' and the moments which are 'kerygmatic'. The paper establishes that Northrop Frye's theory of symbols can be used to analyse the literary works as the theory has the ability to reach the monads which are found at the centre of the archetypal symbols and hence, can interpret the vision of the writer/poet. Northrop Frye is one of the most influential literary critics and literary theorists of the twentieth century who is influenced by the Eastern thought and religious principles. Frye believes that the monads in the anagogic phase imitate the action of an 'omnipotent society' that contains all the 'powers of nature' within itself and their power to communicate to the readers is not bound by nature or history. This belief forms the basis of the discussion in the paper. The paper concludes that the humanistic and educational thought of the writer/poet rests on his convergence of all the phases of symbols in his literary work. The paper uses Frye's scholarship to break the barriers between different Schools of Criticism, the barriers that tend to make a critic confine himself to a single method of criticism. The research claims that a student of literature needs a synoptic view like that of Frye's theories and principles which can unify structure of knowledge about literature. **C9** 

**284** The Science of Dreaming and Sleep in Selected Charles Dickens' Novels and Letters. Olga Colbert <olvalero@smu.edu> (World Languages and Literature, Southern Methodist University, Plano, TX )

The present study delves into the representation of dreaming in Charles Dickens' Oliver Twist. Dickens showed great interest in the science of dreaming and had ample up-to-date knowledge of the latest sleep and dream theories available in the Victorian era, as can be seen in his personal correspondence, most notably in the famous letter he wrote to Dr. Thomas Stone on 2/2/1851. The purpose of my study is twofold. On the one hand, I explore Dickens' literary use of dreaming as a textual strategy: as a tool to advance the novel's plot, to show the inner state of the novel's characters, or to create an impression of verisimilitude, for instance. But, most importantly, I use Dickens' personal writings side by side with his novels to elucidate whether the scientific paradigm about dreaming included in the novel in question is consistent with the current (in Dickens' time) scientific knowledge, or whether the way dreaming is represented in his literary work(s) is

anachronistic or visionary (ahead of his time). Oliver Twist is a particularly useful novel because, in addition to including descriptions of dreams the fictional characters have, we find entire passages dedicated to pondering on the nature of dreaming, enumerating types of common dreams, and taking a stand on the interference of sensory perception during the dreaming state. I am particularly intrigued by Dickens' assumption of the commonality and universality of lucid dreaming as revealed in these passages. I study popular Victorian dream theories, such as those contained in Robert Macnish's The Philosophy of Sleep, as well as recent dream theory, particularly psychophysiologist Stephen LaBerge's numerous articles and books on the topic of lucid dreaming to see if Dickens deviated in any way from the reigning paradigm of the Victorian era in his representation of dreaming in his novels. While Dickens puts to great narrative use many of the characteristics of dreaming described by leading Victorian theorists, I argue, however, that his most visionary statements derive from his acute observations of his own dreaming experiences. C6

**285** Wild Narratives: The Science of Consciousness and the Stories We Tell. J. Scott Jordan <jsjorda@ilstu.edu> (Psychology, Illinois State University, Normal, ILLINOIS )

The models we have of what we are and what we live in necessarily contextualize and constrain our models of science and consciousness. At one time, certain groups of humans conceptualized themselves as eternal spirits living in a transient material world. In contemporary models, they often describe themselves as informational minds living in a physical world, or as physical minds situated in a physical world. Whatever the model, the present talk will propose that all such models constitute wild narratives. They are narratives because they are necessarily representations of (i.e., they are about) what we are and what we live in, and they are wild because they emerge ontogenetically, socially, culturally, and phylogenetically out of lived life. Jordan (2013) proposes such narratives have their roots in unconscious anticipations that allow us to distinguish ourselves from the world, including the actions, perceptions, and cognitions of others. Research indicates these anticipations emerge from a similar cortico-cerebellar architecture that results in all cortical activity being inherently anticipatory because it is continuously, recursively primed by memory-laden cortico-cerebellar networks (Koziol & Lutz, 2013; Schmahmann, 2001). As a result, the past is continually fed forward into the present as anticipation about the future in action, perception, and cognition, simultaneously. In short, we necessarily live within wild narratives. Cultures work to shape developing members' unconscious anticipations through cultural practices such as education, politics, religion, and art (Hahn & Jordan, 2014; Jordan & Ranade, 2014). Jordan (2008, 2016) argues these practices also constitute wild narratives because they emerge spontaneously and contextually out of the interacting, wild narratives of individual members. In addition, they are essential to cultural sustainment because they constrain individual narratives in ways that minimize intra-group conflict and maximize intra-group cooperation, while simultaneously serving to distinguish inter-group narratives (Jordan & Mays, 2017). Within the Wild Narratives framework, science is conceptualized as a cultural practice that affords group members the ability to generate increasingly sophisticated, reliable models (i.e., wild narratives) of the larger-scale contexts in which we are embedded (Dewey, 1929; Jordan & Day, 2015). Such an approach to science allows one to describe the relationship between science and consciousness in ways that do not engender epistemic gaps between the observer and the observed. Rather, both the observer and the observed reside within the larger-scale context we often, narratively refer to as reality. By conceptualizing ourselves, as well as all phenomena, as constituting aspects (Spinoza, translated by Boyle, 1977), or embodiments (Jordan & Day, 2015) of that larger scale context, we can see we must necessarily be about such contexts. As a result, all phenomena are naturally and necessarily meaningful. Such ubiquitous, natural, and necessary meaningful-ness completely bypasses the hard problem that emerges in consciousness studies when we begin with wild narratives based on assumptions such as physical, mental, objective, and subjective. In conclusion, the paper will review a number of contemporary artistic narratives that address this issue directly. These include W. G. Sebald's, The Rings of Saturn, Hayao Miyazaki's, Mononoke-hime, and HBO's Deadwood. C9

# 6.02 Art and aesthetics

286 Consciousness Goes To The Movies. Nick Day <nick@conscious-pictures.com> (Conscious Pictures, Sonoma, CA )

Since the earliest days of cinema, consciousness and the deeper nature of reality have been irresistible themes for filmmakers. Topics we are familiar with in consciousness studies, such as altered states, brain-in-a-vat scenarios, parallel realities, switching minds between bodies, lucid dreaming, NDEs and many flavors of AI occur frequently in movies, either as central to the drama or as backdrops. Of course, our capacity to accept the artifice of a movie and lose ourselves in its narrative are in themselves remarkable aspects of our own consciousness. Watching a well made film is one of the richest experiences we can have, and neuroscience is learning a great deal by studying our brain on movies. Motion pictures that directly explore consciousness and reality, such as The Matrix, Being John Malkovich, Eternal Sunshine of the Spotless Mind, Groundhog Day and Inception are hugely popular, while other films are designed to evoke an altered state of consciousness by using the form itself, for example, the hypnotic and meditative qualities of Meshes of the Afternoon, Koyanisquatsti or Samsara. Movies play a significant role in contemporary culture, reflecting individual and societal anxieties, and providing an arena where these concerns can be addressed and processed collectively. AI movies in particular presuppose that consciousness is computable, and the apparently unstoppable advance of technology brings with it an existential fear that conscious computers and androids will eventually dominate or even destroy humanity. Blade Runner, The Matrix, 2001: A Space Odyssey and Her are outstanding examples (and warnings) of AI run amok, although it is notable that many of these also include strong themes of redemption. In this presentation, award-winning filmmaker Nick Day explores what we might learn about consciousness from cinema, the various ways consciousness gets represented on the big screen, and to what extent the movies get it right, if indeed they ever do. C9

288 What the Syndrome of Hemi-neglect Has to Say About Consciousness. Stuart Ross Snider, MD (Neurology-Ret) <stuartrosssnider@yahoo.com> (Natural Selection Sculpture, Studio Sculptura Arborum, LLC, Tucson, AZ )

: It is an understatement to say that there is uncertainty about the shape and boundaries of human consciousness. Think of clinical neurology! However, in the neurologic syndrome of left hemi-neglect some fascinating, literal delineation of "perceptual consciousness" is possible. In a right-handed person, part of the non-dominant, right parietal lobe functions to cognitively organize the left half of 3-dimensional space. As a case study, a Mr. R has a confirmed right parietal lesion. A blunt trauma or embolic stroke may result in neglect of (inattention to) visual, somatosensory and auditory stimuli in or from his left half of space, without loss of ability to see, feel, or hear on the left side. The cranial nerves are intact. Mr. R can feel left fingernail squeeze (a test of pain), acknowledge a penlight from the left, and hear someone speaking from the left, although the sound he cannot localize the voice. In addition, Mr. R does not visually search out the speaker's location as would be the case in a normal patient. When Mr. R is asked if there is a person or window (both to the his left), he will say report "no" or report that the sound came from outside. When the speaker walks from the Mr. R's right to his left, then Mr. R stops visually following the speaker as he passes a few degrees to the left of the Mr. R's midline. Although Mr. R does respond to left-sided stimuli when individually presented, he doesnot perceive stimuli on the left when two right and left stimuli are done simultaneously. Only stimuli on the right are reported. In spite of Mr. R being aware of single stimuli on his left, he is not conscious of the left side with bi-lateral stimulus. Nor does he spontaneously search to the left. There are three points to be made: (1) "Perceptual consciousness" is more complex than "component awareness"; (2) The "virtual shape" of Mr. R's consciousness is that of a right brain hemisphere, the flat surface of which corresponds to a vertical plane parallel to the interhemispheric fissure. And, the volume of his"virtual shape consciousness" exists only on his right side, both inside and outside his body; (3) These observations of hemi-neglect, a rigorous natural experiment, support the theory of conscious dualism, ie: the separation of mind and body/brain. Stuart Ross Snider, M.D. http://www.facebook.com/ stuartross.snider https://www.amazon.com/Stuart-Ross-Snider/e/B01406RECG http://www. natural-selection-sculpture.com/ https://www.linkedin.com/in/stuart-ross-snider-81189048/ https:// www.artslant.com/global/artists/show/282615-stuart-ross-snider https://www.doximity.com/pub/ stuart-snider-md Key Words:perceptual consciousness, component awareness, electroencephalog-

raphy, interhemispheric fissure, dualism, separation of mind and body Dr. Stuart Ross Snider MD, Neurologist: Private practice 1981-2011. Previous faculty positions at: Columbia Presbyterian Med Center Neurological Institute, NYC; University of Arizona, Dept Neurology Tucson, AZ: Fellowships: University Gothenberg Sweden A1

**289** Quantum Art - Bridge to the Miraculous. Tamara Thompson <tamarat@mindspring. com> (Quantum Art, Oakland, California)

Quantum Art, Bridge to the Miraculous presents my philosophy of how artistic representations can be a bridge to timeless sacred wisdom, enlightening the experiencer to the interiority of uncommon levels of mindfulness. Revelatory experiences made possible through artistic portals can result in ethereal moments of transpersonal quantum consciousness, those deeply felt dimensions of ego altered, timeless, non-ordinary, non-local states of awareness. Classical models of physics have explained consciousness based on physical laws; however recent quantum theories allow for advanced concepts of consciousness as something that may not be completely material. Hinting at ineffability, supernal realities may emanate from deep inner connectedness of an immaterial, quantum mind accessible through empirical introspection. Respectfully, in my humble attempt to describe and summarize immense mathematical and theoretical concepts, I suggest integration between quantum theories of superposition and entanglement with the shared experience of timeless states of transpersonal non-local awareness. Defined by physicist, Dr. Marcin Nowakowski, "Ouantum entanglement is a phenomenon which does not have any reflection in classical world and as such is a manifestation of the so-called non-locality of quantum correlations". It is my belief that these dynamic interactions of timeless conscious experience are destinations genuinely accessible through Art. Through the ages, human cultures have used a variety of belief systems, mythologies and rituals, to access non-ordinary experiences of inspired awareness, feelings of universal unity and sense of timelessness. Sacred and inspirational art serves as a visual bridge, guiding observers into transcendent inner journeys and deeply enhanced expressions of being. Through history, mystical excursions have informed artists to encode their feelings in imagery that leave indelible impressions entangled through time on thoughtful and receptive viewers. Revelatory and inspirational experiences recorded by the artist in compelling iconography established the ideological importance of political, religious and cultural mythologies. Works of inspired content created under these conditions were often embedded with the artist's feelings and perception of the subject matter. Multiple narratives of figurative icons from various social traditions evolved to function as emotional and conceptual conduits for collective coherence influencing cultural evolution. These social vision quests were guided toward psychological consensus of extended realms inside non-ordinary, non-local states of awareness. Visionary artist, Alex Grey observes "skilled painters intimate with expanded states of awareness, translate these subtle archetypal dimensions to facilitate realization of divine spirit". These inner journeys revealed symbolic bridges to transpersonal realms of hidden wisdom, enabling observers of their art to "feel and see" the unseen. Advanced quantum theories of superposition, entanglement and measurement have recently contributed to contemporary dialogues that bridge the persistent philosophical dualism of modern consciousness research and reductionist scientific experiments. A number of these interesting and challenging dialogues correlate to timeless experiences of fundamental awareness through non-local entanglement in what I term Quantum Art. Quantum entanglement, once described by Albert Einstein as "spooky action at a distance" describes shared wave function; Justin Riddle, Ph.D. says,"spaceless and timeless bonds that underlie a deeply interconnected reality". These ideas acknowledge works of art as possible entangled quantum portals into non-local states of awareness. A1

#### 6.03 Music

290 Impact of Indian Classical Music Raga Performance by Musicians on Their State of Consciousness Using Electro Photonic Imaging Pritam Pyari , Sant Saran; Saran Pyari Roy; Sukhdev Roy <sukhdevroy@iitdalumni.com> (Music, Dayalbagh Educational Institute, Agra, Uttar Pradesh India)

In Eastern experiential traditions, the very nature of consciousness is described as unstruck

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music (Anhad Nada). Hence, the objective of Indian classical music is to attain self-realization and enlightenment by hearing and merging in inner divine sound. It is well recognized in its traditions that different Ragas or musical melodies, have a profound impact on the consciousness states, as they correspond to focused attention at different energy centres and hence also have a healing effect. In our earlier psychometric and experimental studies using Electro Photonic Imaging (EPI) technique, presented at TSC-2016 and TSC-2017 respectively, it was shown that different ragas have a profound effect on respective chakras and result in improvement of health parameters of yoga-meditators and students. EPI is based on Indian Ayurvedic system and traditional Chinese medicine that involve meridians, energy channels and energy fields, and leads to a psychosomatic assessment. The results showed in general, a significant improvement in the Ajna (Third-Eye) chakra alignment and its energy, in meditators, whereas in students it was in Vishuddha (Throat) Chakra. As expected, the ragas resulted in considerable reduction in stress and improvement in health indices. Both EPI and the subjective analysis indicated higher state of consciousness in meditators in comparison to students. The subjective experience correlated with specific states of consciousness attributed to different Ragas and Chakras, according to eastern experiential traditions. An interesting aspect that emerged from these studies is that the musician while playing music is also in a focused state akin to a deep meditative state, which creates a heightened response of the musical raga. In the Indian classical music, the raga is open to imaginative intuitive improvisation by the musician, depending on his or her expertise. In this paper, we report the results of a pilot study undertaken to test the effect of Indian classical music raga performance by musicians on their consciousness using EPI. Expert male and female musicians were selected, who were adept in playing sitar, harmonium, flute and tabla. They performed various ragas of their choice that included Yaman, Ahir Bhairav and Bhupali for 15 minutes. The bio-electromagnetic field glow of the musicians through EPI, was recorded with a CCD camera from all ten fingers, before and after each musical performance. The EPI results were analyzed and correlated with the respective subjective responses through a psychometric test. There was a marked improvement in the energy levels, chakra alignment, yin-yang, emotional pressure, left/ right symmetry and organ balance in all cases. Moreover, the different ragas also had a positive impact on the respective chakras to which they are traditionally attributed to have the maximum impact. The study highlights the importance of (i) integration of subjective and objective, or first-person and third-person experimental phenomenological studies on consciousness; (ii) the age-old Indian traditional knowledge of the impact of ragas on consciousness; (iii) measurement and progression of the consciousness state of an individual through music, and (iv) the utility and reliability of EPI as an accurate, non-invasive, safe, low-cost and fast technique for consciousness and health assessment. C9

**291 Impact of Shabda Recitation on Daily Spiritual Experience of Young Students** Geet Satsangi , Shabd Kumar <geetsumita@gmail.com> (Agra, India)

Music is the mediator between spiritual and sensual life. It connects with inner voice and lifts spirits by realigning oneself back into life's balance. Students at Dayalbagh are engaged in Shabda recitation in melodious tunes along with musical instruments since very young age. This paper investigates impact of such Shabda recitation practice on the spiritual experience of young students. Students between the age group of 3 years to 10 years who regularly participate in Shabda recitation were selected as the experimental group (n=65). Daily Spiritual Experience Scale (DSES), Underwood (2013) was used to measure and compare their spiritual experiences with the control group (n=50). This research provides useful statistical comparison between the two groups and data on the relationship between the Shabda recitation and spiritual experiences. This research reinforces the existing theory of inherent connection between music and consciousness. **C27** 

292 Development of Musical Compositions for Inculcating Value Based Behaviour Among Viii Standard Students. Lalitesh Tiwari , Neha Shivhare <lalitesh967@gmail.com> (Pedagogical Sciences, Dayalbagh Educational Institute, Agra, Uttar Pradesh India)

This paper focuses on the development of Musical rhymes (compositions) for inculcating 'Value-Based Behaviour' (VBB) among VIII standard students. 'Value-Based Behavior' implies integration of certain core values (personal, social, democratic, behavioural and scientific values)

with the behavior of the students. It reflects the level of consciousness and orientation of an individual toward personal, social, democratic and behavioural values. The researcher chose 'Music' as a medium for developing 'Value-Based Behaviour' among students. As many scholars (Vaidya, 1994; Chandra & Mishra, 2012) and various educational agencies (NCERT, India; NUEPA, India) have suggested in their research that music plays a vital role in the development of values. Hence, for achieving this goal the researcher adopted an integrated approach for inculcating values among the school going students through music. This approach is based on the assumption that values are implicitly present in the content of various school subjects, and in order to develop musical compositions, the concepts were selected from the prescribed syllabi of the subjects: English, Social Science, and Science. In total, five rhymes from each of the three subjects, and thus total fifteen musical rhymes (integrating scholastic subjects' specific concepts and associated values ) were prepared and were based on the selected Indian Classical Ragas (Bhoopali, Khamaj, Yaman, Bilawal, Bihag etc because of their Pure i.e Shuddh and Dynamic i.e Praval nature ). For instance one of the musical rhymes of Social Sciences related to the topic 'Resources' was entitled as 'Greatness/ Glory of Humanitarian Resources' to depict values inherent in the content and was based on Indian classical raga.(Bilawal) to inculcate values among students. The present paper will elaborate the different steps taken for making rhymes, and will also explain the various aspects of rhymes developed. P1

#### 6.04 Religion and spirituality

**293** Ecstatic Mystical States and Certain Aspects of the Near-death Syndrome are Exaptations of the Evolution-driven Serotonergic Stress System. Seymour Reichlin <seymourreichlin@gmail.com> (X, )

Ecstatic mystical states such as those elicited in Sufi, Jewish and Christian mystics by psychological means (as far as one can tell from experiences which are acknowledged to be ineffable, (by definition indescribable), resemble those induced by Psilicybin and LSD in many ways: they are accompanied by feelings of peace and quiet, of joy, a sense that everything is known (noetic feeling), a feeling of cosmic unity and understanding (the oceanic feeling), feelings of revelation, an altered sense of time, visions of mystical or unearthly beings that can be interpreted as God, a bright, even blinding white light, and senses more vivid than normal. Survivors of the near death experience (NDE) describe many of the same changes in consciousness. Not every ecstatic experience includes every one of these features, and that is true for the NDE and for those taking these drugs as well. Most notable is that ecstatic mystical states, however induced, are commonly followed by a relatively permanent change in personal outlook, positive feelings about life and relationships with others and increased religiosity. Since the drug-induced state is known to act by stimulating serotonin 2A receptors I believe it reasonable to assume that the other two states are likely also associated with serotonin-mediated hyperfunction. If we accept Dobzhansky's dictum that "nothing in biology makes sense except in the light of evolution", it would seem unlkely that ecstatic mysticism of itself would be a state that would enhance survival. The solution to this riddle, I suggest, comes from the fact that the serotoninergic system also mediates stress responses: in mammals, acting in the hypothalamus, these include activation of the pituitary-adrenal axis, release of growth hormone, prolactin, vasopressin, and oxytocin. Serotoninergic activation also blunts sexual feeling (not an unreasonable response if one is being chased by a saber toothed tiger). All of these reactions have positive survival value. From a phylogenetic standpoint, serotonergic neuronal activity mediates stress avoidance behavior in animals as primitive as the worm, c. elegans, and even has an adaptive function in plants. Throughout evolutionary history, the serotoninergic system, has likely been coopted as the major mediator of stress responses. Changes in mental state brought about by culturally derived deliberate brain manipulation through measures like meditation, dance, music, drumming, isolation, starvation, I suggest, induce an increase in brain serotoninergic activity as does the stress of nearly dying. The term introduced by Steven Jay Gould to describe a function that serves a purpose other than that for which it evolved is "exaptation". The capacity to achieve a mystical state, is likely derived from induced hyperactivity of serotoninergic pathways that themselves evolved to adapt to stress. C24

#### **294** Egoless God: Creation and the Evolution of Consciousness as Based on the "radical" Non-dualism of Avatar Adi Da Samraj. Dan Sleeth <a href="mailto:</a>didam.org</a> (Lower Lakae, California)

Teasing out the subtleties of God requires a sensitive measuring instrument. Six orientations to life are possible, corresponding to a seven-stage process of growth overall. This schema is the offering of a unique and unsurpassed nondual sage who lived in our time, Avatar Adi Da Samraj. This schema is a precise mapping of the origin and evolution of consciousness. Whereas the first three stages of life pertain to the developmental epochs from birth through adulthood, the second three stages of life depict highly evolved spiritual capabilities. The first three stages are focused in bodily-based and mortal beliefs about existence, immersed in the world process, as said of nature, Gaia, or the material orientation of science. Adi Da refers to this point of view as "Conventional Monism". The most profound points of view to come can be depicted as follows: 1. Fourth and Fifth Stage "Conventional Dualism": reality consists of a series of spiritual pairings - e.g., Creator and creation. 2. Sixth Stage of Life: a. Primary Dualism: the highest of the pairings, consciousness and spiritual energy or purusha and prakriti. b. Secondary Non-Dualism: equating reality solely with spirit energy, or prakriti. c. Ultimate Non-Dualism: equating reality solely with transcendental consciousness, or purusha. 3. Seventh Stage "Radical" "Non-Dualism": free, nonbinding existence, witnessing all that is arising in Love-Bliss and Consciousness all at once or Prior Unity. The origin and evolution of consciousness has enormous implications for creation: In the beginning - there is only God' seventh-stage Consciousness Itself. Within this divine state an inexplicably odd event takes place, a kind of spasm, spontaneously, without cause or reason. This illusory contraction brings forth a false sense of separate self, or egoity. And so, our inherent Oneness seems to split apart - into self and other. This egoity arises abruptly in the immense joy of Divine Reality, out of nowhere. This dismal spasm/split is the real catalyst behind creation. Regrettably, we can identify with egoity, beguiled into forgetting our Divine Nature. In that case, the attractiveness of our ongoing divinity prompts the split to try and reunite, recover its Prior Unity. Like a frayed wire, the pieces long to splice together, to embrace what has been rent apart. But it is a futile effort. Failing to offset the spasm, which requires the split, actually prevents any reunion. The spasm/split is true original sin, the source of all suffering. Instead of reunion, the splice has an unexpected outcome. From this failed embrace, the entire menagerie of colors, odors, flavors, and various kinds of touch we associate with life - commonly known as creation or Big Bang (if not birth) - spill out. Strange enough, the splice/spill is only a side-effect, or accident, as well as impostor of God, as it goes about hurling objects throughout existence. Yet, we are always God all along. We only feel our Divine Nature "Conscious Light or Love-Bliss" when the error of this separation is released. In so doing, we dissolve into a blissful state, merely aware of all that arises P2

295 Environmental Consciousness in Ancient India: The Heart and Soul of Spiritual Practice. Preeti Srivastava , Prof. Savita Srivastava <2301preetisrivastava@gmail.com> (EDU-CATION, Dayalbagh Educational Institute, Agra, UP India)

The ancient Indian literature has many references which preach that it is our Dharma to protect our environment, conserve our natural resources and to maintain ecological balance. If we had followed this advice (Dharma), we would not have worried now about protecting our environment which has been exploited for personal and business gains. In the past man lived in partnership with nature but today nature is looted and polluted but no one cares. Modern Indian Scientists should be astonished and also feel proud of our ancestors for their knowledge and views about environment. Ancient seers knew about various aspects of environment, about cosmic order, and also about the importance of co-ordination between all natural powers for universal peace and harmony. The prayer says that not only regions, waters, plants trees, natural energies but all creatures should live in harmony and peace. Peace should remain everywhere. The mantra takes about the concord with the universe; A "peace of sky, peace of mid-region, peace of environment, peace of waters, peace of plants, peace of trees, peace of all-gods, peace of Brahman, peace of universe, peace of peace"; May that peace come to me! Mantra of the Ishavasyopanishad: one should enjoy with renouncing or giving up others part. Vedic message is clear that environment belongs to all living beings, so it needs protection by all, for the welfare of all. Rig-Veda X.I/ 46 Lady of the

Forest! Lady of the Forest! Who seems to vanish from sight in the distance? Why do you never come to the Village? Surely you are not afraid of us. When the grasshopper replies To the lowing of the cattle, As though to the sound of tinkling bells, The lady of the Forest makes merry'. Sometime you catch a glimpse of her, and think it is cattle grazing Or a house, far away And at the evening you hear the Lady of the Forest " Like the distant sound of moving wagons. Her voice is as the sound of man calling his cattle. Or as the crash of a felled tree, if we stay in the forest in the evening You will hear her like a far voice of crying? And what greater respect could Man show towards all the elements of Mother Nature than the prayer from Yajurvieda36/7 for peace or recite the Shanti mant4 which desires that 'let there be peace in the heaven, horizons-where the Earth and sky meet, peace in the vegetation" peace on earth, peace in everything' etc., and this prayer is always sung at the end of any holy anusthan or ceremony and this Shanti mantra may be accepted as the ultimate for any environmentalist. Thus, the study proves the origin of environmental studies from the Vedas. **P1** 

**296** The Development of Religious Consciousness in India. Savita Srivastava, Dr. Preeti Srivastava <2708deisavitasrivastava@gmail.com> (Foundations of Education, Dayalbagh Educational Institute, Agra, Uttar Pradesh India)

In India, people found themselves in need of a vision of life and developed a sense of which is called religious awareness. How is it possible that things should happen in the manner in which they are happening? The cause-and-effect relationship is ingrained in the very principle of thinking itself. The first phase of religion may be said to be a recognition of there being something behind the operations of nature. As the phenomena are multifarious, the simple, inquisitive mind of the human being attributed many causes behind many operations, many individual significant phases of human observation. Because of the imperishable nature of the causes attributed to these controlling factors of phenomena, they are also considered to be immortal. Such an intelligent cause behind the occurrences in the world, transcendentally operating, is a God - a Divinity - and the realm. In India, there are prayers offered to the animating principles behind every occurrence in the phenomena of the world - thousands and thousands of gods everywhere. Every god is worshipped as a necessary controlling power behind everything that is happening anywhere. There can be any number of gods. Without understanding the significance of this stage of religion, historians of religion wrongly designate this stage as polytheism. Polytheism is not a proper word because it has a slight touch of something undesirable, and nobody likes to use the word 'polytheistic' in regard to this stage of religion where it is an honest recognition of the Gods in heaven. The religious awareness which arose in this fashion went further and further, into deeper and deeper forms of this acceptance of there being gods; and wonder gave rise to a kind of doubt. It is said that philosophy begins with wonder. It also can begin with some doubt about the vision that originally one has attained. It is perfectly all right to believe that there must be many divinities, but that is the result of the wonder in perception. The doubt then arises: if there are so many gods, in what way is each one connected to the other? If each god is totally independent of the other, there is no one single, central force for controlling all phenomena. There was a feeling that perhaps they act together, as members in a meeting jointly act to come to certain conclusions. A group idea of gods arose; so many groups of gods are there - many gods, group gods. Otherwise, if each god is totally independent, there would be no way of coming to a consensus in regard to anything. It is just like it is necessary for us to hold a meeting to come to any conclusion. Thus, Ancient Indian literature i.e. Vedic Lit. are to bring to a halt any further discussion in the matter of religion - to say, once and for all, everything about religious awareness throughout the process of its development, right from the beginning till the modern day. P1

#### 6.05 Mythology

#### 6.06 Sociology

**297** Impact of Foreign Invasions, Explorations and Migrations on the Culture, Beliefs and Religions of South Asia. Guru Prasann Satsangi <guru.prasann.satsangi@gmail.com> (D.E.I. Prem Vidyalaya Girls Intermediate College, AGRA, Uttar Pradesh India)

#### The Science of Consciousness TSC 2018 | Tucson, Arizona

The southern part of Asia has been culturally rich for a long time and remains to be. The different countries of South Asia have their very own diverse but unique culture. But the question is that the culture, traditions and beliefs that are experienced in that certain area are their own native cultures or not? As the history of these countries state the answer would be NO, because the South Asian countries have endured many invasions, explorations and migrations in the past. This has caused the influx of new tribes into different areas of the south Asian countries. There are many reasons for the explorations, migrations and invasions those could be propagation of religion, migration for trade or invasion for expansion of kingdoms. Due to the influx of a new tribe in a certain area the cultures, traditions and rituals were exchanged and religion was propagated, which made the culture of the area more diverse and unique. This paper is based on historical events and facts in an attempt to understand the impact of the invasions migrations and explorations that the Southern Asia has endured, that has caused the culture, beliefs, traditions and religion to evolve, thus making it diverse. P1

#### 6.07 Anthropology

**298** Sacred Awareness. Eric Campbell <ecampbel@umbc.edu> (University of Maryland-Baltimore County, Baltimore, MD )

Sacred beliefs and values are universal in human societies because they are necessary for the stability of large, cooperative human groups. Such functional explanations of sacredness appear in popular books, exposing societies to what, by these authors' own lights, are highly dangerous truths. However, there is little acknowledgement of these dangers and no proposals to address them. My paper first explains why the kind of awareness these explanations offer is dangerous. Second, I argue that just such awareness is nevertheless uniquely positioned to serve as an ecumenical sacred value in the modern world. In The Righteous Mind, Jonathan Haidt purports to defend religion against its atheistic detractors by arguing for its social utility. A central element of his strategy is to argue for the social importance of sacred values. Sacred values are characterized by their priority and 'forbiddenness'. They are prior in the sense of being those to which other values and desires must occasionally be sacrificed. They are forbidden in two importantly different senses. First, it is not permitted to reject or seriously question them. Second, and the focus of this paper, is that sacred values (and their supporting mythologies) constitutively resist being understood or legitimized solely in the sort of socio-functional terms common to Haidt and other authors (e.g. Yuval Harari's best-selling Sapiens). Haidt agrees with anthropologist Christian Smith that all socio-moral groups are organized around sacred values, and with Durkheim that sacred values are 'set apart' and 'forbidden' from the 'profane,' or ordinary concerns of life. But the effect of Haidt's (and Harari's similar) explanations of sacred values is to violate this sense of 'forbiddenness'. By their own lights, we should expect that if a critical mass of people were to accept these explanations, a core socio-functional element of sacred belief would be undermined, which in turn should constitute a fundamental threat to modern cooperative human societies. If sacred values are crucial to modern socio-moral groups, but they cannot survive a basic awareness of their nature and function, this suggests that we attempt to limit the relevant forms of awareness. Indeed, there is excellent evidence that this has been the dominant strategy in human history. However, apart from its other downsides, undertaking this strategy consciously raises fundamental practical problems that the heretofore unconscious strategies did not face. Instead, I argue that one of the most important tasks facing modern humanity is to find sacred values that can survive and flourish in the face of the relevant forms of awareness. My proposal is that there is one value uniquely well-positioned to take on this role, namely that of awareness itself. In addition to the many 'profane' benefits increasingly discussed by researchers into mindful awareness, I explain why developing awareness of both the 'first-personal' sort associated with Eastern meditative practice, and the 'third-personal' variety associated with Western science, possesses the sacrificial and transformational potential necessary to serve as a genuinely sacred value, one especially appropriate to contemporary socio-political challenges. P1

#### 6.08 Information technology

#### 6.09 Ethics and legal studies

**299** Ethical Business Organisations and Corporate Social Responsibility Madhuri Malhotra <madhurimalhotra@gmail.com> (Ethics And Finance, Loyola Institute of Business Administration - Chennai, Chennai, TAMILNADU India)

A systems thinking emphasises on the interrelationships rather than linear cause-effect chains and seeing processes of change rather than snapshots (Senge, 1990). The whole has one or more defining properties or functions. Each part in the set can affect the behaviour or properties of the whole. There is a subset of parts that is sufficient in one or more environments for carrying out the defining function of the whole. The way that each essential part of a system affects its behaviour or properties depends on the behaviour of one other essential part of the system. It depends on the interrelationship of various components in a model (system). System thinking approach can be applied to business models as well. One of the areas where system approach tends to maximise the benefits is corporate social responsibility. Corporate social responsibility has been defined in many ways by researchers, however, agreement on how the idea of corporate social responsibility should be implemented in organisations, still remains a question amongst academia, businesses and society. This gap is problematic for corporations because they are increasingly being required to align with societal norms while generating financial returns. The following definitions seems to capture the essence of corporate social responsibility in business organisations: corporate social responsibility is a business system that enables the production and distribution of wealth for the betterment of its stakeholders through the implementation and integration of ethical systems and sustainable management practices. The components such as production and distribution of wealth, stakeholder management, ethical systems, sustainable management practices, compiled with the application of a systems approach makes the definition of corporate social responsibility conclusive. This paper presents a conceptual overview of the system's approach applied to concept of corporate social responsibility. A comparison between system approach to CSR (corporate social responsibility) and theories presented in this paper and importance of system approach is highlighted. An in depth review of the definition and supporting concepts will provide the needed vision and knowledge to enable corporations to successfully manage CSR strategies. P1

**300** Consciousness and the Art of Birthing: From Bioethics to Ontological Politics. Kala Perkins <quasar9@mac.com> (Bioethics, Graduate Theological Union, Woodside, CA)

Our new biotechnological capabilities have brought us to the frontier of the meaning and integrity of birth and personhood. Questions of legal and biological parenthood, best interests of the birthing agents and dangers of exploitation interface with the international dynamics of surrogacy, autonomy and responsibility. We are being called upon to develop a new moral spectrum to protect the dignity and autonomy of life. Ethical and legal challenges continuing to arise, with attempts to safeguard against commodification and exploitation of human beings. Gamete and embryo preservation through freezing presents diverse social, cultural and legal considerations. This presentation explores several of these political, social and legal dilemmas with reference to specific cases with their ethical and moral challenges. What is birth and what is being born? When and how does consciousness arise in bio-systemic correlations with formative organics? What is our responsibility for the bio-systemic integration of consciousness and life across the socio-cultural and species spectrum? What is the relationship between consciousness and in-form-ation that implicates an ontological identity termed life, and what is the cosmological implication of that integer? With our understanding of the topological correlates of complexity and life expression, what may be the multi-varied implications of our reconfiguring the biodynamics of global life? **P2** 

#### 6.10 Education

301 Zusatze\*/Neuro-Noetic Illuminatrix/Neuro-Noetic Scapes: Learning Curriculum Design And Implementation As An Heuristic For Realizing A Neuro-Noetic Mapping, Imaging, Imagining, And Information System. Michael Landis, Dr. Madeline Seltzer <mlandis@manor. edu> (Liberal Arts, Manor College, Jenkintown, PA)

#### The Science of Consciousness TSC2018 | Tucson, Arizona

For almost twenty years now, my academic colleague and I have guided students at Manor College--a two-year private post-secondary institution, serving largely first-generation, economically and educationally disadvantaged students in the metropolitan Philadelphia, Pennsylvania region--through an interdisciplinary, team-taught English Composition course sequence, with its constitutive curriculum: a learning interface which immerses students both cognitively and experientially in what is effectively a Multi-Modal Neuro-Noetic "Imaging Lattice." This "Imaging Lattice" functions as an interface for imaging and imagining the multi-faceted complexities of the Neuro-Noetic "landscapes" (the "features" and "contours" constitutive of "brain" as well as the more-difficult-to-access-and-re-present emergent attributes of "mind,": both referents in David Chalmers' illuminative Easy Problem/Hard Problem binary/dichotomy). What we have learned longitudinally through these two decades of curricular and pedagogical experimentation and co-learning is that ultimately, through developing fluency in and flexibility with the conventions of English Composition as a primary mechanism for Neuro-Noetic "examination"... "imaging"... and "imagining"...experiencing the capacities of the multi-modal "illuminative" junctures -- in the contexts of this team-taught post-secondary interdisciplinary English Composition course sequence (with its constitutive curricular content, comprised of readings and assignments associated with key multi-disciplinary contributors to the history of ideas related directly or obliquely to neuroscience and noetic science, e.g., Plato, Joseph Campbell, Stuart Hameroff, Roger Penrose, Guiolio Tononi, David Chalmers, David Eagleman, Daniel Dennett, Brian Swimme, et. al), students begin to re-cognize the value of critical writing--the thinking that is composition--critical reading--the thinking that is reading--critical thinking--the thinking that is logical reasoning--and critical creativity--the thinking that is imagining--as well as the value of their own agencies in these modal processes. These processes, in effect, function as integrated, accessible, dialectic/self-amplificatory learning algorithms conducive to more robust cognitive and experiential encounters with the complex facets of the Neuro-Noetic "landscape" (including consciousness as such...or determinate re-presentations of consciousness in diverse emergent iterations). Through our poster presentation, we hope to give conference participants a kind of tableau--a somewhat fixed "objective reduction"--of nearly twenty-years of dynamic interaction and synergetic dialectic/recursive co-learning vis-a-vis the above-mentioned designed learning interface.\*Note "Zusatze" is a German word employed by the early editors of Georg Friedrich Wilhelm Hegel's pioneering Neuro-Noetic assay, entitled, in English Translation, "The Philosophy of Mind." "Zusatze" translates into English as "additions" or "addenda"; in many editions, editors and translators of Hegel's classic work include the zusatze--essentially, footnotes in the footers of his pages, below clearly demarcated textspace limen. However, resonant of Hegel's dialectical system, the zusatze take on a more metaphorical/tropological significance: the unfolding of consciousness as such through its multi-faceted determinants or iterations, as instrumental in the PanPsychic process of "Spirit re-cognizing itself as Spirit"--Latent Universal Consciousness as such becoming Realized or Actualized through dialectic process... P2

**302** Opportunities for Critical Thinking About Alien Abduction Experiences in a Course on Consciousness. Jennifer Lyke <jennifer.lyke@stockton.edu> (Stockton University, Galloway, NEW JERSEY )

This presentation discusses multiple opportunities for teaching critical thinking skills relevant to understanding alien abduction experiences in an interdisciplinary undergraduate course on states of consciousness. The topic of alien abduction experiences is rarely addressed in the standard undergraduate curriculum, and students frequently assume traditional explanations for these experiences, specifically that experiencers are either delusional or disingenuous, are accepted by the public and experts alike. On the contrary, the topic offers several opportunities to engage students in thinking critically about available evidence while developing specific analytic skills for exploring the complexity and conceptual challenges of the broader topic of consciousness. When presented with multiple viable explanations for aspects of the alien abduction experience, including medical, psychological, cultural, and historical factors, students must consider contradictory explanatory paradigms, the validity of various sources of evidence, and possibilities for synthesizing interdisciplinary perspectives. Students may also begin to appreciate the challenges of identifying objective rationale for complex, subjective experiences, of which alien abduction

experiences are only one example. Also, they must ultimately tolerate the ambiguity of exploring a state of consciousness with no accepted explanation. Finally, this topic provides the opportunity for students learn about their own judgments under conditions of uncertainty and understand the role of motivated and emotional reasoning in people's decision-making processes. In general, it is recommended that states of consciousness be more widely incorporated as topics in the undergraduate curriculum specifically because they offer these types of opportunities for developing critical thinking skills. **P2** 

**303** Impact of Demographic Variables on Organizational Commitment: A Study Amongst College Teachers. Gurusaran Sandhu <priyanshimittal19@gmail.com> (Dayalbagh Educational Institute, Agra, Uttar Pradesh India)

In the present study an attempt has been made by the investigators to study the impact of demographic variables on organizational commitment of College Teachers in the district of Agra, Uttar Pradesh. The investigators used Descriptive Survey method for the present study. The research is delimited to a sample consists of 110 College Teachers from Dayalbagh Educational institute which is situated in the district of Agra, Uttar Pradesh . The Random sampling technique has been used for the selection of sample. For the data analysis t- test has been used in the present study. It is found through the present study that the demographic variables that are Gender, Age and marital status do not differ significantly towards organizational commitment of teachers of the Dayalbagh Educational institute which is situated in the district of Agra, Uttar Pradesh. **P1** 

**304** The Power of Workplace Spirituality: It's Impact on Organizational Commitment Amongst College Teachers. Dayal Sandhu , Gurusaran Sandhu, Garima Sandhu <sandhu.dayal9@gmail.com> (Pedagogical Sciences, Dayalbagh Educational Institute, Agra, India)

Workplace Spirituality in its elementary constituent is consciousness, inter-linkage with one another and a superior existence, a sense of contentment, and value as well as implication to one's profession. The multidimensional concept of spirituality has a vast array of widespread span across organizational processes and systems. It is an area which has an impact on the subtle, subconscious system of a person, hence leading to various mental and physiological and thought involving changes. Organizational spirituality at the workplace is growing rapidly and people are looking for their spiritual needs at the workplace. They seek value, support and meaning in their lives and organizations are also getting positive work outcomes in the workplace where employee's spiritual needs are fulfilled. This research is intended to determine the impact of workplace spirituality towards employees' organizational commitment amongst college teachers. The organizational commitment has been treated as dependent variable and workplace spirituality considered as predictor variable for the research. The research employed normative survey method for the purpose of investigation. Accidental non-probability method of sampling technique is used to select seven higher educational institutions of Agra city of Uttar Pradesh. India and random probability sampling technique is used to select 420 teachers of six educational streams. The investigator used self-developed workplace spirituality questionnaire, organizational commitment scale by Dhar, Mishra and Srivastav (2002) to collect information of teachers and to gauge workplace spirituality and organizational commitment amongst college teachers respectively. A total of 519 copies of questionnaires were administered to teachers of selected seven college of Agra district, U.P.India and a total of 420 questionnaires were returned and properly filled. This study employed statistical techniques like Analysis of Variance (ANOVA), Tukey HSD Post Hoc Test, Pearson Product Moment Correlation Coefficient and linear regression analysis to obtain the results. The findings of the study reported that level of workplace spirituality and organizational commitment of college teachers of Agra City, U.P., India is found to be moderate. It is also inferred that there is statistical significant association and positive relationship of workplace spirituality with organizational commitment. The study further revealed that there is positive and significant impact of workplace spirituality towards organizational commitment amongst college teachers which is analyzed from linear regression analysis. This research suggested arrangement of workshops on yoga, meditation and other relaxation techniques and behavioral, technical and leadership training to the college teachers. It suggested minimization of work, simplification of rules and procedures, recruitment of competent, well educated and trained staff, recognizing a good work, frequent and

non-critical feedback to teachers on their performance. This research further suggested constitution of personnel management team in each college to resolve work related problems of teachers, leading to improvement in their total performance and enrichment of their work life and also prevention of political interference in the management and administration of college. **P1** 

## **305** Bringing Consciousness Studies To The Two-year College Student. Madeline Seltzer <mseltzer@manor.edu> (English, Manor College, Jenkintown, PA )

After attending two Science of Consciousness Conferences, a colleague and I decided that it was essential to introduce our students to the study of consciousness. The students at our small, 2-year college are usually first-generation college students from blue-collar backgrounds who are interested in eventually working as Veterinary Technologists, Paralegals, Nurses, Dental Hygienists, Dental Assistants, etc. These students enter Manor from rather parochial backgrounds that provided little room for critical thinking. We as instructors in a year-long composition course have felt the need to provide them with opportunities to examine their beliefs, introducing them to new ideas that they can examine and choose to follow or reject. Our course reflects Socrates' admonition to examine our lives because, as he so succinctly stated: "the unexamined life is not worth living." To deepen and expand this examination, we introduce students to the many facets of consciousness studies, including but not limited to the disciplines of Religion, Philosophy, Cosmology, Biology, Evolution, Literature, Psychology, Quantum Physics, and Neuroscience. We use a multi-disciplinary approach, using the pedagogy and methodology unique to the study of consciousness in these disciplines. Students are introduced to ideas of diverse thinkers such as Stuart Hameroff and Roger Penrose, Brian Swimme, David Eagleman, Joseph Campbell, Plato, David Chalmers, Giulio Tononi, Jakob von Uexkull, Carl Jung, M. Esther Harding, Thich Naht Hann, Pema Chodron, etc... In our poster, we will present assignments, activities, and student work as well as the pedagogical discoveries derived from our nearly 20 years of team teaching these courses. P1

## 306 Reading as a Conscious System: Innovative Digital Curriculum Design With an Approach to Kindle Reading Consciousness of Elementary Struggling Readers by Strengthening Reading Sub-systems. Swati Singh <ssanchal1084@gmail.com> (San Jose, )

This study outlines how reading consciousness should be enhanced in a group of elementary struggling readers and examines how such consciousness influences students' reading and writing skills. It is posited that consciousness "is the state" of awareness or, of being aware of an external object or something within oneself. The results of primary research based on surveys of struggling readers in US classrooms are presented. General Systems Theory (GST) framework and the use of digital tools is applied to build a teaching model and construct to improve reading consciousness. Our brain is identical to a conscious mind and can be described as a hierarchy of low-level decoding skills and high-level comprehension-making skills. The higher levels are the neural systems that process semantics, syntax, and discourse. Underlying these abilities are the lower-level phonological skills dedicated to deciphering the reading code. All these systems must function well for individuals to read quickly and make meaning from the text. Since long, educators have been working on panacea that will finally solve the problem of failing readers in our primary schools. In its well-known 2000 report, the National Reading Panel described the key "building blocks" of literacy: phonics, fluency, vocabulary, and comprehension. These building blocks contribute largely to enhance reading consciousness of an individual at different levels - Level 1: phonics which is consciousness of letter sounds, Level 2: vocabulary which is word consciousness, Level 3: fluency which is conscious articulation and pronunciation with appropriate pace, and Level 4: comprehension which is deeper, critical and inner awareness of the meaning of literature. Over the last several years, these building blocks have achieved a kind of celebrity status in the education world. Nowadays, many teachers take it for granted that any decent reading program should touch on all four. It is more effective for students, however, to focus on one reading skill at a time and talk about their application of that skill in a number of text samples. The participants of this survey- based primary research study are mixed race 5th grade students in the US who attend reading program sessions being run in their school to overcome their reading weaknesses. This study focuses on building up students' reading consciousness through the application of General

Systems Theory (GST) framework that works in iterations. It designs an innovative reading curriculum containing 10 lessons that follows a cycle of iterated lessons with some variations until we reach the desired level of students' consciousness. The desired state in this case is the enhanced consciousness or awareness of students for each reading skill, that makes them conscious enough to incorporate these taught strategies during their reading practice. **P1** 

#### 307 Artificial Intelligence (AI) - Towards Conscious and Intelligent Global Education.

Preetham Tadiparthi <tpreetham@gmail.com> (WIPRO Technologies, Cupertino, CA)

This paper discusses and proposes a tight control systems to make the world's educational systems more conscious and intelligent; impact of artificial intelligence in the domain of education with the help of integration between immersive technologies & AI. This is prepared with two aims in mind. The first was to explain to a non-specialist, what AI brings to Education, i.e. its goals, how it is built, and how it works. After all, only by securing a certain degree of understanding can we move beyond the science-fiction imagery of AI, and the associated fears. The second aim was to set out the argument for what AI can offer learning, both now and in the future, with an eye towards improving learning and life outcomes for all. Education is an odd bird: we all know it could be better, while at the same time it is the best it has ever been in human history. For the last two centuries, the world went through a great expansion in learning: our literacy rate skyrocketed from 12% to 88% worldwide, and Primary, Secondary and Tertiary education have all seen drastic growth (in schools and students), breaking records. Like computers and the internet, AI will alter both the face and function - the what, why, and how - of education. Natural Language Processing, machine learning, and crowdsourcing have boosted online learning and enabled teachers in higher education to multiply the size of their classrooms while addressing individual students' learning needs and styles. Over the next fifteen years, the use of these technologies like teaching robots, ITS & learning analytics in the classroom and in the home, is likely to expand significantly. Educators will rejoice as they're empowered to focus on the more personal aspects of education while students will enjoy personal one-one to attention for their focused personal development towards becoming a complete man as envisioned by Dr. Makund Bihari Lal founding director of Dayalbagh Educational Institute. By providing the student, their educator and their parents with a more accurate picture of their learning aptitude, the student has a competitive advantage. We discuss some of the trending and/or futuristic AI applications which can be change the face of the education from kindergarten till doctoral and research studies in universities. If done right, AI can augment and empower what universities already do; but continuing their missions of research, teaching and external engagement will require fundamental reassessment and transformation. Some challenges in blended new world of education are discussed i.e. effect on student's social development, if education occurs more and more online etc. Fields such as psychology and ethics will need to be applied to thinking about how people can more rewardingly work alongside intelligent machines and systems. It is still my belief that nothing can replace a good old-fashioned teacher, but we must also acknowledge that the teacher is only as effective as the tools they have to work with. Artificial intelligence may soon become a permanent fixture in the classroom, as common even as a teacher's aide. C9

#### 6.11 Entertainment

#### 6.12 Miscellaneous

**308 Environmental Conscious Consumer Buying Behaviour in Emerging Economic Scenario.** Nidhi Verma , Prof. Shalini Dubey <vermanidhi.92@gmail.com> (Applied Business Economics, Dayalbagh Educational Institute, Agra, Uttar Pradesh India)

In today's era, it is an alarming state as a lot of depletion is taking place due to innumerable made-made and natural actions which are affecting the environment largely. The present status is such which should entail long-term productive activities for a profitable and healthy living by turning them environmental conscious beings. This paper mainly examines the level of awareness of consumers buying behaviour towards environmental consciousness. It also explains the relationship between economic development and environmental consciousness. Furthermore, it also compares the impact of consumers buying behaviour in regard to environmental conscious-

ness on both the sample cities i.e. Agra and Delhi. To accomplish the objectives of the study a well-planned questionnaire has been prepared, in order to analyse the data appropriate tools has been used to draw meaningful inferences. This type of research is of vital significance to guide the global economy in the right direction of environmental conscious consumption which may lead to ultimate goal of making the Earth a place to live for us and for the coming generations again. **P1** 

**309** Thresholds: Weather Patterns Affected by Collective Human Consciousness. Kang Zhou , Wenhua Lu <13588030692@163.com> (Rocky Rose in Depth Research Group, Hangzhou, ZHEJIANG PROVINCE China)

Normal instability of multi-flow system can introduce self-organized patterns, most of which can be recognized and classified with precise, predictable models in meteorology, where the emergence of certain weather phenomena can be determined by thresholds, dictated by a group of key parameters. Examples of these are Reynolds Number that differs the turbulent flow with laminar flow. We can recognize the difference by our naked eyes if the snow is smoothly falling down, or is wrapped with swirled, mostly violent air stream and become a blizzard, or the critical diameter when dealing with Ostwald ripening for water drops telling that if condensation-based water cluster, or fog can last for a while. However, There are at least one class of abnormal weather pattern that seems to be intimately related to the consciousness or collective consciousness of humans, and cannot be accounted for by these fluid dynamics alone, even when we introduce the detailed concept of fluids instability. It has been discovered that there seems to be a correlation between chanting the sacred mantra of Buddhism and the formation of solar halo, aureole, or glazed cloud. As the evidence accumulates, it seems that the local weather can have an appreciable change, when there is a dedicated spiritual ritual on the ground. According to a number of convincing observers, the formation of these phenomenal weather patterns have several features showing the exact relationship between the rainbow and human's collective spiritual progress. 1. The aureole or glazed clouds appear at exactly the right pace with the ritual going from one phase to the next. 2. the shape of the clouds, or glazed clouds thus produced, contain the images, or religious totems like dragons, birds, or other spiritual creatures depicted in the sacred scripture that are not supposed to appear naturally. 3. The probability for the the aureole, or glazed cloud to show up is not necessarily determined by the number of people participating the ritual. Instead, the experienced practitioners said the -alignment of the heart - or the convergence of collective intent is the key for the OMEN to happen. 4. The images in the sky cannot be the illusion of the practitioners. Since they appear in the sky, they have been spotted on a much wider scale by other local people, thus qualified to be named as "non-local". These features contribute to the statement which claims "There are gods and goddesses in nature (both earth and sky) and they are interacting with our thoughts and emotions". And the spiritual ritual itself do exert a non-local influence to the physical world. More study needs to be done in order to decipher how certain mantra can have such influential effect on the physical environment, and the principles of how the patterns sponsored by "spiritual realm" can interact with physics, impinging new organizational behavior of the fluids system that in turn gives us mysterious interpretation of the belief system the religious followers hold true. P2

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### TSC 2018 Integrated East-West Forum Plenary Abstracts

## Complete Neuro-Theology as Ultimate Reality Science of Consciousness

#### Revered Prof. Prem Saran Satsangi Leader of Radhasoami Faith, Dayalbagh and Chairman, Advisory Committee on Education, Dayalbagh Educational Institutions, Dayalbagh, Agra, India

Radhasoami philosophy (based on 'Saar Bachan') revealed by Param Purush Puran Dhani Huzur Soamiji Maharaj two centuries ago has consistency with other extant spiritual meditational practices of the world (to name a few, Buddhism (Buddhavacana), Jainism (Agamas), Christianity (Bible), Islam (Koran), Sufism (e.g. the Masnavi of Maulana Rumi), Sikhism (Guru Granth Sahab) and Hinduism (as represented by Vedas, Upanishads and Gita). In contrast, much of Western scientific and philosophical study of consciousness takes place in a secularized setting. To facilitate this integration, we have generalized the modelling framework for contextuality based quantum teleportation to n-dimensional quantum states, or n-qudits (quantum odd-prime based units) which holds considerable promise for even higher mathematical abstraction.

Leading scientists like Stephen Hawking and Max Tegmark find that we are in the age of superintelligent machines and are a little worried and propose our safety as the major requirement. We believe that the Supreme Creator has already provided for that safety and what they dread is indeed, the Ultimate Reality, so there is no need to dread that. The Supreme Creator is behaving as an innovative entity and His actions conform to Hilbert vector space and Schrödinger's equation and the associated wave function and this is baffling scientists as they do not want God to be identified as a mathematical construct. Once we become spiritual subtle particles, we are not bothered any more about these trivial things of the physical world as we have crossed the physical world. We are in the Universe of Mind, let us say, and that is where the Hindu philosophy and much of the philosophy anywhere else ends. We are the only ones (i.e. religion of Eastern Saints) who go way beyond that and we know that one day, the Universe of Mind has also to be wound up (Great Dissolution) and it will be all Purely Spiritual Universe and that is the ultimate reality, but this will take infinity to the power infinity time to complete its mammoth task of providing this benefit to infinity to power infinity size of people. They are not all here on this earth for us to be aware of them, but they do exist, some of them in subtler particle shapes, some of them in very much less fortunate births which often require deaths, so they are caught in this cycle of birth, death and rebirth and they are not able to break out from it. This is the kind of task which involves particle size which are much smaller than the 10-35 metre known as Max Planck dimension and which is what distances larger than 1010 light years. All these begin to fall in shape and begin to fall in our inner range of experience if we stick to the philosophy such as what we follow. There are other groups also following similar philosophy also and they are enjoying this kind of benefit. We are not the only ones, but like several schools, we are content only with Ultimate Reality, so this is where we differ. We promise and we experience through our Mentor the Ultimate Bliss, full state that we all aspire to reach where there is nothing but happiness all the time, what we characterize as bliss. That explains the motivation for leading a sort of disciplined life and doing selfless service to the community.

## 'Quantum Pan-Protopsychism' : A Philosophical Approach to Consciousness Accommodating Both East and West

Stuart Hameroff MD Professor, Anesthesiology and Psychology

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#### Director, Center for Consciousness Studies Banner-University Medical Center The University of Arizona, Tucson, Arizona

Pursuing the essence of the 'hard problem' of conscious experience, philosophers and neuroscientists are turning from ideas about emergence and complexity of brain neuronal activities to panpsychism, the notion that 'qualia', phenomenal experience, feelings and awareness are somehow fundamental properties of matter. Such approaches move toward ancient spiritual traditions such as idealism in which consciousness is all-pervasive and omnipresent. But resorting to panpsychism opens other problems for scientific approaches: 1) At what level of matter does experience occur? Is it at the level of molecules, atoms, nucleons, quarks, or the structure of spacetime geometry? 2) How do myriads of presumably primordial micro-experiences at these tiny levels combine into full, rich conscious experience? 3) At molecular, atomic and subatomic levels, the laws of quantum mechanics reign, and particles become wave-like quantum superpositions of multiple possibilities, then 'collapsing' ('reducing') to definite states ('quantum state reduction'). Penrose has suggested superpositions evolve as separations of mass and spacetime curvature until reaching an objective threshold ('objective reduction', 'OR') at which they spontaneously reduce to definite states, accompanied by qualia. In the environment, such individual OR qualia are random, evanescent, lack memory and meaning, and deemed 'proto-conscious'. However when combined by quantum entanglement, and 'orchestrated' ('Orch OR') by biological microtubules or other means, full, rich conscious experience can be bound together. Orch OR theory thus bridges and accommodates both scientific and traditional spiritual approaches to consciousness.

### An Experiential Understanding of Time

#### James J. Barrell Department of Psychology University of West Georgia

Time is an important part of our consciousness. I will present an understanding of time based on the application of an experiential method (Barrell 1975, Price and Barrell 2012, Barrell J.J. and Barrell, J.E. 1976). We can experience ourselves moving toward a future. This is most evident when we set goals. However we can also experience a future coming to us. An example is our experience that the sun rises and falls every day. There are those days that time appears to fly by as well as those days in which it appears to drag on forever. How can we make sense out of all this?

We can take a conceptual perspective and conclude that as speed increases time slows down. But what does this mean from the position of our own direct experience? How can we verify such conclusions in terms of our everyday lives? This presentation will address such issues as the dimensionality of time, the relationship of time to movement, the possibility of an overall experiential model for the understanding of time and how this relates to our conscious experience.

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## Evolving Supermen, New World Order and Pure Spiritual Consciousness: An Eastern Perspective

Bani Dayal Dhir

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Keywords: Superman, Arya Nagar, New World Order, Pure spiritual consciousness

In our life style of Better Worldliness, we require to awaken our inner spiritual consciousness where there is the kingdom of our Inner True Self, rather than the rule of and authority of mind, intelligence and matter alone. - Revered Prof. P.S. Satsangi

The concept of superman has always intrigued us, has often seemed far-fetched and at times almost an impossibility in a world governed by pragmatism. The expression 'Superman' has found a direct or an indirect mention in the philosophical texts since the time of Plato. Even as we move towards the Indian civilization and explore the philosophical thought of Vedic culture or Upanishads, we may find references to Superman. Nonetheless, our quest for Nietzschean Übermensch, Shavian Superman and Aristotelian Magnanimous man is still continuing. Who is not aware of Plato's dream of an ideal Republic and the humanist thinker Sir Thomas More's Utopia? Even after centuries the treatises are admired for their rhetorical beauty, theoretical depth and astounding vision, but, unfortunately, they have remained mere abstract philosophies with no concrete exemplification till date.

In a paradigm shift from 'abstract theory' to 'practice', the paper foregrounds the Eastern Radhasoami Saints' perspective of Superman, showcasing the making of a superman in the age of superintelligent machines at Dayalbagh, the Garden of the Merciful. Huzur Sahabji Maharaj, the August Founder of Dayalbagh, propounded the concept of Superman and unfolded His dream of creating 'Arya Nagar', an ideal place on this earth. Radhasoami Spiritual Philosophy defines philosophy as a way of life, an experience, and not simply an abstract system of knowledge. Unlike the dreams of philosophers and humanist scholars, the dream of 'Arya Nagar', dreamt by the Supreme Lord Himself, is already being realized in concrete terms at Dayalbagh. Revered Prof. P. S. Satsangi Sahab, the Supreme Architect Himself, has translated the dream into reality by launching the 'Supermen Evolutionary Scheme' at Dayalbagh for infants and toddlers in the age group of 3 months to 3 years. The "Aryas of Dayalbagh", would blossom as 'Supermen'; not due to some magical powers or extraordinary technical abilities as one might assume, but adorned with the power of values and qualities, these supermen would transform the world into an ideal abode which we call, in Saintly parlance, "Arya Nagar'. Recalling Ervin Schrödinger, who wondered almost 75 years ago if quantum mechanics played any role in biology, the discussion would allude to some aspects of Quantum Biology while presenting the notion of Dayalbagh Superman.

Moving from descriptive mode to comparative mode of analysis, the paper would juxtapose the Eastern and the Western notions of superman, unravelling the distinctness of the Eastern perspective. The Supermen evolving in the Garden of the Merciful, exemplify a 'New World Order' which is defined in scientific terms by Revered Prof. P. S. Satsangi Sahab as the model of 'Sigma 6Q way of Dayalbagh life'. The path which the budding supermen are treading would ultimately lead to the state of Pure Spiritual Consciousness as they imbibe the highest value and quality system engrained by the Supreme Saints.

The conclusion would propose the conversion of world into a 'big Arya Nagar' as the only elixir for the world ailing with casteism, racism, materialism and sectarianism. Further, contextualizing the Supreme Saint's dream in the era of Superintelligent machines, the conclusion would

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assert that the supermen endowed with qualities and values, engaged in a new method of devotion, spreading the message of 'Fatherhood of God and brotherhood of man' would control and prevent the misuse of Superintelligent machines, thus bringing respite to the anxious and worried scientists, about "Being Human in the Age of Artificial Intelligence" (Max Tegmark, 2017). The machines developed by supermen, through coordination, innovation, qualities and values would be beneficial for the society and mankind.

## Pattern of linking all possible events of the universe is not random, it is a composition of 12 self-repeating patterns

Anirban Bandyopadhyay

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In the existing world of information processing, information is a "bit" 0 or 1 waiting for a human to give it a meaning. A "bit" has no significance of its own. It is also based on a hypothesis that every single event that is happening, has happened and will be happening in the world irrespective of its complexity, could be regenerated as sum of simple events. This is called sequentialization, this is considered the total destruction of true information that links events in nature. Then, we build up scientific models to regenerate it. Following this procedure, for a century we have been analyzing events in nature, developing scientific protocols. Preserving the purity of integration of events as it happens in nature is important. It is the basic core of all science & scientific models. Historically, there was always a suspicion, possibly nature is not sequential, but, any event that we see in nature is a passage to an endless journey of events within and above. In the Turing philosophy, linear linking was considered absolute. All other possible connections were never considered important. The world of connecting events within and above was considered impossible, undefined, and if one cannot make equations or differentiation, then, what is the point of studying it. So, historically, scientists have always found a way to bypass such singularity. Our journey is through singularity, we consider that every single event that has happened, hapenning and will happen are all linked by a topology, at a time we see only one event as a single point by there is an endless journey within and above. We propose that discrete isolated events are not random they are linked by a topology, but that linking, even if regulated by free will cannot be random. Free will is random only when we want to confine it in a linear sequence. However, if we want to see it as a topology growing within and above, it follows a mathematics, choices of the number system, a pattern, that never repeats itself, yet not random.

## No-Self, Self-Awareness, and the Sense of Agency

Rocco J. Gennaro University of Southern Indiana Evansville Indiana USA

The notion that there is really no "self" is a common feature of some Eastern Philosophy, especially within some versions of Buddhism and Indian Philosophy. This is sometimes called the Buddhist "no-self" or "not-self" (anattā or anātman) doctrine. Yet it seems to conflict with the also fairly common view that each conscious mental state essentially involves an element of "self-awareness" or "reflexive awareness." There is also, in certain circles, the widely held notion that we each have a "sense of agency" when we act in various ways. In this talk, I will spell out these apparent contradictions and examine some attempts to avoid them. I will also show how holding the higher-order thought (HOT) theory of consciousness can be of great benefit in this

task, particularly as opposed to some other contemporary theories of consciousness.

## Electroconductive Properties of Microtubules, Actin and Kinesin: Physical Force, Energy, Power and Information Considerations

Jack A. Tuszyński Department of Oncology & Department of Physics University of Alberta, Edmonton, Canada

We provide an overview of the modeling performed at both atomistic and coarse-grained levels in order to gain insight into electrostatic and electroconductive properties of the cytoskeleton. Computer simulations and experimental measurements carried out for microtubules and actin filaments are presented. Charge and dipole values for monomers and dimers as well as polymerized forms of these proteins are summarized. Continuum approximations for cable equations describing actin filaments and microtubules compare favorably to measurements in buffer solutions showing soliton waves and transistor-like amplification of ionic signals. In addition, experimental evidence for memristive behavior of microtubules supports their hypothesized role in memory storage and information processing. Conductivity and capacitance of tubulin and microtubules have been measured and modeled. A dramatic change in conductivity occurs when tubulin forms microtubules. In living cells, this signals a conductive phase transition coinciding with mitosis in dividing cells. Finally, we provide estimates of the forces, energies and power involved in the action of electric fields on microtubules and kinesin motors. These calculations are compared and contrasted with typical values experienced at a cell level.

## Can Quantum Decision Theory Help in Advancing Consciousness Science?

Subhash Kak Regents Professor, Oklahoma State University Stillwater, Oklahoma, USA

Much work in the field of consciousness science concerns how the capacity of consciousness might be supported by quantum processes within the brain. Here we take a different tack and ask if quantum decision theory can help us understand the phenomenon of consciousness. Considering first the question of modeling of beliefs, we argue that evidence supports that beliefs are not classical statistical variables and they should, in the general case, be considered as superposition states of disjoint or polar outcomes. We show how the well-known disjunction effect, which is the false judgement that the probability P(A or B) is less than either P(A) or P(B), may be understood from the perspective of the belief as a quantum vector. We compare classical and quantum decision trees with regard to performance in different systems and ask if real data in healthcare, related to use of different treatments, favors one over the other. We hope this approach will help frame question regarding consciousness in a form where different hypotheses can be tested with data that can be easily obtained.

## **Twentieth Century Varieties of Dual-Aspect Thinking**

Harald Atmanspacher Collegium Helveticum ETH Zurich Switzerland

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The program of naturalizing the mind is conventionally understood as the attempt to reduce whatever appears mental to physical explanations. In recent decades this has become a central motif in cognitive neuroscience and consciousness studies, where it features as the reduction of conscious states to brain behavior. On the long run, the resulting physicalism can be viewed as a counterposition against both idealist positions and Cartesian dualism.

However, there is a tradition of dual-aspect thinking in which both the physicaland the mental are construed as aspects of an underlying reality, which is itself neutral with respect to the mind-matter distinction. I will present and compare some of the variants of dual-aspect thinking in the

20th century, such as Bertrand Russell's neutral monism, the holistic dual-aspect monism of Wolfgang Pauli and Carl Jung, David Bohm's implicate order, and naturalistic dualism due to Dave Chalmers. They can all be viewed as versions of a naturalization that aims at a concept of natura beyond the duality of the mental and the physical

nature beyond the duality of the mental and the physical.

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## 9. Peak Experiences, Mystic Experiences and Epiphany: Are these same? An analysis of Practitioners of Surat Shabda Yoga

#### Sumita Srivastava, Anjul Dayal

This paper presents descriptions of peak experience, mystic experience and epiphany collected from 25 employees practicing Surat Shabda Yoga. These descriptions were compared parallel to the data collected from the control group (n=105). The experience questionnaire (Privette 1987) was administered on both the groups which consisted of a narrative description and a series of Likert type scale questions. Maslow advocated that peak experiences universally happen and he did not associate them with mysticism and epiphany. This study was conducted to offer a collection of experiential correlates of such events to examine if the major theoretical descriptions of the subjective characteristics of the event were consistent or not. A multivariate analysis of variance followed by t test indicates a significant difference in the two samples.

## 10. Do Self Actualized Employees Gain 'Being' (B) Values Through Peak Experiences? An Experimental Study

#### Sumita Srivastava, Anjul Dayal

Abraham Maslow describes peak experiences as the sudden feelings of intense happiness and well being possibly by awareness of an ultimate truth. These are termed as one of the mystical experiences. Transpersonal psychology theory suggests that people, who are high on self actualization need, experience peak experiences epiphenomenally. In a famous article 'Towards Psychology of Being', it is discussed that peak experiences result in short term as well as long lasting effects. To explore the possible connection of need for self actualization, occurrence of peak experiences and development of being values among employees, an experimental study was conducted. In a blended experiences in the past, participated as the experimental group. The other employees comprised the control group. The experiment was designed to observe the Being values of the subjects in an organizational setting where individuals were given tasks to perform as a team and were responsible for the achievement of the group goal. Thus, B values of subjects were observed by simulating organizational environment. Qualitative data from individual subjects was also recorded to further confirm the data derived from the observation and this helped in drawing the inference. Both qualitative and quantitative analyses confirm that B values are

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higher in experimental group. Additional information about the subjects regarding their practice of Surat Shabda Yoga was also recorded to further test if practice of Surat Shabda Yoga significantly carries the effect of peak experiences on being values. The results obtained through Sobel's test reveal interesting findings.

### 12. Evolving Quantum teleportation circuits using NEAT

#### Vaibhav Kumar

A majority of the quantum theories of consciousness exploit the power of mathematical abstraction for providing a generalized model, Srivastava et. al. [1] have shown that higher level of mathematical abstractions may be well suited to understanding consciousness. A generalized view by Srivastava et. al. [2] has a promising modelling framework for contextuality based quantum teleportation using n-qubits and generalizing it for n-qudits, by extending the single quantum twostate system to a n-dimensional quantum system or n-qudits where n can even be infinite. So, to model consciousness it is imperative to model efficient quantum teleportation circuits.

In this work, we show that quantum teleportation circuits can leverage evolutionary genetic algorithms [3] to make them more efficient using Quantum entanglement. The set of quantum gates and circuits will be evolved using NeuroEvolution of Augmentation Topologies (NEAT).

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[3] Kenneth O. Stanley, Department of Computer Sciences, The University of Texas at Austin. Risto Miikkulainen, Department of Computer Sciences, The University of Texas at Austin, "Evolving Neural Networks through Augmenting Topologies".

## 15. Meditational Spiritual Intercession and Recovery from Disease in Palliative Care : Decoded by Integrated Information Theory (IIT)

#### Siddharth Agarwal, Sapna Agarwal

Human body is a biological, open system and maintains itself in the changing environment. Disease state is cured by many medicinal systems for healing. Esoteric healing (through introspective hypnosis, meditation and spiritual intercession) is the system where its believers regard Supreme Being as Omnipotent, Omnipresent and Omniscient. Such persons take ill health as a boon and pray through meditation that He may by His Mercy grant health or if God wishes otherwise, they happily accept it so that they keep moving ahead on their spiritual path. This study is an observational trial ,where we have applied Integrated Information Theory(IIT) ,with phi as a physical measuring unit, to measure the effect of spiritual intercession on the outcome of the diseased person, where results clearly point towards better psychological and spiritual healing in patients who believe in esoteric cures. Modern science in terms of cognitive psychology or neurophysiology has begun to emphasize the role of consciousness but, that is confined only to the physical world. It is only with the advent of Param Purush Puran Dhani Soami Ji Maharaj (200 years ago) that in the religion of Saints, the ultimate consciousness or the Super Consciousness of the highest order has been revealed. Proponents of Integrated Information Theory (IIT) have proposed the construction of a "consciousness meter" that measures the phi (consciousness of any system), from an i-phone to a brain dead patient.

## 17. An Evidence of Journey Into Higher Consciousness - Near Birth And Near Death Observations

#### Anjoo Bhatnagar, Phoolchand Bhatnagar, Vijai Kumar

We have in this study compared the clinical signs, symptoms, reflexes and EEG findings at the time of beginning and end of life. There are certain unusual and striking similarities in these which makes us think of phenomenon beyond physical and mental planes of consciousness. This phenomenon can be explained by correlating it with eastern philosophy of birth, death and rebirth and existence of spirit and its ascent and descent in human frame and attaining highest form of consciousness at the time of death according to Religion of Saints(Radhasoami Faith).

## 18. Surat Shabda Yoga - Quantum teleportation and entanglement meets its counterpart in Eastern Spirituality

Swati Idnani, Suresh Idnani, Sneha Idnani, Teena Idnani

In western science, quantum physicists have been fascinated and are actively exploring the possibility of teleportation - a process by which quantum information (e.g. the exact state of an atom or photon) can be transmitted (exactly, in principle) from one location to another, with the help of classical communication and previously shared quantum entanglement between the sending and receiving location. Quantum teleportation is not a form of transport, but of communication; it provides a way of transporting a qubit from one location to another, without having to move a physical particle along with it.

An important aspect of quantum information theory is entanglement, which imposes statistical correlations between otherwise distinct physical systems. These correlations hold even when measurements are chosen and performed independently, out of causal contact from one another. Thus, an observation resulting from a measurement choice made at one point in spacetime seems to instantaneously affect outcomes in another region, even though light hasn't yet had time to travel the distance. When we relate the two i.e. Surat-Shabda-Yoga's underlying principles with that of the varying amount of research going on within the Quantum teleportation realm, there is a lot of similarity to be found.

## 23. Consciousness and Cognition: Extrapolations from Bacterial Studies for Understanding Neural Behavior through Imprints of Social Intelligence Conserved across Life Forms

#### Tatavarty Neh Satsangi, Raj Kamal Bhatnagar, Tatavarty Guru Sant

A parallel of forms of social intelligence evolution is happening at higher forms of life also and is being investigated intensively. Meditation, considered as platform of social intelligence and consciousness, has been shown to induce profound alterations in individuals to trigger altered brain functions. Correlation between mediation induced morphological changes in cells (telomere length) and accompanying biochemical events in practicing individuals are becoming more apparent.

According to the unified field superstring theory, waves of vibration flow from everything in universe impacting the collective consciousness. As a consequence of such oneness group meditation has been shown to amplify the consciousness behavior of participating subjects. Such perception is enhanced in the presence of a mentor, who facilitates and directs the flow of waves of mentee. A special attainment is achieved by establishing the bond between mentor and mentee

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(Katho Upanishad). Investigation of such paradigms in human species has revealed acquisition of social and individual intelligence through meditation practices under guidance of the mentor and it probably represents direction of human evolution. These observations may form basis of investigation for benefits of satsang community and group meditation at specified time in the presence of the mentor. The presentation will explore analogies of bacterial quorum sensing and group meditation to reach higher level of functionality or consciousness during community meditation practices.

## 27. Nature and Brain : Integrated study of Inner Experience and Brain Oscillations

Pooja Sahni, Jyoti Kumar, Prakash Sahni

Being in nature can yield conscious experiences that can potentially alter our process of thinking. Studies show that experiences (i.e. patterns of neuronal activity) can modify the synaptic circuitry of the developing brain. Such changes in neural activity of brain and in behaviour can be measured using EEG and through cognitive experiments of psychology (Price and Barrell, Inner Experience and Neuroscience). EEG studies have provided evidence of enhanced structural plasticity, brain synchrony and neural oscillations. In the first phase of the research, we used psychological tests to study the correlation between nature connectedness. Consciousness Quotient (measuring seven aspects of life: physical, emotional, cognitive, social-relational, self, inner growth and spiritual) and pro-environment behaviour. Significant correlations between Consciousness Quotient and the pro-Environmental behaviour (r=0.738, p<0.01) were demonstrated. Further analysis deduced that pro- environment behaviour among subjects correlated positively with the spiritual consciousness (r=0.761, p<0.01) inner growth (r=0.736, p<0.01) and cognitive or mental consciousness (r=0.641, p<0.01)- sub-factors of Consciousness Quotient. In Study 2, Electroencephalography(EEG)was performed on participants by generating virtual experience through nature Audio-visual in lab. The results of study 1 and 2 were presented in TSC 2016 and TSC 2017 respectively. In the second phase, a mixed methodology approach is followed to comprehensively study the neuro-psycho pathways that are functional while engaged in natural environment. This study investigated the impact of nature experience on brain oscillations and affect through EEG, State Mindfulness Index (Tanay & Bernstein, 2013) and Qualitative first person subjective reports of inner experience (Price & Barrell, 2012) respectively. Results show that on EEG measurements of participants before and after natural environment virtual experience elicit increased power at the alpha frequency band known for creative thinking and consciously practicing mindfulness and meditation. Computation of noise free Alpha Asymmetry index, average score on State Mindfulness index and the first person subjective reports were further statistically analysed for correlations. Both Alpha activation and State mindfulness index indicated increased awareness and internal attention which further positively correlated with 'relaxation', 'free flow' and 'Ataraxia' main themes emergent from the first person subjective reports.

We are also proposing a Systemic model for eco-human interaction viz various attributes (components) of natural environment, based on the General systems theory and empirical data from the studies that could explain the neuro-psycho pathways that are functional while engaged in natural environment.

## 36. An Empirical Perspective on Meta-Cognition and Emotional Competence with Reference To Mindfulness

#### Kavita Kumar, Aysha Begum

Metacognitive thinking is a higher order thinking that involves active control of self over the thinking process. It brings an awareness of an individual's self as a cognitive thinker. The present

study intended to identify the difference in emotional competence between high and low metacognitive thinking among college students. Emotional competence refers to one's ability to express or release one's inner feelings, identification, understanding, expression, regulation and use of one's emotions and those of others in social settings. Students life is a time when students have to constantly deal with faculty members, peer group and interact with all age groups. This is the period where emotional competence and metacognitive thinking may play a crucial role in dealing with a number of issues.

The sample of the present study constituted 100 students between age range of 18-25 years. Two scales, Metacognitive Thinking Scale (Sandhu & Goyal, 2010) and Emotional Competence Scale (Sharma & Bhardwaj,1998) were administered and 't-test' was computed for data analyses. Results indicate that there is a difference in emotional competence between high and low metacognitive thinking among college students (t =3.82, p< 0.01). The results revealed that college students with high metacognitive thinking. The results would be discussed in reference to mindfulness. Various research findings have predicted that mindfulness plays a vital role in enhancement of metacognition and emotional competence.

## 41. Topological Quantum Chemistry of Tubulin Molecule

#### Pushpa Sahni

Several graph-theoretic approaches were proposed to predict the functions of proteins based on their shared neighborhoods (Samanta and Liang, 2003; Vazquez et al., 2003) or on their closeness in the PINs. Graph-theoretic approaches show that the topological characteristics of proteins complement their sequence and structural characteristics and enable transfer of their functional annotation (Sharan and Ideker, 2006; Yook et al., 2004). Protein function, such as enzymatic catalysis, ion channel opening, cell movement and information processing depends on regulated changes in protein shape, or conformation. Each topological atom is a quantum atom and vice versa, a property that enables the construction of a topologically inspired force field called Quantum Chemical Topology Force Field (QCTFF). Biological information processing can be explained by using topographic indices of biomolecules which signify the process of signal transmission that leads to the synchronized regulatory unit.

Topological advanced information processing systems will lead to the advent of super intelligence era. Current neurological explanations of consciousness suggest that it is a manifestation of emergent firing patterns of neuronal groups involved in specific networks. In human brain, microtubules are present in neurons and have been implicated to play an important role in function of neurons and the brain, and are purported to give rise to cognitive brain functions such as memory and consciousness. Quantum hopfield network model of the brain explains five levels of neural interaction for learning and association (Srivastava et al., 2016). Also graph theoretical applications in chemistry have undergone a dramatic revival lately. Constitutional (molecular) graphs have points (vertices) representing atoms and lines (edges) symbolizing covalent bonds. This is used to explore complete set of all possible monocyclic aromatic and hetero-aromatic compounds by a combination of Pauli's principle, Polya's theorem, and electro-negativities. Reaction graphs and synthon graphs differ from constitutional graphs in their meaning of vertices and edges and find other kinds of chemical applications.

Microtubules are the largest cytoskeletal filaments in cells, with a diameter of 25 nanometers. They are made out of subunits called tubulin. Each tubulin subunit is made up of one alpha and one beta tubulin that are attached to each other, so technically tubulin is a heterodimer. An Orch. OR qubit based on topological quantum computing specific to microtubule polymer geometry was suggested by Hameroff et. al. in 2002. Conductances along particular microtubule lattice geometry, e.g. Fibonacci helical pathways, were proposed to function as topological bits and

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qubits. Bandopadhyay (2011) has preliminary evidence for ballistic conductance along different, discrete helical pathways in single microtubules. The topology of microtubule lattices involves helical windings which repeat on any given protofilament according to the Fibonacci series (3,5,8,13,21...). Each of the winding patterns also corresponds with pathways along specific aromatic amino acid groups which may promote exciton or spin transfer along those pathways. If the winding patterns, rather than individual tubulin subunits are taken as qubits, then microtubules may be resistant to decoherence by virtue of topological quantum error correction. If any individual tubulins. There has been recent work towards addressing how symmetry constrains global band structures, but a complete and constructive approach to the problem has not yet been presented. So, our effort would be to combine group theory, chemistry and graph theory to provide a framework for topological quantum chemistry of tubulin molecule.

It is expected that in due course of time, mind-science (i.e. cognitive science) together with already advanced brain-science will develop so as to bring up the empirical sides upto the level where the details of spirit-mind-brain inter-connections will be actively probed.

## 42. From n-Qubit Multi-Particle Quantum Teleportation Modelling to n-Qudit Contextuality based Quantum Teleportation and Beyond

#### Dayal Pyari Srivastava

This talk further generalizes the modelling framework for contextuality based quantum teleportation presented at the previous East-West Forum (TSC 2017) to n-dimensional quantum states, or n-qudits (quantum odd-prime based units) which holds considerable promise for even higher mathematical abstraction (Srivastava, 2017). The proposed generalization extends the two states in the qubit model, to n states and this n could tend towards infinity. We are heading towards point-sized loops or fine-grained particles of nature, which have been rejected out of hand by string theorists. It is not physical reality when measured from the sense of Planck's length of 10-35 metre, but finer grained particles than Planck's length 10-35 metre may exist, although, they are not matter anymore. We argue that why stop at degree of freedom of three, but instead pursue quantum odd-prime based units with higher degree n such as 5, 7, 11, 13, 17 and so on till nth degree of freedom even tending to infinity. String theorists admit its multiple landscapes with higher degrees of freedom which points its uniqueness both for particles finer than 10-35 metre as well as distances greater than 1010 light years. Modern research by physicists and mathematicians including Roger Penrose, Max Tegmark, Nick Bostrom and Herbert Bernstein provides scientific basis to this work.

## 43. Western Scientific Techniques applied to study Eastern Meditation Practices in Dayalbagh Community

#### Mukti Sahni

The tools and concepts used in Dayalbagh community combine neuroscience and theological practices for scientific study, and are among the most modern ones available in the Western world such as 15-channel SQUID (Superconducting Quantum Interference Devices)-based Magen-to-encephalogram (MEG) installed in Magnetically Shielded Room as well as measures for social issues like Corporate Social Responsibility (CSR), a term coined by Harvard management gurus. We can observe the effect on the environment which can be measured without even being privy to these ultra-transcendental meditational practices, and this is the direction in which we are trying to measure Corporate Social Responsibility for a group of people who practise this and others as control group who do not practise this.

A survey conducted in April 2016 in India over all communities found that 38% employees log in extra hours for social work. A similar survey conducted over our community members all over the country from Kashmir to Kanyakumari and even further to Sri Lankan shores, including cosmopolitan cities, rural hinterland and tribal areas and, of course, the headquarters at Dayalbagh, found the corresponding participation level to be close to 100%, all the year round, with no expectation of any material returns (nishkam sewa, i.e. selfless service). We have found in this quest that it is best to pursue the golden mean instead of pursuing the extreme positions and we can also come up with measures which can be observed by anybody in the outside world. This raises great prospects of realizing possibilities and potentials for using this mode of ultra-transcendental yoga without even becoming an adherent or an initiated follower of the Faith.

Roger Penrose in his recent book (Faith, Fashion and Fantasy in the new Physics of the Universe, 2016), instead of subtler points, approaches the exponentiation a<sup>b</sup> where b and a both can tend to infinity, and not only that,  $(a^b)^n$ , all three can tend to infinity, so he is doing it on the other extreme side, whereas the quantum mechanics people approach it from the infinitesimally small size and they stop at strings of dimension one, but there is no reason to do that. As we reach higher integers, we have higher capabilities. Penrose figures that there have been a series of big bangs and they conform to what he calls as 'conformal cosmic cosmology'. So he proposes this rather than big bangs which take place in large numbers and the first big bang in the physical world is followed by other big bangs and there is inflation theory, starting with core of fusion reactors, it cools down very fast. Penrose concedes that to a certain extent, all these are justified but there must be a true worth attached with these and all such attempts are not likely to prove scientific in nature. For instance, he is not a proponent of string theory, he would rather promote the conformal cyclic cosmology, which he himself says might be called conformal crazy cosmology, so crazy in its outcomes, but all of them are saying about the same thing, there have been a series of big bangs. We find particles going to even smaller size, subtler than Max Planck's dimension of 10-35 metre and those are the ones which belong to Universe of Mind and Universe of spirit force and they have no problem in understanding the heat and light. They perceive it as very blissful, musical and ultimate abode for it. We need to resolve the inextricably linked problems of subtlest particles smaller than 10-35 metre Planck's length and large distances more than 1010 light years, and approach zero and infinity by application of logic and induction in the right way. Like Max Tegmark in his book 'Our Mathematical Universe', we also believe that it is this mathematics and its abstractions which will lead scientists to the ultimate reality and this is a very good evidence of such effort

Luckily at Dayalbagh, we have a confluence of people with the latest scientific techniques as well as people who are armed with this inner force of reality.

## 45. Control mechanism of Body and Mind to improve the academic performance of the students through yoga and meditation

#### Jyoti Arora, Ravindra Bhardwaj

According to the World Health Organisation, young generation experience a lot of stress and anxiety in their life. Stress is a significant problem which affects both physical as well as mental health of the adolescents. Stress is a situation where the organism's homeostasis is threatened or the organism perceives a situation as threatening. Ancient philosophy of ethical life style; yoga and meditation has beneficial effects on cognition, attenuation of emotional intensity and stress reduction. It integrates the personality by bringing body-mind-soul coordination in a well-balanced way. The present paper is specifically aimed at assessing the effect of yoga and meditation on the overall performance of the students. Statistically, the results are very optimistic in yoga and meditation. This practice can alter an individual's social, self, physical and emotional wellbeing. It

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also indicates that practitioners doing yoga along with spiritual intentions report higher psychological satisfaction than those doing yoga alone. Results suggest that yoga with meditation is a positive addition which can be an effective way to help students cope up with stress and focus on a specific task. Anxiety is one of the major problems among the young generation nowadays. Yogic intervention was found to reduce the anxiety level of the students and result in significant improvement in the academic performance of the students at university level.

## 49. Cyclic Time in Multiverses

#### Anand Mohan, P Sriramamurti, Hans Mohan

There are ways of knowing what is true about the Multiverses beyond science, including philosophy, mathematics, the humanities and social sciences, personal revelation, and religion. Vedic literature and the Religion of Saints describe the entire creational panorama. The Yugas, Mahayugas, Manvantaras come within their gamut. Tracing them scientifically back in time, the geological time scale describes the timing and related events that occurred during Earth's history. For example five major mass extinctions have occurred in the geological past. It is thus difficult to comprehend passage of time; is it merely an illusion or just a human concept. The concept of entropy, the second law of thermodynamics intertwines with the arrow of time. As we know on Earth, a solar day is around 24 hours. On Mercury a day lasts 1408 hours, and on Venus it lasts 5832 hours. Considering the immensity of creation, it is apparent that there is no single time for the multiverses and there is no uniform size of multiverses. Thus space and time constitute greatest mysteries of the human mind. Intuitive perceptions of Sages and Saints pave ways of knowing Truth which unfolds differently at different levels of consciousness. The geological system, the solar system, the galactic system and systems beyond can be explored by quantum-nano-computation, biometrics, neurotheology during the course of investigations expanding our knowledge.

According to Revered Prof. P. S. Satsangi Sahab there were three Big Bangs in the Macrocosm- the Mega Cosmos, the first one at the beginning of creation of the Pure Spiritual Region, the second at the bottom of Mahasunn at the time of creation of the Brahmanda (there are several Brahmandas) and the third at the time of creation of this Pind we live in (there are several of them). The Nirmal Chetan Desh is only One. The spirit entities in Pind come down by Shabda current and trace back their steps only with the help of Sant Satguru (Mentor) of the time.

The consciousness that artificial intelligence produces should be guided to program good ethics to improve humanity by changing the world order according to the values that Param Sants set forth from time to time. Like a chip in Robot with AI there is a Mind particle in a living man as also the Spirit particle – the Atman. No Robot with a chip can anytime supersede an intelligent man or a spiritually realized man – the Superman. Atman is a super subatomic particle beyond mental sphere having zero as well as infinite dimension at the same time.

The philosophy of Surat Shabda Yoga of Radhasoami Faith enunciates that one should develop spiritual super-intelligence, recognizing the existence of purely Spiritual or Spiritual-Cognito or Spiritual-Cognito-Material-Universes. There will be these big bangs, black holes, creations and dissolutions, Srishtis and Pralayas at different levels and times with a somnambulant comatose condition at the beginning of zero time i.e., potential static equilibrium state to a state of continual dynamic equilibrium state of unity with duality at will after final great dissolution. We are in-between zero and infinity. Below is a shloka in Sanskrit with its meaning that imparts a significant message.

Purnam adah purnam idam Purnát purnam udacyate Purnasya purnam adaya Purnam eva avashisyate

It was infinite before creation and this creation is infinite. Infinite comes out of infinite. By taking out infinite from infinite, It is only infinite that remains as remainder.

## 50. Measuring the Immeasurable : The Dilemma for Science of Consciousness

#### P Sriramamurti, Sukhdev Roy

Tremendous multidisciplinary scientific effort is directed to understand consciousness, the very essence of our existence. Recent advancements in science and technology offer great optimism for decoding the brain, the neuro-plastic repository of all conscious experience, to gain valuable insights into the nature of consciousness, health and well-being. Although a wide range of theories of consciousness have been proposed, it is generally being accepted that the objective scientific approach is severely limited, as it does not incorporate subjective human experience. This fact is highlighted in the hard problem of consciousness, which emphasizes that physical neural correlates of various human functions can never reveal the inner subjective experiences. Hence, leading neuroscientists are accepting the necessity to follow an integrated approach that takes into account third-person objectivity alongwith first-person phenomenology.

Eastern philosophical traditions, on the other hand, provide a detailed account of not only the nature of consciousness and its entire spectrum, but the scientific methodology of attaining the various states of consciousness through yoga-meditation, which are repeatable, reproducible and verifiable. Eastern sages and saints were expert scientists of inner dimensions. According to their accounts, consciousness is the very basis of being. It is described as Sat-Chit-Anand, i.e, truth-intelligence-bliss, the unchanging reality that is highly abstract, immortal, eternal, infinite, extremely blissful and beautiful, incomprehensible, immeasurable and ineffable. The human form is explained to be a microcosm of the macrocosm and the true nature of consciousness is spiritual, which can only be experienced by a human being, through the art and science of meditation, under the supervision of an adept. The spirit entity acquires covers of the mind and body, as it gets embodied. The various gradations of consciousness result in the admixture of spirit with subtle and gross matter. Hence, for self-realization of pure spirit, it is necessary to transcend the physical senses and mind.

The important question then is, how can we measure the immeasurable spiritual experience? The paper attempts to provide a comprehensive answer. An attempt to understand the ultimate nature of consciousness through the mind is futile. It is no wonder that the key to the science of consciousness, lies in the simultaneous conceptualization of the extreme mathematical abstractions of the immeasurable zero and infinity. Atman in Upanishads is described to be smaller than the smallest and bigger than the biggest. It is only by merging with the infinite that one can acquire knowledge of the infinite. Hence, the art of meditation as explained in Surat-Shabda-Yo-ga, (ultra-transcendental meditation) is the systematic methodology to be in resonance with the sounds of different states of consciousness that correspond to different levels of reality. The paper presents, (i) the details of the characteristics of different states of consciousness, ranging from the most depleted state of hell, to the original infinite source of super-consciousness, the August Supreme Being - Radhasoami, revealed as, Param-Sat-Chit-Anand-Prem-Prakash-Anahad Nada Swarupam, (ii) the protocol of the advanced Surat-Shabda-Yoga meditation at different nerve centres and apertures in the central nervous system, and (iii) a spiritual scientific approach to measure the immeasurable, resolving the dilemma of the science of consciousness forever.

## 52. Directed Attention and Awareness can elevate the level of Consciousness

#### Vineeta Mathur

Individual consciousness is divided into Mind consciousness related to memories, thoughts, ideas, feelings and predictions etc., and Spiritual consciousness which mystics speak about. Our first link with reality is a form of thought. Thought is a form of energy and concerted thoughts, like meditation, can reset neuronal connections in the brain. What a man thinks, that he becomes.

Ancient religious teachings say that consciously directed thinking can bring about a change in our mind consciousness and personality. Teachings of Oriental Saints explain how Satsang and Surat Shabda Yoga teach consciously directed thinking and enable one to overcome the babble in one's mind (gunavan), and free oneself from the mind's compulsion, but this requires practice. Satsang provides a facilitating environment to obtain a directed change overriding genetic program in an individual. This results in a peaceful mind which eventually leads to a peaceful life but there are no short cuts.

In a study comprising 60 adult professional between 25 to 50 years of both genders, working in various fields, the sample group was of 30 adults living a lifestyle of simplicity and following Surat Shabda Yoga wherein they are taught techniques to control mind-wandering. The control group was of 30 adults living an urban lifestyle with no religious/spiritual conviction. Both the sample and control group participants were asked to take a modified self structured and validated version of the Mindful Attention and Awareness (MAA) questionnaire and the Spiritual Well-Being (SWB) based questionnaire. Responses were rated on a 5 point Likert scale, with response options ranging from strongly agree (5) to strongly disagree (1). The scores were then studied statistically using the Pearson's correlation method. Significant positive correlations were found between SWB and MAA scores (.67) for adults following Surat Shabda Yoga. Spiritual well being scores showed insignificant correlation with MAA scores for control group of urban adults. The study clearly indicated that mind wanders more in those who do not practice meditation. A correlation exists between focussed attention and elevated consciousness and suggests that Spiritual consciousness may be achieved by quietening the mind and focussing attention.

## 53. Implementation and Simulation Studies of the Multi-Particle Quantum Teleportation Model

#### Apurva Narayan, Dayal Pyari Srivastava, Vishal Sahni, Prem Saran Satsangi

Srivastava et. al. have successfully applied the graph theoretic quantum system modelling (GTQSM) framework for modeling microtubules in the brain as n-qudit quantum Hopfield network [1] and modeling n-qubit multi-particle quantum teleportation [2]. In [2], detailed theoretical framework and models are presented for a three-particle entangled teleportation circuit. The model presents three parties (Alice: the sender, Charlie: the supervisor, and Bob: the receiver) entangled through a triplet called a GHZ state. Here, Alice communicates the classical measurements to Bob which encode the information required to apply the necessary Pauli spin matrices, for recovering the qubit sent by Alice using quantum teleportation.

In this work, we present the robustness of the circuits presented in [2]. We perform both simulations and actual implementation of the circuit on a quantum computer. The simulations are performed using IBM's Quantum Composer and QISKit software development kit [3]. The actual implementation of the circuit is done on the preliminary IBMQX4, a 5-qubit quantum processor using the QISkit framework [3]. IBM's quantum processor is made up of superconducting transmon qubits, located in a dilution refrigerator at the IBM Research headquarters at the Thomas J. Watson Research Center, New Jersey, USA. The result presents resilience of the three-qubit teleportation circuit and impact of noise in actual implementation.

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## 56. Impact of Teachers' Mindfulness, Daily Spiritual Experiences (DSE) and Spiritual Ecological Consciousness (SEC) on Students' Performance, with Special Focus on Continuous Evaluation System

#### Prem Pyari, Kavita Kumar, Prem Kumari Srivastava, Anoop Srivastava

Mindfulness is a mental state achieved by focusing one's awareness on the present moment, while peacefully acknowledging and accepting one's feelings, thoughts and bodily sensations. On several occasions, the mind drifts, one loses touch with the body, and is engrossed in obsessive thoughts or worries about the future, and that makes one anxious. On the contrary, when one is mindful, there is a reduction of stress, enhancement of performance and awareness through self-observation of the mind, and increase in attention to others' well-being. Relatedly, the Daily Spiritual Experiences (DSE) are about the connection with the transcendent in one's daily life. DSE focus on those aspects of life that represent day-to-day spiritual experiences. Having such spiritual or religious experiences, people gradually make progress on the path of spiritual growth. One of the most significant recent innovations in the conceptualization and measurement of religiosity and spirituality is the Daily Spiritual Experiences Scale (DSES). Spiritual Ecological Consciousness (SEC) reinforces the significance of a symbiotic relationship between humans and their environment, both living and non-living, and the importance of fostering environmental sustainability through responsible ecological behavior. Using the above tripartite constructs of Mindfulness, DSE and SEC, this research study focuses on the positive correlation between the three in the school teachers of Agra, India. It has been hypothesized that the academic performance of the students taught by those teachers who show significant positive correlation between the three will be better than those without such a correlation. The results will also be analyzed on the basis of the continuous evaluation system followed by the schools.

## 58. Effect of Yoga-Meditation Mudras on Consciousness using Electro Photonic Imaging

#### Sant Saran, Sukhdev Roy

In this paper, we report the results of a pilot phenomenological study on the effect of Yoga mudras on the consciousness state and health of yoga-meditators, using Electro Photonic Imaging (EPI) technique, which is based on Indian Ayurvedic system and traditional Chinese medicine. It involves meridians, energy channels and energy fields, and leads to a psychosomatic assessment. EPI also known as gas discharge visualization, is a technique used to record the human bio-electromagnetic field. In EPI, electrons at finger-tips are stimulated by applying a short electric pulse of a high voltage (10 kV), high frequency (1024 Hz) and low current for less than a millisecond. This results in a glow due to the ionization of gaseous molecules in the surrounding air through the discharged electrons from the finger-tips, which is then captured by a CCD camera. To experimentally assess the impact of yoga mudras during meditation, 30 meditators, both male and female, in the age group of 15-48 years, were selected. Regular sessions involved meditation in different mudras, namely Gyana, Prana, Dhyana and Surya mudras, for 30 minutes.

The bio-electromagnetic field glow of the subjects through EPI, was recorded from all ten fingers, before and after meditation, and with and without mudras. The effect on respective energy centres was analysed with respect to various parameters, namely, activation coefficient, integral area, integral entropy and form factor that reveal the physiological and psychophysiological condition of the human body in terms of stress, energy, left-right symmetry, organ balance, emotional pressure, entropy, yin-yang balance and chakra alignment. The subjective responses were also recorded through a questionnaire, by noting the qualitative effect of meditation in terms of feelings, imagination, color, etc. The extensive analysis showed in general, a significant improvement in the integral area, increase in form factor, increase in front energy with decrease in left and right energy, and decrease in integral entropy, indicating the lowering of disorder after meditation. Interestingly, Yoga-mudra meditation improved the balance and alignment of corresponding chakras. The results confirmed that yoga-mudra meditation leads to improvement in health and stimulation of higher energy centres.

The pilot study highlights the importance of (i) integration of subjective and objective studies, or first-person and third-person experiential and experimental phenomenological studies on consciousness; (ii) efficacy of Yoga-Mudra meditation, which makes considerable impact on consciousness states in a short time; (iii) scientific validation of ancient eastern traditional knowledge; and (iv) utility and reliability of the non-invasive, safe and fast EPI technique, for consciousness and health assessment.

# 64. Effect of artificially generated music resonating at the characteristic frequencies of different regions of the brain during meditation

#### Karan Narain, Anoop Srivastava, Dayal Pyari Srivastava, Vishal Sahni, Prem Saran Satsangi

Many Indian scriptures and spiritual traditions suggest that the universe was created through a Divine Sound. A few also describe the existence of Heavenly music that flows in the form a Spirit current. Spiritual current entails vibrations at some frequency. Spanda, implying vibrations, inter alia, is a key concept in Kashmiri Shaivism.

Recent research on neuronal correlates of brain activity during meditational practice has led to detection of certain characteristic frequencies associated with different levels of consciousness. Dominant characteristic frequencies, so detected, are also associated with specifically corresponding regions of the human brain (Satsangi, et. al., 2016). Further, certain instrumental sounds have also been found to be characteristic of specific regions. Meditation focused at these regions of the brain can lead to realization of corresponding levels of consciousness, accompanied by the manifestation of internal music resonating with the characteristic sounds of the region.

This study aims to measure the effect of artificially generated external music with dominant frequencies associated with specific regions and levels of consciousness on meditational experience, played while a subject is meditating. The measurements done with the help of a highly sensitive measuring instrument, namely SQUID based Magneto-Encephalo-Gram (MEG), in control and experimental conditions provide interesting results towards better understanding of consciousness.

While synthesizers can be modelled for simulating celestial music of higher regions through machine learning techniques, the Supreme Bliss of these regions cannot be experienced through such attempts. Therefore, main contribution of this study would be to provide a verification of the frequencies and instrumental sounds at the various levels of consciousness as identified in recent

research, and as observed by experienced meditation practitioners, which could act as a motivator for internal meditation practice.

## 65. Enhancing Economic Consciousness by Assessing Present Economic Climate in India and Evaluating Possible Alternative Approaches Using Fuzzy AHP

Mukti Srivastava, Sanjeev Swami, K. Santi Swarup

The economy of India is a developing mixed economy. It is the world's sixth-largest economy by nominal GDP and the third-largest by purchasing power parity (PPP). In any economy, especially in an economy so large as that of India, economic decisions and policies at the governmental level affect all the stakeholders in the economy like the various industries, government sector itself, consumers, etc.

It has been noticed and pointed out by a number of economists that certain macroeconomic decisions, e.g., Demonetization and GST (Goods and Services Tax), in the recent past, have had major ramifications for almost all metrics of economic performance in the country, such as GDP growth, inflation, industrial production and exports. There are conflicting claims by leading economists about the effect such efforts have had on the Indian economic scenario.

To avoid pitfalls in the efforts to drive the economy in the right direction, economic advisers are expected to analyse and present the benefits of a Feasibility Study, which may help sustain the adopted practice as well as control destructive elements and help develop control measures for mitigating them in the future. However, it is not clearly known whether such a study was done before implementing policy decisions like Demonetization and introduction of GST.

While conducting a feasibility study, if the problem to be addressed is complex, it can be dealt with holistically by application of systems methodology to assess the various elements involved in the system concerned and to find effective solutions for proper mitigation. AHP is one such method for multi-criteria decision-making that helps in making an informed choice between possible alternatives. Fuzzy logic is an approach that deals with uncertain data and impervious knowledge. Fuzzy logic can be used when decision makers need to take a decision in uncertain circumstances and through such fuzzy grading, subjective techniques can be used to achieve objective results, hence making grading of consciousness possible.

In the present study, the authors have attempted to develop better consciousness about the prevailing economic problems and evaluating the alternative approaches to deal with such problems using systems methodology, including Fuzzy AHP, invoking Ashby's Law of Requisite Variety. It is expected that the process followed and the results obtained will lead to better consciousness about the economic scenario and hence lead to optimal solutions. Better consciousness is expected to make better leaders, as people who want to lead ought to attain higher levels of consciousness so that they develop intuition, improve others' lives, do not become tyrants, and are able to remain in control even in uncertain or tough circumstances.

### TSC 2018 Integrated East-West Forum Poster Abstracts

## 1. Consciousness and Mystic Sounds Perceived in Human Form during its Increased State of Self Absorption

#### Kanta Arora

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a yogi should always listen to the sound in the interior of right ear. This sound when constantly practised will drown every sound from outside and on persistence will be heard subtler and subtler resembling bheri, mardala, ghanta, military drum, kinkin, bamboo flute, harp and bhramara (vee-na). When the consciousness gets concentrated in anterior fontanelle located in the top centre region of head, air (prana) enters Brahmarandhra, and the nada (sound) is heard. The sound of Om is called the song of creation. Om is part of many mantras in Tibetan Buddhism, used as short form in Namokar Mantra of Jainism and as Onkar in Sikhism. Holy Bible also contains many references to the melody of heavenly sound current. Great Saint Teresa of Avila talked of her experience of the sweet holy voice wherein one's soul is lost in ecstay. Guru Nanak explained that air and fire honk in human body, when one focuses on one's inner self one gets attuned to orchestra of primal five sounds and gets filled with divine sound flow and melts into ultimate sound. Kabir tells us that when all the nine doors of senses are closed, there rings the unstruck melody, those who describe the adventure have not reached the end, and who reach there become silent. Sant Mat teaches the internal sound practice and explains that mystic name Radhasoami is the master key to catch vibrating spirit current of highest region.

The paper concludes that as air regulated in the various musical instruments produces different sounds, Prana (air) the essence of human form, experiences different sounds at its various higher nerve centres. Depending on the nature of mind (gross or subtle) sounds manifest differently. One travels led by a mysterious sound, all sounds in turn are a hidden call to unforeseen delight.

## 2. Spiritual Teletransportation – A Possibility in Eastern Traditions & Philosophy : An Analysis

#### Preetam Pyari, Soam Prakash

Teletransportation is considered even today as a paranormal phenomenon which is non-local entanglement. Actually, it is a theoretical transfer of matter/energy from one part to another without traversing the physical space between them. The process involves dematerialization and re-materialization. Many people consider it as future science.

Spiritual teletransportation is a power embedded in a 'soul' to travel to another place without travelling actually, but getting transported all its physical and mental characteristics. There are enormous literature and examples in Hindu mythology, and religious literature is full of such capabilities with examples. Many spiritual leaders are having power embedded to generate same body and mind to help, secure and protect their devotees at time when it's needed much. Recently, a 'photon' was transported with the help of "Entanglement". We need three photons to achieve quantum teleportation. In religion a Saint has embedded location. This has progressively been developing in science also can transfer information to 'clouds', or is the carrier as the other is storage.

## 3. The Psychological And Biological Correlates of Mental Activity used to Achieve Highest Spiritual State

#### Vineeta Mathur

Western traditions of religion, including the Bible, do not focus on the relationship between mind and religion. Yet speaking of human weaknesses and evil actions in religious texts shows a link to the human awareness. Biblical stories provide various intrapsychic forces compelling both good and evil actions. The Commandments revolve around human behaviour and morals. They show highly accurate intuitive analysis of the human mind. Christianity taught issues related to love and forgiveness, devotion and redemption without explaining how they could be achieved by quietening the mind. The Upanishads, Buddhism, the concept of yin yang, Ayurveda and the Christian traditions all point towards the biological correlates of mental activity used to get highest spiritual state. Today experts in psycho-neuroimmunology and psycho-neuroendocrinology are

studying how "energy" interconnects brain and body. This may bridge the gap between Eastern and Western biomedical concepts. Today this idea supports modern Cognitive Neuroscience which states that our thoughts and feelings make us who we are, and these can be correlated to functions of the brain.

## 5. Effect of Meditation on Information Processing: Evidence from Stroop and Flanker Task

#### Sona Ahuja

The selective attention directed towards particular stimuli increases the ability to process the information extracted from that stimuli due to sole access to available working memory resources at that instance. The hypothesis is that the coding of task-relevant information is enhanced modulating the task-irrelevant information. Meditation is believed to improve the executive control as it involves the regulation of attention. The regular practice increases the ability to focus on task-relevant information, as the practitioner is conditioned to attend to the particular stimuli while restraining the task-irrelevant stimuli. This hypothesis of association of enhanced ability of information processing by the practice of meditation was tested using Stroop task and Flanker task. The Stroop effect is a demonstration of interference on the reaction time of a task. In cognitive psychology, the Eriksen Flanker Task is a set of response inhibition tests used to assess the ability to suppress responses that are inappropriate in a particular context. The results are discussed for three levels of practitioners – novice, intermediate and advanced meditators. The findings also reveal the interactional effect of the meditation and age on information processing.

## 6. Machine Consciousness a Possibility or a Necessity?

#### Adhar Sharma

This paper addresses the possibility and the necessity of development of artificial intelligence or machine consciousness. Every 2 or 3 million years some natural catastrophe takes place and devastates all life on earth. But life goes on and the consciousness grows on. Put, simply natural world destruction is unpleasant but a necessary part of the evolution of life and consciousness. The fear of catastrophe doesn't stop evolution and development of humans. Yet, at this tipping point of machine age we fear anti-human machine consciousness. The betterment of artificial intelligence can be achieved by values and the attempts to insert consciousness could be fruitless.

## 7. Recall performance of ADHD children for attended and unattended stimuli

#### Sahab Pyari Sinha, Surat Pyari Sinha

Consciousness is involved in various forms of awareness and plays a pivotal role in reception, transmission and storage of information. Hence, attention and memory are the basic components of consciousness. The present study focused on immediate and delayed recall performance of children with Attention deficit hyperactive disorder (ADHD) and normoactive children for attended and unattended stimuli under self-imposed or externally imposed event rate condition. The term unattended means unawareness or without conscious identification. The rationale is that unattended information biases the response given to attended information. This is taken as evidence for extensive pre-attentive (automatic or unconscious) processing.

## 8. Dayalbagh Model of Holistic Life care: Integrating the best of the East and West

#### C Jyothika, Chellapilla Vasantha Lakshmi, Chellapilla Patvardhan

The Dayalbagh Model of Life Care signifies that absence of physical and mental ailments are just a subset of the Life Care. A system of Life care enables a fulfilling life that is devoid of ailments and provides for the development of a higher consciousness towards a better "after life". The stress is on the Ultimate Goal of life which is realization of Self or Supreme Consciousness. This is because human life is perceived as a means of attaining the highest levels of spiritual status. This is itself viewed as a means of freeing oneself from the bondage of the cycle of life and death. So any improvements in life style that only improve the physical well-being are only a part of the deal and not the deal itself. The stress is on organic locally grown foods, clean air and water and reduction of desires to acquire worldly materialistic possessions for improved physical and mental health. A stress-free life enabled by a simple life style in which regular meditation and physical work are a part of daily routine. The community practices Surat Shabda Yoga that is the highest form of Yoga. Fortitude to bear any reverses is enabled by a deep faith in the overall beneficence of the Supreme Being and a positive outlook towards life. No wonder that it is common to see a 90 year old going through daily life routine even using a bicycle and without any medicinal support at all. This is not to say that science and technology is shunned. Diagnostic systems enabled by the western science are very much used when needed but the emphasis is on prevention by a Life care system and treatment is more often than not conservative using AYUSH (Ayurveda, Yoga, Unani, Siddha and Homeopathy). That is the model that integrates the best of the east and west that is being followed in Dayalbagh. The results are there for all to see. It has withstood the test of time - being more than 100 years old.

### 11. Mindfulness and Social Action

#### Asoka Bandarage

Synthesizing western social science analysis and Eastern yoga and Buddhist philosophy, this paper will explore how the defining values of human evolution -altruism and cooperation - have been undermined in the process of modern economic development and the adulation of individualism and competition. Transcending the individualist focus of the current 'mindfulness revolution' in the west, the paper will examine the unity of personal and social transformation and the ecological and ethical principles underlying mindfulness philosophy. Expanding the Middle Path approach presented in the author's book, "Sustainability and Well-Being: The Middle Path to Environment, Society and the Economy (Palgrave MacMillan)", the paper will also explore how the broader consciousness and ethical approach underlying mindfulness can be applied in social action towards climate and environmental protection and social justice.

## 13. Impact of Shabda Recitation on Daily Spiritual Experience of Young Students

#### Geet Satsangi, Shabd Kumar

Music is the mediator between spiritual and sensual life. It connects with inner voice and lifts spirits by realigning itself back into life's balance. Students at Dayalbagh are engaged in Shabda recitation in melodious tunes along with musical instruments since a very young age. This paper investigates impact of such Shabda recitation practice on the spiritual experience of young students. Students between the age group of 3 years to 10 years who regularly participate in Shabda recitation were selected as the experimental group (n=65). Daily Spiritual Experience Scale (DSES), Underwood (2013) was used to measure and compare their spiritual experiences with the control group (n=50). This research provides useful statistical comparison between the two groups and data on the relationship between Shabda recitation and spiritual experiences. This research reinforces the existing theory of inherent connection between music and consciousness.

## 14. Peak Experiences, Mystic Experiences and Epiphany: Are these Same?

#### Sumita Srivastava, Neha Paliwal, Anjul Dayal, Kumar Vaibhav

Peak experiences, mystic experiences and epiphany are considered integral aspects of positive psychology. Although these experiences have some commonality, yet researchers distinguish them on various bases. Peak experience is known as a sudden moment of joy, bliss and ecstasy. Epiphany on the other hand is a profound transformational experience that yields enduring results. Mystic experiences are connected with the awareness of transcendent. The term peak experience was first coined by Abraham Maslow. Based primarily on phenomenological approach, this paper presents findings of a study carried out to examine such experiences of business leaders. Business leaders who have been reported high on self- actualization need were made to participate in the study, because Maslow and other researchers profoundly associate a positive connection between self-actualizers and such experiences. The objective of the study was to revisit the concepts of peak experiences, epiphany and mystic experiences in the cross- cultural context of east and west. 26 business leaders participated in the study, 16 leaders from India and 10 leaders from USA. The study was conducted in two steps. In the first step, qualitative data was recorded which was immediately followed by quantitative data collection. For qualitative data collection, phenomenological analysis was conducted where inner world of the participant was in focus. In the subsequent step, experience questionnaire (Privette 1987) was used to understand the aspects that had not been captured at the first stage. This provided statistical comparison between the constructs and data on the relationship between the experiences and performance of business leaders.

## 16. Willfulness And Surrender: A Neuro-Theological Perspective

#### Vineeta Mathur

Religious traditions such as Islam, Hinduism and Sant Mat have a different perspective of willfulness and in these traditions the will is surrendered to God. In Islam the word 'Aslama' means surrender of will, in Hinduism the word for surrender of will is 'Prapatti' and in Sant Mat it is 'Gur Mauj'. It is a subjective experience that leads to deep spiritual consciousness and the intuitive feeling that the will of God has taken over the will of the individual human being.

From a neurological perspective, surrender is an intense turning off of the structures subservient of the willful processes. The effect may be studied by demonstrating reduced activity in the structures that carry out willful thoughts and behaviours. From a theological point of view surrender of willful behaviour emerges as a choice to act on the will of God with complete trust. A study was conducted with 60 participants between 25 to 70 years of age. Of these 30 respondents had lived wilfully as per their choice, and experienced pleasures and luxury in life while the other 30 respondents were devotees and disciples of a spiritually realized Guru and lived in accordance with the teachings of their Adept. They were given two questionnaires and the scores were used to assess their intuitive consciousness and also evaluate their willfulness by assessing their choices. Analysis of scores and Pearson's correlation (0.787\*\* at 0.05 level) for devotees. Further studies could be done to demonstrate reduction in brain activity of the participants as the effect of surrender to the Adept.

### 19. A spiritual quantum theory of perception and qualia

#### Mani Sundaram, Prem Sundaram

In order, to construct a complete and scientific theory of qualia and perception we need both

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quantum physics and spiritual wisdom. Qualia, the ability to experience water as wet, is an act of consciousness. Consciousness is not only fundamental but the ultimate reality and cause of all creation and its consciousness. Evolution of creation is the manifestation of cause. Nothing comes out of nothing. Physical or objective reality which is a superimposition or Maya is manifestation of subtle reality, the cause. Universe is information. The "bits" or 'bands of information' are constituents of "it". Reality is quantum. However, the quantum is non matter.

We propose that these bits are Tanmatras or gravitons. They are subtle particles of gravitational field, a quantum spiritual force field. These "bit" of information are not only cause of physical reality but also of our perception. The perception is an information processing process, consisting of three factors i.e. the knower, the process of knowing and the object of knowledge.

#### 20. Mudras, enhancing consciousness

#### Hima Krovidi

In this paper we discuss how the Mudra's in dance and Yoga enhance the consciousness. Mudrä is communication. The history of Mudrä dates back to the formation of the universe or, what we may call the cosmos. None of it would have been possible without union and communication. Each living, non-living, animate or inanimate being in the cosmos communicates at many levels. Yoga states that the fingers of our hand represent the 'Pancha Mahabhutas' or the 5 elements. Touching one finger with others in different combinations creates circuits in our body through which energy flows. Such a flow of energy allows the body to gain better circulation of blood, indirectly formulating long-term health benefits. Mudras are expressive hand gestures that form an intrinsic part of Indian Classical Dance, Yoga and visual arts. Mudras are believed to channelize natural forces and aid spiritual and mental well being by enhancing the flow of energies through the body. Yoga is generally perceived as a combination of postures and breathing techniques for overall fitness and well being. While the postures are designed to affect all the body systems and breathing practices bring awareness of the relationship that exists between the body and the mind, there is still so much more to yoga – it has a subtle effect on our consciousness.

#### 21. Impact of Indian Classical music in evolving a Race of Super-Humans

#### Manju Srivastava, Darash Adhari, Aseem Srivastava

Music is divine and it is the food of soul and the spirit. Music is an art which has its impact on regions far beyond the pind and brahmanda. The divinity and music have inseparable relationship. Divinity expresses itself through music only. Divine music is all the time there in cosmos. It's like a store house of the energy of the supreme father, who is omnipotent and omnipresent. The soul being the part of supreme father is all the time yearning to hear the divine music. Its power and charm nourishes, stirs and uplifts the soul. Thus it may be designed and used for awakening and development of the deeper and higher layers of consciousness within the new generation (the generation of super humans), and above their mind, and their greater powers and potentialities. As it is a consciousness in which the three aspects of the Deity, Wisdom, Power and Love, fuse together and where all the higher values and aspirations of humanity like truth, beauty, goodness, harmony and unity are not mere abstractions or feelings but part of the very substance of consciousness. The melodic mode (Raaga) structures in the Indian classical music system activate specific chakras, which allow the Kundalini energy to rise easily and energize and nourish the chakra. The raga also influences the chakra to maintain its optimum spin and balance, ensuring a balanced energy supply to different organs that are connected to the specific chakra. Thus it is assumed that if we make the children to listen to the different ragas from the birth itself it will activate their kundalini energy and consciousness to the extent that they can be evolved as the super-humans. Thus, in the present study we investigated the effect of different ragas on group of children between ages three months to 12 years. We have continued to follow them, to explore the effects of such training

#### Forum ABSTRACTS

#### 22. Modelling Microtubules as Self-Correcting Topological Quantum Memories

#### Shiroman Prakash, V Gurucharan

Penrose and Hameroff have long advocated the idea that some form of topological quantum computation arises in microtubules — an idea that is very appealing to those seeking to bridge western science with eastern philosophy. This idea is also very controversial because the brain exists at room temperature, so thermal noise, as well as other forms of noise, are expected to make functional quantum coherence impossible to maintain in microtubules. Notable critics include Max Tegmark. In this talk, we present new arguments in favour of the Penrose and Hameroff's ideas by drawing on the developments in topological quantum computing over the 20+ years since they originally proposed their theory. In particular, we will point out another objection to the idea of topological quantum computing in microtubules, namely that conventional models of topological quantum error correcting codes (such as the toric code and its variants), although extremely powerful at low temperatures, are not very resilient to thermal noise. The reason for this is that large errors with the capability of changing the ground state of the system have the same energy as small, correctable errors, so both are equally probable at finite temperature. We will then point out that this objection can be addressed using more recent developments in self-correcting topological quantum memories, where quasiparticles associated with the errors are attracted to each other, and therefore the advantages of topological error protection can be extended to thermal noise. We will review some of the technical challenges associated with constructing self-correcting error-correcting codes and compare some of the existing models in the literature to microtubules. Finally, we will also admit a slightly religious motivation for pursuing this work - namely the intrinsic mathematical beauty of topological quantum computation and its connection to gauge theories, particularly generalisations of Maxwell's equations known as Chern-Simons theories.

#### 24. Better Worldliness and Future of Mankind: Under Probabilistic Scenarios in Long Term

#### Guru Sant Tatavarty, Anoop Srivastava, Sanjeev Swami

In this paper, we offer a novel attempt to combine the teachings of religion of saints and science. We have provided a systemic approach on how the moral and spiritual reawakening can contribute immensely to the growth of societies and individuals. We have conceptualized a comprehensive process for assessment of level of consciousness and have developed an absolute scale of consciousness by identifying the major attributes based on the teachings of Saints. Further, based on the awareness of one's own level of consciousness, we have also developed optimal policy framework for attainment of higher levels of consciousness using Markov Decision Process model (MDP). MDP is a technique used for optimal policy formation for time based sequential decision making problems. Based on the findings of MDP model we have conducted a comprehensive survey and in-depth interviews for consciousness management under probabilistic scenarios. An attempt has been made to showcase how the spark of spirit can make positive impact on millions of people ultimately resulting in the "New World Order" and "Better Worldliness".

## 25. In silico study of tubulin isotypes in perspective of qudit

#### Raag Saluja, Amla Chopra

Srivastava et al (2016) have mathematically modelled microtubules as n-qudits. They have given an equation for qudits, illustrating that these qudits are composed of different qubits fused

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together. Hameroff et al have demonstrated that tubulin is a qubit. We conjecture that different types of tubulins in a microtubule are the different types of qubits required to satisfy this equation given by Srivastava et al. Differences in microtubules arise from differences in tubulins' (1) sequence (called isotypes) and (2) post-translational modifications (called isoforms). In this paper, we have focussed on the different tubulin isotypes, with a special emphasis on neuronal ones. We have predicted the structures and simulated neuronal and non-neuronal tubulin isotypes and compared their physicochemical properties. We have analysed their potential energies, enthalpies, coulomb and Lennard-Jones interactions.We propose that subtle differences in tubulins' amino acid sequences alter the physicochemical properties, indicating an inherent difference in the rate and also the mechanism of quantum tunnelling in the molecule. This represents a difference in "information" flow rate of the different qubits that fuse to form a qudit, as modelled by Srivastava et al.

## 26. Teaching Aparavidya (Quantum field theory) to students with analogies to the Vedic Science of Consciousness

Sonali Bhatnagar, Gunjan Agarwal, Rama Sinha

Aparavidya is all of modern science and systems science, whereas paravidya is the knowledge derived from esoteric experimentations and research of Saints by making use of hidden senses which exist in the human brain and can be rendered kinetic through meditation. The Vedic science describes deeper levels of the mind as causally prior, intrinsically more dynamic, abstract, comprehensive and unified-parallel to the structure of more fundamental levels in physics (Alexander, Davies et. al., 1987).

In the paper titled "The e-book: Assistive technology to educational technology" based on a research grant, the author designed set of seven interactive exercises for school, undergraduate and post- graduate students of the department based on quantum field theory. During the course on Particle physics the students filled up a questionnaire pre-learning and post-learning with these exercises on carriers of interactions, hadron decays, four-momentum conservation, decays based on strangeness conservation, accelerators and charm particle decays. The students' responses were analyzed and then they were given a guided worksheet on analogies between the Vedic science and modern science. The characteristics of unified field of consciousness as mentioned in our Vedas seems to be analogous to the unified quantum field theoretical picture of nature at the fundamental level. The analysis of the answers gave us directions to work further.

#### 28. Science and Religion at the Neuro-theological juncture Chhavi Gupta, Gopi Gupta, Amolly Gupta

As a unique and emerging field of study, Neurotheology has the potential to offer a great deal to our understanding of the human mind, consciousness, scientific discovery, spiritual experience, and theological discourse. A better understanding of it therefore can create a much needed bridge between the empirical science of neurology with the intangibility and sensitivities of theology.

In this paper we will discuss research being done in the field of Neurotheology by renowned neuroscientists, like Dr. Andrew Newberg's research on the relationship between brain function and various mental states. He is a pioneer in the neurological study of religious and spiritual experiences whose research includes taking brain scans of people in prayer, meditation, rituals, and trance states, in an attempt to better understand the nature of religious and spiritual practices.

## 29. Influence of words, sound and language on hyper communicative states and quantum consciousness

#### Sneha Idnani, Swati Idnani, Suresh Idnani, Pushpa Idnani, Teena Idnani

The human brain as a collection of nerve cells operates as a multi-layered frequency receptor. Due to initial conditionings early on in life each receptor becomes wired to perceive a particular wave frequency. As the brain's receptors tune-in to a particular pattern of frequency waves a 'pattern recognition' response is received by the brain and interpreted according to the perceptions allotted to the frequency. Neuroscience, quantum biology, and quantum physics are all now beginning to converge to reveal that our bodies are not only biochemical systems but also a sophisticated resonating quantum system. Brain mapping and DNA are central to this quantum system. Where western science continues to apply genetic improvements via material procedures devoted towards DNA decoding and encoding, eastern spiritual traditions have observed influences in DNA forms from light, sound, words and language. Our paper aims to focus on how the non-physical format of natural phenomenon that exists in the form of sound and language has contributed to making the human form as the evolutionary agent leading us to the doorstep of Quantum consciousness.

#### 30. Understanding the hierarchical organisation of Chakras

#### C.M. Markan

In Eastern Philosophy the role of chakras or apertures in the human frame are considered crucial for correspondence and communion between the various spheres of creation (macrocosm) and the nerve centers (microcosm). For the perception of the macrocosm, the spirit-current must be associated with the proper apertures in the microcosm with substances and powers similar to those that exist in macrocosm. These are verifiable by the performance of the experimentations or prescribed training of focused attention when innermost functions of the brain centers (which ordinarily lie dormant) develop. Even though such description appears to be ex-cathedra, this paper attempts to explore the nature of these apertures by comparing spectral properties of self-symmetric and scale-free spontaneous brain activity with Weber-Fechner law of psychophysical sensations experienced during meditation. Further, correspondence between powers associated with hierarchical levels of subtlety and the hierarchical organization of these apertures is also attempted to draw interesting insights.

#### 31. Positive Influence of Prenatal Meditation and Spiritual Pursuits on Infant's Mindfulness

#### Ritu Mishra, Rajesh Sinha, Rupali Misra Nigam, Sahab Prasad Misra

A review of the following three major Indian Origin World Religions – Buddhism, Hinduism and Sant Mat - reveals their view point about fetal consciousness and the role of positive spiritual environment and meditation on child health and temperament. According to Buddhist-text -Garbhāvakrāntisūtra - special instructions on prenatal conduct and environment are laid out which focus on purity of thoughts, surroundings and action. According to Vedic texts –consciousness enters fetus in the seventh month. Carakasamhitā prescribes the pregnant woman to be surrounded by various soothing and pleasant sense objects, to be told pleasant stories and to be in company of persons of agreeable form, speech, and behavior. Vyas, in the conclusion of the Mahabharata, mentions that pregnant women should listen to his narrative to create many types of indelible samskaras in the fetus. According to Sant Mat - the Jiva (jivatma or soul) is the Ansha (emanation) of Supreme Being, and in the form of particular spirit or Atma or soul gets attached to the foetus around the time of conception. Women are advised to be in sat sangat (company of the pure) during pre- and post-natal stage and regularly pray to the Supreme Being for His Grace and Mercy. This is believed to be instrumental in helping them bear a child with supra-abilities.

#### 32. Soul Consciousness Leading To Social Consciousness And Ultimate Consciousness

#### Ranjeet Satsangi, Sumiran Satsangi, Dhur Satsangi

Human being is a triune of gross physical body, subtle mind and extremely subtle Spirit or Soul. While gross physical body and mind are perishable, soul is imperishable and is on eternal journey. In the journey it attains various life forms and is in a constant process of constant and continuous evolution till it acquires it's original nature that of truth, love, peace, purity, power, happiness, bliss, and wisdom. We generally identify ourselves with our body, position in job, our role as parent, child, boss, sibling, and spouse. We identify our self with the state of our mind i.e. happy, sad, elevated, or depressed etc. But in fact all these things are temporary and get changed with time and ultimately lost. If we think logically, we can easily come to conclusion that we are in fact Soul which temporarily wears costume of body and mind. We acquire temporary positions, higher or lower, in our jobs. We play different roles in life which get changed with time. Once we are sons and daughters, then become fathers and mothers, and then later in life we become grand parents. If we become aware of this fact and constantly remind this fact that " I am in fact a soul, a tiny little particle residing in the middle of my two eyes. I am pure consciousness. I am all truth, goodness and beauty. I am all peace, love, happiness, power and wisdom. I do not require to acquire happiness, peace, and bliss from out side people and situations, instead I am peace myself. I am happiness and bliss myself. All others around me are also souls in eternal journey with me. We all have the same source, the powerful soul i.e Supreme Being Almighty." This kind of awareness and consciousness will certainly lead to social harmony and mutual love and respect. That is through soul consciousness social consciousness may be developed. Understanding soul nature of ourselves will lead to self realization and realization of the ultimate truth and consciousness.

#### 33. Superhuman Consciousness - Highest Achievement of Nature and a Novelty in Creation

#### Anmol Saran, Achal Srivastava, Neha Srivastava

Commonly every human effort is done with a chief motive of earning profit or material success in life. The present study was undertaken to understand how a community living in Dayalbagh is gradually advancing closer towards a superman race by discharging the duty of four Varnas e.g. Brahmin, Kshattriya, Vaishya, Shudra, willingly by performing community service.

## 34. Impact of Indian Classical Music Raga Performance on Consciousness of Musicians using Electro Photonic Imaging

#### Pritam Pyari, Sant Saran, Saran Pyari Roy, Sukhdev Roy

In Eastern experiential traditions, the very nature of consciousness is described as unstruck music (Anhad Nada). Hence, the objective of Indian classical music is to attain self-realization and enlightenment by hearing and merging in inner divine sound. It is well recognized in its traditions that different Ragas or musical melodies have a profound impact on the consciousness states, as they correspond to focused attention at different energy centres and hence also have a healing effect. In our earlier psychometric and experimental studies using Electro Photonic Imaging (EPI) technique, presented at TSC-2016 and TSC-2017 respectively, it was shown that different ragas have a profound effect on respective chakras and result in improvement of health parameters of yoga-meditators and students. EPI is based on Indian Ayurvedic system and traditional Chinese medicine that involve meridians, energy channels and energy fields, and leads to a psychosomatic assessment. The results showed in general, a significant improvement in the Agnaya (Third-Eye) chakra alignment and its energy in the older group of meditators, whereas in students it was in Vishuddha (Throat) Chakra. As expected, the ragas resulted in considerable reduction in stress and improvement in health indices. Both EPI and the subjective analysis indicated higher state of consciousness in meditators in comparison to students. The subjective experience pertaining to the preference of ragas, imagination, perception of feelings and colors in majority of the individuals correlated with specific states of consciousness that correspond to that attributed to the different Ragas and Chakras, according to eastern experiential traditions. The study highlights the importance of (i) integration of subjective and objective, or first-person and third-person experimental phenomenological studies on consciousness; (ii) the age-old Indian traditional knowledge of the impact of ragas on consciousness; (iii) measurement and progression of the consciousness state of an individual through music, and (iv) the utility and reliability of EPI as an accurate, non-invasive, safe, low-cost and fast technique for consciousness and health assessment.

#### 35. Thought Consciousness : A Panacea for All Ills and Evils of Mind

#### Shipra Satsangi, Ranjeet Satsangi, Dhur Satsangi

It is a well known fact that thought is the root cause of our actions and behaviour. As the thoughts so are our feelings and actions and behaviour, which if repeated become our habits and our habits build our character. We are nothing but a bundle of our thoughts and feelings which manifests our personality. So if the quality of our thoughts will be positive, then certainly our behaviour will be positive. Therefore if we become conscious of our thoughts, we become aware of our thoughts, their type and quality, and we can stop their free flow, can divert their direction, can modify them, and can replace them with more positive, creative and powerful thoughts. If we are aware of them we can check them at their very onset and save ourselves from evil feelings and actions. The root cause of all our feelings of hurt, fear, hatred, insecurity, jealousy, revenge, anger, unhappiness, depression is our thoughts which no doubt depend upon our belief system which is the result of our past experiences, our physical, social and spiritual environment. But through proper training of thought consciousness, belief system too can be modified leading to modified behavior and actions.

#### 37. Consciousness as Predictor of Decision Making

#### Kavita Kumar, Kanti Singh Pawar

In the present paper, the investigators have made an attempt to study consciousness as a predictor of decision making. 100 students from the undergraduate and postgraduate classes of Dayalbagh Educational Institute, Dayalbagh, Agra, were selected and administered the Consciousness Quotient inventory by Brazdau (2013) and General Decision Making Style inventory by Scott & Bruce (1995). The data was analysed on the basis of multiple regression analysis. The results showed that there is a positive relationship between consciousness and decision making, but it is not significant (r = 0.14, p > 0.05). Moreover, consciousness also contributes positively in decision making (R2 = 0.14, p < 0.05). The implications of the study are to explore the CQ of students at an early stage of their educational journey and thereafter provide a conducive environment to enhance the consciousness and decision making for their progressive growth and development.

#### 38. Human Being - The vibrating radiating bioplasma Mehar Parmar, Renu Singh Parmar, Nirakh Parmar

Chakra is a Sanskrit word that literally means "wheel of light". It is generally agreed that there are seven major, primary chakras and 122 secondary, smaller chakras throughout our body. The primary seven chakras are seen clearly as spinning vortexes of energy lined up along the midline of our body. The secondary 122 chakras are found wherever our joints are throughout our body.

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The locations of our primary 7 chakras are: a). First chakra-the base of our spine b). Second chakra-below our navel c). Third chakra-in our solar plexus, or displaced to the left in some people d). Fourth chakra-centre of our chest at the level of our heart e). Fifth chakra-in our throat 6. Sixth chakra-centre of our forehead, just above the level of our eyebrows f). Seventh chakra-above the crown of our head. The qualities and functioning of our human aura reflect qualities and functioning of our chakras. Our chakras and our human aura are intertwined. Chakras have different possible colours or combinations of colours (including red, orange, yellow, green, blue, indigo, violet, and white), sizes and shapes, spin and rotation direction, and intensity

We receive vibrational intuitive energy differently through our different chakras, because each chakra resonates vibrationally with specific energetic information. And we may tend to interpret our experience more through certain chakras, and not so much through others.

Modern science tells us that the human organism is not just a physical structure made of molecules, but like everything else, is composed of energy field. We are constantly changing, ebbing, and flowing, just like the sea. Scientists are learning to measure these subtle changes. The human energy field is the frontier for modern research, and the development of new diagnostic and treatment systems. We are constantly swimming in a vast sea of life energy field.

## 39. Does Vedic ontology of consciousness qualify as a scientific theory of evolution?

#### Mohit Kulshreshtha

Consciousness does not seem to fit into the usual Darwinian evolutionary framework of biologists and remains a problem; so acute, as to invite doubts (Schmid 1883, Nagel 2012, etc.) on the widely-accepted material monist framework itself. As an alternative approach, Cornelissen (2008) pointed out significance of the Vedic ontology to "hard problem" (Chalmers 1995) of consciousness. What makes Vedic world-view so attractive is the fact that, while sharing monism with physicalism, it approaches the problem of consciousness through gradualism and successionism of Darwinism. In this paper, drawing upon its modern exposition by revivalists like Sri Aurobindo, Swami Vivekananda and Paramahansa Yogananda, etc, we make a novel assessment of Vedic ontology of consciousness for qualifying as a scientific theory; we do it in terms of (i) inductivism (while addressing also to Hume's problem of induction), (ii) Kuhn's (1977) criteria of theory choice; and, (iii) critical rationalism (Popper 1959).

In all three of aforesaid assessments, not only the Vedic evolutionary ontology of consciousness qualifies for status of a scientific theory with flying colours, but also it is indicated to be an option for which there is no possibility of not choosing (James 1896) even by a Darwinian. We find that, besides being aligned to philosophic intuitions of many scientists and philosophers of repute, the Vedic theory responds quite competently to many philosophical queries originating in important fields such as biological evolution, bio semiotics, consciousness, origin-of-life research, meaning of life, medical healing, scientific and religious epistemology, etc. and which popular Darwinism leaves either unaddressed or unsatisfactorily answered.

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#### 40. Superhuman, Super-intelligence by Supreme being

Kundan Srivastava, Vijay Srivastava, Neha Paliwal, Shweta Na

Our soul is a drop of God's power by which we are conscious, alive and intelligent and able to make many smart machines but we cannot make the soul or protoplasm. We can save lives but cannot give lives. Can any smart machine make a machine or human being, definitely not. Artificial intelligence is a brain without 'heart and soul', so it may be harmful to the human race. But by making good bonding of body to soul one can be Superhuman with Superintelligence. Because of good bonding with the soul, the person will also have good moral and ethical values. So, in this research paper we will present how by making good bonding with the Supreme Being, who is the reservoir of light, intelligence and energy, one can become Superhuman with Super-intelligence and full of moral and ethical values and can properly utilize the artificial intelligence.

#### 44. Parallel Evolution of Brain and Consciousness-From Primitive Stage to the Incoming Era of Superintelligence

#### Swanti Gupta

The evolution of human brain has paralleled the evolution of human mind. From the primitive Reptilian Brain to the Mammalian brain the uniqueness being the massive increase in the number and complexity of connections, synapses and increase of neocortex area. But is this the only governing factor or is the environment, culture and the value education system also an important conducive factor for the same. This ideology of evolution of Superman with balanced body, mind and soul has been put to practicality under the Sant-Su Scheme in Dayalbagh. Here focus is on the early childhood development as it is known that 85% of the brain development is completed by three years of age. According to French and Murphy it is particularly true for children aged from birth to three years that early experiences determine how the neural circuits in the brain are connected. Thus, conglomerating all important factors, I propose the ideal environment model for early child development which can lead to four-fold increase of capabilities and development of Superman like species.

#### 46. Five Tanmatras - the Quantum spiritual mechanisms of perception and qualia

#### Mani Sundaram, Prem Sundaram

Tanmatras are the dynamic vibrations, potentials, the subtle force particles carrying the root energy of consciousness. They are the subtle forms of our sense organs known as internal senses or sensations, and also subtle form of five elements or Maha tattvas. They are the common factor between perceiver and object, making communication possible. Objects are in reality these floating bundles of different frequency vibrations which interact with the ether and thus with sound and ultimately with Nad, the flow of consciousness.

#### 47. Implicate Quantum Dynamics Of Entrepreneurial Venture Creation Through Potential Values And Quality Linked To

#### **Kinentic Existential State**

#### Sanjay Bhushan, Nidhi Bhushan

The fundamental and intriguing challenge that the new entrepreneurial ventures of today con-stantly face is to sustain the supply of a certain quanta of creative and productive resources for their present and future development and expansion. An entrepreneur constantly requires these basic impetuses or capabilities to take calculated risks and nurture a business idea to fruition despite unpredictable and uncertain internal- external environmental shocks that surround a business system. As what the Quantum physics has taught us that the fundamental particles and their grosser matter forms are understood to evolve into complex intelligent and self-governing forms of 'Life' and to sustain these forms; they need to constantly derive energy from a subtler higher source. Also, all evolving systems and life, ecology, economic systems do maintain distinct recognisable states and are resilient to external shocks despite ever-changing components and continuous export of entropy at micro scale due to strong feedbacks and causal inter-dependence under the 'Source-Sink' dynamics of exchange of energy.

## **48.** A Critical Assessment of G.B. Shaw's Life Force Theory with Special Reference to his Concept of Superman

#### Sonal Singh, Sudhi Singh

Borrowing as well as rejecting ideas from the philosophy and studies of intellectuals like, Henri Bergson, Samuel Butler, Charles Darwin and Friedrich Wilhelm Nietzsche, the modern Irish writer George Bernard Shaw came out with his own theory called as the Life Force Theory. This theory is based on the concept of G.B. Shaw regarding creative evolution. According to him, the Life Force is the vital force present on Earth that strives to attain the perfect state of being by entering the life forms and continually creating better versions than the ones already developed. Women are the chief instruments of the Life Force who are born with an irresistible impulse not only to preserve the species but also to procreate better ones. The role of man in this theory of Life Force, although placed next to that of woman, is not insignificant as he helps in bearing Superman, who is a symbol of the superior race of men that will evolve in the future. Shaw says that every alert woman is constantly on the look out for a 'Genius' man amongst the herd of ordinary men to choose the father for her future children in order to ensure their having greater intellect. This is a way of selective breeding to attain life's ultimate purpose that is evolution from the state of ordinary life form to the state of 'Pure thought' as imagined by Shaw. The transformation of a man into a Superman is an important milestone in this process. The ideal father should be rich, young, able-bodied and intellectually superior and the resulting Superman from the gradual evolution would be an ideal individual, a higher being, who will be, as Shaw states, "omnipotent, omniscient, infallible, completely self-conscious, in short a God." (Man and Superman, Act III) The Superman, with his mind's eye shall be able to see the purpose of life and would work towards it. This theory propagated by Shaw is incomplete and subject to criticism on many grounds. However, it is thought provoking and provides interesting matter for analysis and comparison with other concepts of evolution.

#### 51. A Study of the Levels of Consciousness of Students Participating in Co- Curricular Activities and Event Management in Higher Education with Special Reference to Dayalbagh Educational Institute (DEI)

Shalini Nigam, Anoop Srivastava, Kavita Kumar, Reeti Kumar, Manaswi Swami

Our graduates should not merely serve the modern needs of the country in the sphere of Science, Technology, Agriculture, Industry and Defense, but their outlook on life and behaviour should be such as to reflect a spirit of tolerance, temperance, truthfulness, courage, and beauty, in their thoughts, words and deeds. Education should help in character-building and national integration of students. The co-curricular activities, if embedded in the Education System, inculcate various qualities and values among students which are necessary for their all round development. Qualities like creativity, leadership, planning, communication, coordination, decision making, team work and values like selfless service, humility, dignity of labour, loyalty, justice, tolerance etc. are developed. Complete comprehensive education endeavors to develop physical, mental, intellectual, emotional, ethical and spiritual strength of an individual. Dayalbagh Educational Institute (DEI) commemorates number of events throughout the year, where the students get ample opportunities to sharpen their skills and develop a number of qualities and values.

A pilot study was conducted in Dayalbagh Educational Institute to comprehend if co- curricular activities and event management, where students participate and share responsibilities augment their consciousness levels. The study is based on the levels of personal consciousness of Barrett (1996-1997). These levels comprise survival, relationship, self-esteem, transformation, internal cohesion and service. A self- constructed questionnaire was administered on 80 students from various disciplines who participated in different events in the University. Analyzing the results, it was found that there was a difference in the levels of consciousness of girls and boys. The results have been analyzed in terms of faculties also. The present research is ongoing and has its implications in the importance of students involvement in extra - curricular activities to develop into conscious human beings.

### 54. Human – An Hierarchical Systems Theory

#### Gazal Mathur, Sohang Mathur, Bhakti Mathur

In this paper we propose to elucidate upon the fact that the human species is a deliberate manifestation of the universe. Within this human system lie the vessels required for ultimate emancipation. The physical and mental components are interwoven subsystems of the spirit which is the controlling force. It is now a question of when. When we purposefully merge the east-west perspectives, we may be able to solve the human existence equation.

#### 55. Environmental Conscious Consumer Buying Behaviour In Emerging Economic Scenario

#### Shalini Dubey, Nidhi Verma

In today's era, it is an alarming state as a lot of depletion is taking place due to innumerable made-made and natural actions which are affecting the environment largely. The present status is such which should entail long-term productive activities for a profitable and healthy living by turning them environmental conscious beings. This paper mainly examines the level of awareness of consumers buying behaviour towards environmental consciousness. It also explains the relationship between economic development and environmental consciousness. Furthermore, it also compares the impact of consumers buying behaviour in regard to environmental consciousness on two sample cities viz. Agra and Delhi. To accomplish the objectives of the study a well-planned questionnaire has been prepared. In order to analyse the data appropriate tools have been used to draw meaningful inferences. This type of research is of vital significance to guide the global economy in the right direction of environmental conscious consumption which may lead to ultimate goal of making the Earth a place to live for us and for the coming generations again.

#### 57. Embodied Consciousness as a Bound-State in an Open Quantum System and Experiential States in Surat-Shabda-

#### **Yoga Meditation**

#### Sukhdev Roy

Although conscious states can be tuned by resonances with the environment, such as music, controlling the environmentally-mediated coupling through focused attention can also lead to transitions to higher states of consciousness. Hence, yoga-meditation helps in controlling the senses and mind for embodied consciousness to resonate at higher frequency states, enabling transitions from the confined sensory-based existence, to the continuum and potentially unbound free state. This is experienced as widely reported expansion in consciousness or conscious awareness. The proposed theory is well suited to address various aspects of consciousness that includes parapsy-chological phenomena as well as healing. It also provides an explanation for the interplay between the microcosm and macrocosm, as well as experiential states in Surat-Shabda-Yoga (ultra-transcendental) meditation, in which meditation on divine sound currents emanating from regions of the universal mind and the pure spiritual regions, induces resonance with embodied consciousness that experiences the corresponding state of consciousness.

#### 59. Kinesthetics: The key to Spatial Perception in Hindu Temple Architecture

#### Renu Singh Parmar, Mehar Parmar, Nirakh Parmar

Traditional Indian architecture is the story of movement and pauses where Kinesthetics of a space is fundamental to its experience and perception. The study of Meenakshi Sundareshwara Temple at Madurai, Kailash Temple at Ellora and Sun Temple of Modhera unravels that Kinesthetics, the dynamic perception of space through movement with ever-changing points of view and the varying vignettes resultant of the spatial composition, is the most fundamental facet of space-making in Hindu Temple architecture. This tool of Kinesthetics heightens the progression from the corporeal to the spiritual as one progresses from the entrance gateway (Gopuram) to the inner sanctum (Garbha-griha) catalyzing the co-evolution of the microcosm and the macrocosm, a growth of two realms- being and experience in traditional Hindu temple.

What matters here is the composite resolution of the ensemble and its multifarious points of view; a time-space continuum. This phenomenon of kinesthetics, thus makes architecture experiential where 'being there' is what matters. Timeless, ever pervading architecture relies more on the fundamental attributes of space-making, ranging from approach and movement, scale and proportion, quality of light and shade to the relationship of the built with the unbuilt.

#### 60. Fuzzy Deep Neural Inference System with Multimodal Data Fusion

#### Sandeep Paul, Dhruv Bhandari

Studies and experiments are done to gather information and draw conclusions. The information can be in form of subjective linguistic terms and the objective numeric values. This paper presents a fuzzy deep neural network that can integrate two types of information a) subjective, uncertain, linguistic, human type expert knowledge represented in form of hierarchical fuzzy if-then rules and b) objective, precise, numeric, mostly obtained from sensors and machines. The proposed system accepts both linguistic and numeric inputs to produce the inference based on the existing knowledge base. The fusion of multimodal inputs along with the feature extraction is done using an autoencoder section of the system. Experiments have been performed on the multimodal benchmark data (RECOLA) consisting of audio, video, ECG and EDA signals, to study the impact of multimodality as against a single modality. Experiments are also conducted to illustrate the effect of way of presenting the multimodal data – sequential or concatenated. The proposed approach

is computationally less expensive than the existing approaches and the performance is better or at par with the other techniques. It would also be interesting to apply the proposed network to handle multimodal data which include MEG – a high resolution temporal data and EEG – a high resolution spatial data to infer a holistic inference from experimentation.

#### 61. Sustained Spiritualization of 'Sant-Su' Scheme Toddlers Evolving the Race of Supermen

#### Surat Kumar, Kavita Kumar, Bhakti Kumar, Reeti Kumar

In the backdrop of Weiss' field theory, explaining the magnetic induction through magnetic domains of + and – polarities; it was proposed by us that spiritual domains do exist in the structural tubulin scaffold of microtubules. When a disciple comes under the influence of a pure spiritual source (Guru / Spiritual Mentor), all tiny 'spiritual-domains' of disciple are coherently aligned with Guru's spirituality through resonance coupling. Hence, proximity of the Spiritual Mentor can perpetuate greater spiritually among disciples through spiritual induction. Therefore, the disciple in turn becomes spiritually charged through spiritual induction under the spiritual aura of Guru. A scheme of 'Sant-Su' has been started in Dayalbagh with the same objective in mind. In this scheme, toddlers of 3 months to 3 years of age come in the proximity of Spiritual Mentor daily for about 2-3 hours. Such a sustained exposure of younger generation of toddlers to prime spiritual force field or spiritual aura of the Guru, is expected to bring out the characteristics of Supermen, perpetuated by spiritualization.

#### 62. Mindfulness Practice as a predictor of the Social and Emotional Consciousness of Secondary level Students

Astha Upadhyay, Namrata Singh, Archana Kapoor

In our modern, busy lives, we constantly multi-task. It's easy to lose awareness of the present moment as we become engrossed in our efforts to juggle work, home, finances, and other conflicting demands. As humans, we are often "not present" in our own lives. Human minds are easily distracted, habitually examining past events and trying to anticipate the future. This makes us less conscious of our body, mind and soul. Mindfulness is a way of paying attention to, and seeing clearly, whatever is happening in our lives. It helps us recognize and step away from habitual, often unconscious emotional and physiological reactions to everyday events. The present study has been taken up with the aim of finding out the effect of mindfulness based intervention programme on the social and emotional consciousness of students. Consciousness Quotient Inventory (CO-i) was used to assess the social and emotional consciousness of class 9 students, while a self-constructed Mindfulness Inventory was employed for measuring their mindfulness levels. The intervention programme consisted of yoga and meditation sessions along with certain relaxation exercises. The students improved, both in their social as well as emotional consciousness levels, from pre-test to post-test scores, highlighting the importance of mindfulness in the present times. A regular practice of mindfulness in schools may thus prove helpful in making students more conscious, intellectually competent, socially responsible and emotionally stable.

### 63. Self-consciousness and its impact on the Conscientiousness among Secondary level Students

#### Namrata Singh, Astha Upadhyay, Archana Kapoor

Self-consciousness is a topic of considerable importance to a variety of empirical and theoretical disciplines such as developmental and social psychology, cognitive neuroscience, psychiatry, and philosophy. In this way Self-consciousness has also been found to be associated with some

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personality traits, mainly Extraversion and Neuroticism. Conscientiousness is also a personality trait among the five traits of Big Five personality theory consisting of agreeableness, conscientiousness, extraversion, neuroticism, and openness. The present study aims to find out the relationship between the Self Consciousness and Conscientiousness. Correlational analysis on thirty students of secondary level has been done. The participants were selected through random sampling for the purpose. The Self- Consciousness Scale (SCS-R) (Scheier & Carver, 2013) and The Big Five Inventory (BFI) (John & Srivastava, 1999) were used to measure the Self Consciousness and the Conscientiousness respectively. On the basis of the data collected through SCS-R participants were classified in three different levels of consciousness that is low consciousness, average consciousness and high consciousness. Pearson's Coefficient of correlation (r) has been used to calculate the correlation between the self-consciousness and the conscientiousness. As a result, adequate positive correlation was found between the predictor and criterion variables, supporting the hypothesis framed by the researcher. Further the students having high self-consciousness were found highly conscientious in comparison to the students having average and low self-consciousness. On the basis of these findings it can be said that the relationship between conscientiousness and self-consciousness came out to be significant mainly because conscientiousness as a personality trait involves caution, thoroughness, self-discipline, thinking before acting, and acting according to the dictates of one's conscience, so if somebody is so concerned with being systematic and orderly then of course, the person will be high on self-consciousness.

#### The role of Eastern approaches in David Bohm's scientificphilosophical odysseia

#### Paavo Pylkkänen

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The physicist David Bohm is one of those Western scientist-philosophers whose thinking was strongly influenced by encounters with Eastern thought, in particular with the J. Krishnamurti and to some extent also with the Dalai Lama (here one should acknowledge that Krishnamurti did not want to identify with any nationality, tradition or school of thought; but it has often been suggested that his teachings are in some key ways similar to Eastern approaches such Advaita Vedanta and Buddhism). In this talk we will explore some ways in which this influence expresses itself in Bohm's work. We will see that Bohm's early scientific metaphysics, inspired by quantum theory, had strongly holistic and relational features even before his encounters with the East. This is yet another indication that there are important analogies between modern physics and some aspects Eastern philosophy, as has been emphasized by Capra (1995). However, we will also suggest that Bohm's encounter with Krishnamurti played a key role in the process in which his worldview changed from dialectical materialism toward a more comprehensive view, where concepts such as information and meaning play a fundamental ontological role. Also, as an important example of the way Bohm's thinking was influenced by Krishnamurti, we will focus upon Bohm's notion of insight.

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#### ADDITIONAL CONCURRENT ABSTRACTS

#### 1.07 Mental causation and the function of consciousness

The place of consciousness in the causal order of things.

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One of the key problems with consciousness has to do with its causal efficacy. Many philosophers of mind assume that causation can only take place at the physical level: the physical domain is governed by the laws of physics and is causally closed. This means that if a physical event has a cause, this can be described in purely physical terms. If consciousness is taken to be non-physical (as is often done), then it cannot have any physical effects, and we end up with epiphenomenalism. Many cognitive neuroscientists are also keen to announce that conscious experience has no causal physical effects. This view is based upon the Libet experiments (and similar ones) which are taken to imply that consciousness occurs too late to be able to act as a cause of our actions. As van Gulick has noted, for these researchers consciousness is a psychological after-effect rather than an initiating cause; it is a post facto printout. Thus both some prominent philosophical and neuroscientific research implies that conscious experience has no causal physical effects. However, this research rarely acknowledges that causation remains a profoundly puzzling philosophical problem in contemporary philosophy. In particular, researchers typically presuppose that we have a clear understanding of the nature of causality in the physical domain. But in fact there is a venerable tradition, dating back to Russell's (1912) causal anti-fundamentalism, arguing that causal notions can play no legitimate role in how physics represents the world (Frisch 2012). The idea here is that the fundamental laws of physics are radically different from causal laws. Causal laws, as many philosophers understand them, typically describe how local events determine events in their future, while physical laws connect the entirety of physical reality in a time-symmetric manner. In a deterministic picture, the entire state of the universe at a certain time equally determines the relative past and the future of the universe, leaving no room for genuine interventions in the physical domain (see Umea workshop 2017) This talk considers how the causal efficacy of consciousness can be understood in the light of the philosophical debates about causation. Is the principle of the causal closure of the physical domain called into question if causal anti-fundamentalism is correct? And might this make room for the causal efficacy of consciousness? For example, can conscious experiences be seen as (in some sense) local events which determine events in their future (in a similar manner as with causal laws in special sciences such as biology)? And how might taking into account the quantum theory influence our view about the nature of causation in the physical domain? (310)

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#### A Consciousness Devoid of Mental Properties

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1.09 Philosophical Theories of Consciousness

Many millions of years ago no living matter existed on Earth then eventually conditions changed when algae came into existence and then followed by single celled organisms, which were the early precursors of life. These original cells became multicellular organisms and were capable of transmitting signals from one part of the cell to another and this enabled cells to become more complex. Eventually these cells evolved to form self-organizing systems, paving the way for the evolution of animate life. Although these primitive organisms were devoid of brains they were capable of learning called habitation, which is a form of rudimentary learning. They learnt to evolve, which gives us more clues about how complex cells evolved. These organisms were capable of cooperating and communicating with each other in order to make decisions. This coordinated cell action and cooperation is known as cell signalling. This electrical signalling mechanism is similar to neurons in the brain. Even bacteria and slime are conscious because they are capable of interacting and communicating with one another. The environment is not just a multitude of living organisms, it contains a natural process and this process causes life to come into existence or causes life to act or react according to natural forces within their environment. There are many forms of life that do not have brains and so they do not have the ability to "think", but in order to survive and reproduce, they need to make intelligent use of internal and external information, therefore they are conscious yet devoid of mental properties. Living cells learn to adapt and evolve and although each generation may seem similar nevertheless each generation evolves and becomes different, to some degree. Random mutations are exclusively responsible for the gradual development of more complicated organisms that were capable of evolving and adapting. This intelligence was universal, that is, it existed wherever and whenever any form of life came into being. This confirms that consciousness existed long before brains existed. When brains eventually came into being then different forms of life and the brain neurons of each species became altered by their environment and by the individual information that each mind obtained. Like the developing brain, neurons form layers and communicate with each other via neural networks. The consciousness resulting from mental activity is different and separate to the proto-consciousness within some brain neurons. The former is dependent on acquired knowledge and the latter is devoid of mental properties and is relative to the evolutionary forces of nature. When mental activity functions then that is a mechanistic form of consciousness, but during deep sleep and between one thought and another, certain brain neurons continue to function, which are separate to the ones that cause mental activities, therefore when mental activity commences then that is a separate and different form of consciousness. This implies that matter and conscious minds are temporal and that energy and the self-sustaining consciousness entity would continue to exist even if brains became extinct. (311)

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## THE SEVENTH INTEGRATED EAST-WEST FORUM The Science of Consciousness Conference ISC 2018

### **APRIL 2, 2018, TUCSON, ARIZONA, USA**

"Oh, East is East and West is West, and never the twain shall meet, Till Earth and Sky stand presently at God's great Judgment Seat; But there is neither East nor West, Border, Nor Breed, nor Birth, When two strong men stand face to face, though they come from the ends of the earth!" Rudyard Kipling (1889) : The Ballad of East and West



The Integrated East-West Forum is now a familiar feature at the TSC series of conferences, starting with TSC 2012 at Tucson, TSC 2013 at DEI, Dayalbagh, India, TSC 2014 at Tucson, TSC 2015 at Helsinki, Finland, the landmark TSC 2016 at Tucson at the first conference of the series rechristened as 'The Science of Consciousness' and TSC 2017 at San Diego, USA. The Seventh Integrated East-West Forum at TSC 2018 will be yet another landmark integration effort as part of the TSC-series. The above quote rather prophetically captures these momentous

events, when not just two strong men from East and West stand face to face, but in fact, two galaxies of strong men from East and West meet at Tucson (USA) and Dayalbagh, Agra (India) also through video-conferencing.

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## DEI, DAYALBAGH AND THE EAST-WEST FORUM AT TSC SERIES

The tradition in the TSC series of conferences has been to hold meetings in alternate years at Tucson and every other year elsewhere in the world. The conference has been aptly renamed as 'The Science of Consciousness' from TSC 2016 onwards in tune with the growing acceptance of consciousness studies among the scientific community all over the world.

A meaningful East-West dialogue seems feasible as has been increasingly evident from TSC-2012 through TSC-2017. To meet these challenges, the landmark Seventh Integrated East-West Forum at TSC-2018 is intended to be a place where one presents key ideas from both approaches, and where these ideas can interact in the spirit of constructive mutual criticism, evaluation and enrichment. It appears plausible to evolve a science of inner experience (which is repeatable and verifiable) by attempting to integrate Eastern and Western scientific approaches and philosophy by verifying inner spiritual phenomenology of consciousness through well-established scientific epistemology, including three important stages of observation (awareness), report (description) and analysis (understanding) (Price and Barrell, 2012) while also availing of modern techniques of fMRI and MEG scans in capturing repeatable physiological / physical parameters of neural correlates accompanying inner spiritual experience during meditational practices. Invoking higher and higher level of unified quantum field theory, with correspondingly subtler and subtler particle size of fine grained geometry will lead to a significant jump in the level of fineness (fine-grained quantum geometry) which should enable us to access, at least in the abstract world of mathematics and physics, the primary ultimate



TSC 2013 at DEI, Dayalbagh, India

source of consciousness in the whole Universe. We need to resolve the inextricably linked problems of subtlest particles smaller than 10<sup>-35</sup> metres Planck's length and large distances more than 10<sup>10</sup> light years, and approach zero and infinity by application of logic and induction in the right way.

Davalbagh and DEI are closely associated with Radhasoami philosophy, which centers upon a type of meditation practice arising from the spiritual philosophy of Eastern Saints known as "Surat Shabda Yoga". Shabda is referring to a spiritual current which can be perceived in meditation as inner light and particularly unstruck rhythmic sound. Yoga is referring to the uniting of our real essence (soul) through an inner listening with focused mental and spiritual concentration (surat) upon an inner sound (Shabda) which, it is maintained, emanates from Radhasoami the Supreme Being representing the macrocosm i.e. unity. It is therefore taught as the unchanging and primordial technique for uniting the soul with the Supreme Being via the sound-current of Shabda in order to experience oneness with macrocosmic consciousness at multiple levels. India is in many ways still a spiritual society and the Radhasoami philosophy (based on 'Saar Bachan') has a consistency with other extant spiritual meditational



DEI Group at TSC 2016, Tucson

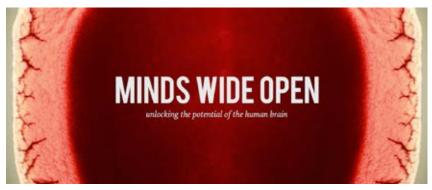


Sir Roger Penrose at DEI (2013) For further details, refer to www.dei.ac.in

practices of the world (to name a few, Buddhism (Buddhavacana), Iainism (Agamas), Christianity (Bible), Islam (Koran), Sufism (e.g. the Masnavi of Maulana Rumi), Sikhism (Guru Granth Sahab) and Hinduism (as represented by Vedas, Upanishads and Gita). In contrast, much of Western scientific and philosophical study of consciousness takes place in a secularized setting. There was consensus among eastern philosophers and western scientists at the TSC 2016 Panel Discussion that, on one side, for internal experiences or human experience, a protocol has to be necessarily followed. Following that protocol is very difficult for western nations as they will have to leave alcohol and non-vegetarian food. So consensus emerged on studying environment around those who perform yoga, mahayoga or Surat Shabda Yoga and we pin our hope on Corporate Social Responsibility as a measure, that those who perform Surat Shabda Yoga have greater sense of Corporate Social Responsibility. The author of one of the latest books, 'Our Mathematical Universe' (Prof. Max Tegmark, MIT) is like us, is in the quest for the ultimate nature of reality. We are trying to explore ultimate nature of reality from two ends, from the ends of science as well as inner or human experience. Therefore, we believe our approach to the problem of consciousness is more complete since we do not only view it from physical science perspective. Moreover, we combine conceptual insights with practical applications which lead to real practical experience of what this inner reality is, and what the human experience is like. Hence, this is where we believe we can offer profound insights in terms of growing ultimate human consciousness.

### THE SCIENCE OF CONSCIOUSNESS TSC 2018

#### FILM SCREENING 60 MINUTES



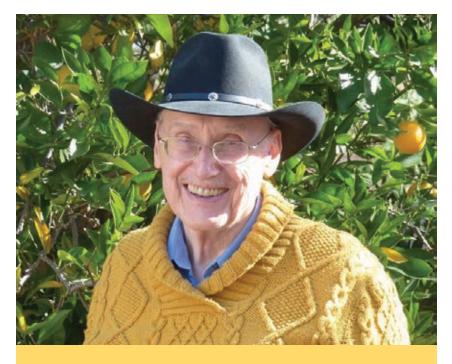
Directed by Tianqiao Chen and Chrissy Luo Executive Producer: Tim May

## Thursday, April 5, 2018 5:00 pm - 6:15 pm Catalina Ballroom Loews Ventana Canyon Resort, Tucson



## Recent technological advances are starting to unlock the mysteries of the human brain.

**Minds Wide Open**, an innovative film, featuring leading, international experts and compelling patient stories, makes the case to policy makers, philanthropic funders and the public that increased support is critical if we are to take advantage of this unparalleled opportunity to advance the science, unlock the wonders of the human mind and create a better world.



Alvin J. Clark is Professor Emeritus of Molecular Biology and Genetics at the University of California, Berkeley. At present he is associated with the laboratory of Professor of Neuroscience Linda Restifo at the McKnight Brain Institutes, University of Arizona. Professor Clark's interest in consciousness studies stems from his exposure to a monistic philosophy that was part of the Shaivism taught and practiced in 10th and 11th century Kashmir. As he understands it, that philosophy asserts that consciousness is the ultimate source of all that is. Professor Clark is therefore curious about the relationship of that ultimate consciousness with the consciousness that he experiences as a human. His main interest at the moment is to understand what influence human genetic diversity has on human consciousness.

# T H A N K Y O U ALVIN J. CLARK



### Welcome to The Science of Consciousness 2019

The Science of Consciousness (TSC) 2019 is the 23rd annual international interdisciplinary conference on fundamental questions and cutting-edge issues connected with conscious experience. TSC is the largest and longest-running interdisciplinary conference emphasizing conceptual, empirical, cultural and even artistic approaches to the study of consciousness. Key areas include the philosophy of mind, cognitive science, neuroscience, anthropology, biology, physics, computer science and mathematics. Held annually since 1994, the TSC conferences alternate yearly between Tucson, Arizona, and various locations around the world.

TSC conferences continue to bring together various perspectives, orientations, and methodologies within the study of consciousness. These include not only academic subjects within the sciences and humanities, but also contemplative and experiential traditions, culture and the arts. TSC aims to integrate viewpoints and bridge gaps, appreciates constructive controversy, and pursues the spirit of genuine dialogue. The format of the conference includes plenary sessions, preconference workshops, concurrent sessions, poster sessions, arts and book exhibits, and social events.

#### Organizers

Harald Atmanspacher (Collegium Helveticum, ETH and University Zurich) Stuart Hameroff (Center for Consciousness Studies, University of Arizona at Tucson)

#### Local Organizing Committee Harald Atmanspacher (chair) Norman Sieroka (co-chair) Gundel Jaeger (conference manager)







### **CIRQUE ROOTS** and their exhibition of

# **Black Light Yoga**

## Wed and Friday 6:30-9:30 PM Catalina K Ballroom

THE SCIENCE OF CONSCIOUSNESS

Loews Ventana Canyon Resort

## DINNER/SHOW CIRQUE ROOTS

PERFORMING

Thursday April 5 7:00 PM KIVA BALLROOM



Limited seating available. Get your tickets early.



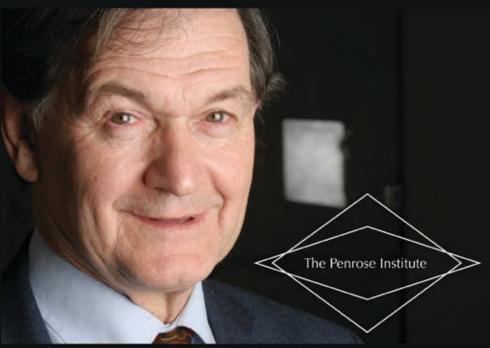
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In remembrance of

## STEPHEN HAWKING 1942 - 2018

# The Penrose Institute



"To understand the human mind, the cosmos and the laws of physics that govern them, and to spread the wonder of science and mathematics."

Biological Technologies to improve the treatment of mental and cognitive disorders and develop a better understanding of consciousness and the nature of our existence.

Computational Technologies to help understand human intelligence and better allow artificial and human intelligence to work together.

Sensor Technologies to measure the geometry of space, enabling us to peer deeply beneath the surface of the Earth to detect natural resources and provide early warning of earthquakes, or to look out into space and provide a picture of the early universe and the distribution of dark matter.

# SCIENCE OF CONSCIOUSNESS

## Congress Center - Interlaken - Switzerland June 25-28, 2019

#### www.tsc2019-interlaken.ch

The Science of Consciousness 2019 will be held at the Congress Center Interlaken, a small town with great reputation in the center of Switzerland. Interlaken is located between lakes and mountains, close to the famous "Top of Europe" at Jungfraujoch, Europe's highest train station at more than 10'000 feet above sea level.