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CBC2015 Abstracts of Accepted Papers

1. EFFECT OF BILINGUALISM ON ANTICIPATORY OCULOMOTOR CONTROL

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Abstract: In this study we examined if highly proficient bilinguals with superior proficiency in L2 have higher anticipatory control in the oculomotor domain compared to the low proficient bilinguals. We examined this in a task that had no conflict and did not require inhibitory control for target discrimination. Participants were instructed to program a saccade towards a target only when the color of the starting circle changed from one color to another. Therefore, to be fast as well as accurate, participants should have prepared saccades in anticipation in this task. The task was simple enough to extract anticipatory behavior in the oculomotor domain. Highly proficient bilinguals were overall faster compared to the less proficient bilinguals. Additionally, highly proficient bilinguals also made greater number of anticipatory saccades than the low proficient group. L2 proficiency also significantly correlated with saccade latency as well as with the number of anticipatory saccades. These results thus demonstrate that higher proficiency in language use leads to better anticipatory control in the oculomotor domain.

2. ANALYSIS OF EEG SIGNALS FOR IMAGINED MOTOR MOVEMENTS

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Abstract: There are changes in the electroencephalogram(EEG) signals when a person tries to imagine moving his arms and legs. To study the same, EEG signals were collected from three subjects using sixty electrodes placed over the scalp. Four different types of imagined movements have been considered namely movement of left hand, right hand, foot and tongue. Such kinds of imagined movements create very subtle but different types of variations in the EEG signals. Also the regions of the brain where the variations originate differ depending on the type of subject as well as type of movement. To identify the regions, it was required to identify the electrodes that were recording the variations. This was done with a combination of feature extraction and selection techniques. Due to the non-stationary and non-linear nature of the EEG signals, autoregressive power spectral density and entropy measures were used for extracting features from all electrode channels. A chi-square based feature selection technique was used to find out features that were the most relevant and in turn provide information about the electrode positions that were most relevant in differentiating different types of imagined movements. It was observed that, the positions of the selected electrodes were not random but seemed to be localized at certain region over the head, though the position of the regions varied from person to person. For two of the subjects the regions seemed to forming in the left and right sides of the head. For the third subject the regions were formed in the left side of the central and posterior regions of the head. To get an idea about the nature of variations, time-frequency analysis of the signals recorded at the selected electrodes were done. Study revealed that, there are indeed some perturbations in the power spectrum, in certain frequency bands, at the onset of any kind of imagined movement which had been absent when the subjects were idle. This was common in all subjects though the changes seemed to vary across subjects. The changes in the power spectrum seemed to affect different frequency bands for different subjects as well as for different types of movements. Even the variations for a particular type of movement for the

same subject seemed to vary based on the regions of the head from where they were emanating. Time frequency analysis further revealed, that, the variations of EEG signals recorded from one region seemed to be of contrasting characteristics when compared with the variations for the signals collected from the other region. For example, in one subject, the imagined left hand movement showed a decrease in power in the 8-16 Hz frequency band in EEG signals from the left side of the head compared to the ones from the right whereas for right hand imagined movement the variations was just the opposite in the sense that the EEG signals from the right side showed a decrease in power in the same frequency range than that of the left. To reinforce the observations detailed above, the selected features were trained individually trained for each subject and passed to to a Support Vector Machine based machine learning classifier. It was found that the classifier was able to identify the type of imagined movement performed by a subject with considerable accuracy.

3. FRESH VIEW OF FILLING-IN WITHIN THE CONTEXT OF HIERARCHICAL PREDICTIVE CODING

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Abstract: Despite the absence of retinal input, the blind spot gets filled up with surrounding visual attributes [Ramachandran, Scientific American, 1992]. This phenomenon is called the perceptual filling-in or completion. Neurophysiological and neuroimaging studies have shown that when filling-in occurs, early visual areas are activated. Additionally, nonlinear neural responses are observed in the retinotopic representation of the blind-spot in the primary visual cortex (V1), which correlated with the perception. Various possible neural mechanisms (symbolic, cognitive and isomorphic theory) have been proposed to explain filling-in. None of these theories is entirely consistent with the findings of brain activation and brain organization, and the knowledge of underlying neural mechanism for filling-in at the blind-spot is far from complete [Komatsu, Nature reviews, 2006]. In this report, we attempted to present a fresh view of the filling-in phenomenon in the framework of hierarchical predictive coding (HPC) of natural images [Rao, Nature Neuroscience, 1999], HPC, which stems from the idea of efficient coding, postulates that neural network learns the statistical regularity of natural scenes and reduces redundancy by removing the predictable components and transmitting what is not predictable. It provides a functional explanation for a range of neural responses and hierarchical reciprocally connected organization of the cortex. Additionally, there exists strong evidence for HPC in the early visual areas. Both classical and extra-classical receptive field (RF) properties in V1 as well as RFs in MST have been explained within the context of HPC [Andy Clark, Behavioral and Brain Sciences, 2013]. We, therefore, speculate that the same computational mechanism could play a significant role in the filling-in process. To test this speculation, we have conducted simulation studies on three leveled (LGN-V1-V2) HPC model network exposed to bar stimuli. After training with natural image patches, the blind-spot was emulated by removing the corresponding feed-forward (LGN-V1) connection in the network in early visual area. In our first investigation, using a shifting bar stimuli across the blind-spot, we recorded the response of predictive estimator neurons (PE neurons) at blind-spot region in V1 of our model network. The response changed significantly (in a non-linear manner) at the length for which both sides of the blind-spot was stimulated and the completion occurred inside the blind-spot. Moreover, we also demonstrated that these responses represent the filling-in completion. These results are in accordance with the physiological findings [Matsumoto, Journal of Neurophysiology, 2005]. In another investigation, we presented two separate bar segment at the opposite end of the model blind-spot to verify the tolerance of completion and recorded the response of PE neurons by varying the relative alignment. We found that the filling-in completion was best when bars were perfectly aligned but faded out with increasing misalignment. These results were consistent with the finding of psychophysical experiments [Araragi, Vision Research, 2008]. These results suggest that the filling-in process could be a manifestation of the general computational principle of hierarchical predictive coding (HPC) of natural images.

4. READING AND WRITING ERRORS IN CONGENITAL WORD BLINDNESS: A CASE STUDY OF HINDI SPEAKING THIRD GRADE CHILD

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Abstract: Reading disorders of childhood frequently are associated with inadequate or inappropriate instruction or emotional disorders. Developmental dyslexia can best be understood in a neurologic context, known also as congenital word blindness. The problems of reading and writing in childhood are commonly known as Congenital Word Blindness. The major problem is non-fluent reading or reading with errors. Most of the cases of developmental dyslexia suffer with the problems of reading and writing and some of them even can't read the single word except the articles and prepositions. In this case study, the focus will be on the reading and writing ability of the children with mild developmental dyslexia in Hindi speaking zone of North India. This study will

consist of reading and writing test like storytelling and paragraph writing and the errors and problems found in the given study. The child with developmental dyslexia has great difficulty in attaching sound and meaning to written words. Problems mostly occur in the same word appearance reading and the letters confuse child. The problems occur in repetitive words and result to omission of letters. The aim of the present study is to find the problems and errors in the word reading and writing accuracy in a transparent orthography (Hindi) in case of third grade bilingual children and to see the reading and writing strategies and errors adopted by him/her in reading and writing words.

5. COMPUTING CONSCIOUSNESS: WITH REFERENCE TO THE LATERALIZATION OF ATTENTION

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Abstract: Attention and consciousness, the two discrete neural processes are intricately intertwined. A volume of studies claims that attention is necessary and sufficient for consciousness. Albeit, this claim is debatable, the fact that attention is closely associated with consciousness cannot be refuted. Interestingly, there is asymmetry in the distribution of attentional skills across the two hemispheres. The right hemisphere is asserted to be dominant for attentional skills. Research asserts that the ventral frontoparietal cortex of the right hemisphere is dominant for the exogenous attentional skills and the endogenous network is bilaterally distributed. This study explores the attentional skills of the 'mute' right hemisphere and the 'vocal' left hemisphere and the extent to which they may impinge on our consciousness. Disorders of consciousness (self-awareness) like Neglect, Capgras syndrome, Balint syndrome and Anosognosia associated with right hemisphere damage, are discussed with reference to the disruption of the attentional network. The idea that 'left hemisphere has the highest level of human consciousness' is reviewed with reference to its dominant endogenous network and a new model of graded consciousness is put forward where perception is a continuous scale with cognition at its higher end. Right hemisphere with its dominance over the exogenous network and partial control over the endogenous network plays a crucial role in initial perception while left with its dominance over the endogenous network is important for cognition. The self-awareness disorders in right hemisphere damaged patients and thought disorders in left hemisphere damaged patients perhaps bear testimony to this fact.

6. TOWARDS A NON-RECURSIVE THEORY OF MIND IN ANIMALS

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Abstract: This paper examines the experimental results in Ethology pertaining to the 'Theory of Mind' (ability to attribute mental states) possessed by Chimpanzees, with a view to shed light on the philosophical debate over discontinuity – where and how should the line be drawn between animal and human cognitive abilities. While Descartes and his modern interpreters (such as Chomsky) assert that the differences in the cognitive abilities of humans and non-humans arise out of a difference in substance, not just degree, there is a strongly prevalent view in philosophy and science that distinctions in animal/human cognition, if any, can be explained by differences of degree alone. While the discontinuity view creates epistemological problems, discussed briefly in this paper, I argue that granting a limited, non-recursive Theory of Mind to chimpanzees and other higher animals can account for experimental results and at the same time, preserve the discontinuity hypothesis advanced by Hauser et al. (1) The discontinuity view in cognitive science holds that the differences observed in the cognitive abilities of humans and non-humans cannot be explained fully just in terms of humans possessing a more complex cognitive architecture than animals. Rather, it is proposed, there is some essential difference in the cognitive make-up of humans, which allows them to interact with, and shape, the world in different and richer ways than animals. The clearest instance of discontinuity is considered to be the case of human language, which has the feature of generating unbounded output from finite input, in other words the ability to generate 'recursive' structures. Several counter-cases have been presented to defuse the force of this version of the discontinuity hypothesis. One such case - animal 'Theory of Mind' is discussed in this paper. I propose that non-humans can, in principle, be granted a rich yet non-recursive Theory of Mind. I begin by sketching an overview of discontinuity in the cognitive abilities of animals and humans. I then talk about the language faculty in humans as the site of discontinuity, and proceed to discuss a specific proposal for discontinuity given by Hauser et al. (2002) and the philosophical implications of this narrow notion of discontinuity. I then proceed to analyze the results of experimental studies on Mind attribution in chimpanzees, in order to assess whether an enriched 'Theory of Mind' may, in principle, be granted to chimpanzees and possibly, other higher animals without denying the discontinuity hypothesis. An attempt at sketching the essential features of such mental attribution has been made. I argue that the methodology I adopt –

granting, in principle, a rich ability of mental attribution to non-humans - helps to sharpen the line of discontinuity and paves the way for designing new experimental studies. I close with a brief discussion of avenues for further research in this area.   -------------------- (1) Hauser, M.D., Chomsky, N., Fitch, W.T. (2002): The Faculty of Language: What is It, Who Has It, and How Did It Evolve?; Science, New Series Vol 298 No. 5598

7. NEUROPROTECTIVE EFFECT OF CURQFEN® IN LPS INDUCECD BRAIN INFLAMMATION

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Abstract: Abstract   Background: The imbalance in the level of excitatory /inhibitory neurotransmitters in the brain viz. Glutamate, Serotonin and Dopamine causes widespread health problems, including neuroinflammation. In the present study an attempt is made to investigate the effect of anti neuroinflammatory activity of CurQfen®. Methods: Male Wistar albino rats were treated intragastrically with CurQfen® (200 and 400mg/kg, Resveratrol 20mg/kg daily for 28 days. Bacterial lipopolysaccharide (250 g/kg/ i.p) were used to induce an inflammatory response, and were injected once on day 1.The neurotransmitter levels was assessed by paper chromatography and fluorimetrically. The behavioral parameters were analyzed by Elevated plus and radial arm mazes. Results: The present study shows that LPS significantly reduced (P<0.001) the brain levels of Serotonin and Dopamine while CurQfen® and Resveratrol restored it, and vice versa with Glutamate. The total time spent and number of entries where decreased in open arm while it was increased in the closed arm of the elevated plus maze after LPS treatment which clearly indicates the anxiety behavior. This effect was reversed by CurQfen® and Resveratrol. The reference memory and working memory errors were enhanced following LPS treatment, while CurQfen and Resveratrol significantly reduced them in radial arm maze. LPS treatment significantly enhanced the total time to complete one session in radial arm maze. Conclusion: It concluded that CurQfen® causes neuroprotection as evidenced by the brain levels of neurotransmitters, and also from the behavioral parameters assessed by elevated plus maze and radial arm maze.

8. METAPHORICAL THINKING: ITS LINK TO NEURO CHEMISTRY OF LEARNING

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Abstract: Metaphorical thinking has a close relationship to individual's learning capabilities as it determines an individual's ability to associate the given concept to an experience outside its environment for e.g if a teacher explains the concept of Radioactivity in the class, Metaphorical thinking determines is the ability of the individual to associate the concept Radioactivity to solid waste decay which are totally different concepts yet possess a certain degree of similarity. For every association that Metaphorical thinking initiates there exists neuronal activity in prefrontal cortex of the brain, the centre of learning. Greater is the ability of an individual to associate the experience with cognition, greater would be the ability to process the given information processing ability. Lack of the ability to associate between experience and cognition results in attention deficiency among learners. The present paper explains that practice of Metaphorical thinking statements during teaching-learning process increases the brain activity in the prefrontal cortex of the brain in turn enables to promote the information processing ability of the individuals. The experiment involved teacher sample handling IX and X standards following C.B.S.E curriculum. The teachers are educated about the Metaphorical thinking technique, its practice and educational implications in teaching-learning process. Teachers are encouraged to use statements which would induce Metaphorical thinking relevant to the content that the teacher teaches in the class. This is done by interacting with the teachers, asking them how they plan the lesson for a particular period, modifying their lesson plan by incorporating statements which initiate metaphorical thinking without disturbing their routine slowly inculcating he habit of using statements which would initiate Metaphorical thinking . After a period of time teachers would develop the habit and try to think in that direction which would eventually reflect on his / her students. As the result of this the academic performance of the students enhance which in turn would reflect on the academic performance.   The result of this experiment is measured by collecting pre and post academic performance of students in the subjects concerned. The ability of the teachers to promote Metaphorical thinking statements is measured by administering a questionnaire evaluating Cognitive structures. The scores thus obtained are evaluated for its association with academic performance. It was found that there exists a positive relationship between Cognitive structures and academic performance showing that the ability of the teacher to implement the

Metaphorical thinking statements enhances the learning which in turn is reflected in the academic performance. References McKinnon, AM. (2012). 'Metaphors in and for the Sociology of Religion: Towards a Theory after Nietzsche'. Journal of Contemporary Religion, vol 27, no. 2, pp. 203–216. [3]. Lakoff G., Johnson M. (2003) [1980]. Metaphors We Live By. Chicago: University of Chicago Press. ISBN 0-226-46801-1. Gurian, M. & Stevens, K. (2005). The Minds of Boys: Saving Our Sons from Falling Behind in School and Life. San Francisco: Jossey-Bass. James, Abigail Norfleet (2007).Teaching the Male Brain: How Boys Think, Feel, and Learn in School.

9. A NOVEL ANALYTICAL APPROACH TO GRID CELL MODELING USING ARBITRARY NUMBER AND PHASE DISTRIBUTION OF HEAD DIRECTION CELLS

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Abstract: Grid cells are a class of spatial cells located in the medial Entorhinal Cortex (mEC) which is assumed to perform the function of path integration and characterized by its unique hexagonal firing fields. Empirically it is proven that head direction (HD) cells, another class of spatial cells which encode the heading direction of an animal, form the major input to the grid cell. Existing computational models of grid cells assume artificial constraints like choosing HD cells having a phase differences that are integral multiples of 60 degrees. Models also superimpose Continuous Attractor Neural Network architecture on grid cells and show hexagonal organization of grid cell activation. The aim of the study is to model grid cell firing (hexagonal firing) without imposing these special constraints on HD cells or grid cell interactions. The proposed model has two layers, a HD layer inclusive of path integration (PI) function and an outer layer that represents the region of Entorhinal Cortex (EC) to which the HD cells form inputs. A virtual animal is made to forage inside a square box in a completely random fashion. Speed and direction of movement form the input to the HD cells whose responses are the projections of the animal's speed and direction on to the preferred direction of that HD cell (0-360 degrees). The response of each HD cell is then integrated and passed through a sine function to get the PI values. During training, the PI values are stacked into the columns of a matrix 'P', which is further made sparse by thresholding its entries and subjected to Principal Component Analysis (PCA). The top few principal components (PC) corresponding to the largest Eigen values are rearranged in increasing order and taken as connections from the HD layer to the outer layer. While remapping the neural response onto the visual space, each neuron in the outer layer gave a unique firing field pattern which included grid cell like firing. The first and second neurons fired at the corners of the box, third and fourth neurons fired at the borders of the box, fifth and sixth neurons showed grid cell like firing. Further analysis showed that PCs of the P matrix were sinusoidal vectors. Investigation of the correlation values between the adjacent rows of the covariance matrix of P pointed out its similarity to circulant matrices. This was in corroboration with the circulant matrix theorem which states that a circulant matrix of any size gives rise to sinusoidal Eigen vectors. This provides a theoretical basis for the responses of grid cells and possibly other spatial cells which are nothing but projections of the path integrated values onto sinusoidal orthonormal basis vectors. The patterns formed by outer layer neurons remained unchanged by varying the number of HD cells proving the independence of grid structure on the number of HD cells. Sparseness of the P matrix was also an imperative factor in the formation of the firing fields. Thus the model provides an insight on how brain processes higher dimensional data to form an abstract representation of space. In future, we aim to extend this model to a more biologically realistic neural version by considering multiple sensory modalities like visual, proprioceptive inputs to HD cells and evolve grid cell activity using self organizing architectures like LISSOM.

10. FRAMING EFFECTS REVERSAL IN DECISIONS FROM EXPERIENCE

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Abstract: When faced with a problem that has one sure outcome and one risky outcome, which do people choose? Tversky and Kahneman (1981) showed that preferences depend on the way the outcomes are framed: describing the same outcome in terms of lives lost instead of lives saved in the famous Asian disease problem leads to a preference reversal in favour of the risky option. More recently, however, researchers demonstrated that preferences for risky alternatives might depend on how the outcomes are presented. Preference patterns reported in Hertwig, Barron, Weber & Erev (2004) suggests a reversed framing effect when people sample outcomes from each alternative rather than reading a small summary description of the alternatives: in the case of decisions from sampling, people favour the risky option in the domain of gains and the sure option in the domain of losses.

Studies examining the experience-description gap focus on the idea that the probability of rare events are overestimated when experienced (Camilleri& Newell, 2013).   In contrast, this study examines the role of experience on the framing effect in the Asian Disease problem. Moreover, we distinguish two types of experience: an experience by sampling where participants sample single outcomes from each alternative in any order, before making a choice, and an experience by interacting where participants are allowed to spread all possible outcomes in front of them before making a choice. We hypothesized that this last condition should allow people to have a more accurate representation of the probabilities associated with each alternative, and thus would lead to a "classic" framing effect (risk-seeking in loss frames, risk-averse in gain frames).   95 participants were presented with 3 gain-framed and 3 loss-framed problems modeled after the Asian Disease Problem. The participants were randomly allocated to one of three choice conditions: Description (in which the problem was presented on paper), Sampling (in which the participants were allowed to sample the information presented as a pack of cards) and Interactive (in which the participants spread out all the cards containing the information and interacted with them). The results revealed a significant interaction effect between framing and choice condition: In the Description choice condition, participants were more risk-seeking with loss-framed problems. This pattern was reversed in the Sampling choice condition where participants were more risk-seeking with gain frames. Finally, as anticipated, the Interactive choice condition resulted in a classic pattern of framing effect, whereby people were more risk averse in the domain of gains. The discussion focuses on the implications of these results for the description-experience choice "gap" and call for a better understanding of the role interactivity may play in fostering a richer representation of probabilities in risky choices.

11. ROLE OF TRAIT EMOTIONAL INTELLIGENCE IN ENHANCING INDIVIDUAL MORAL TRAITS AND MORAL COMPETENCE

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Abstract: Man as social being is ingrained with the faculty of moral understanding which enables him to judge right from wrong and make moral decisions. The study of Morality has always fascinated philosophers, theologians, behaviourists and social thinkers across the timeline in the history. Moral norms and rules are known to exist since the earliest known civilizations in the world and in-depth psychological exploration into the same has begun only less recently. Moral development which involves acquisition of the ability to make moral judgements or take righteous decisions is one of the most vital psychological events in the process of social development of an individual. Human behaviour is largely influenced by the hereditary, bio-physiological, psycho-social, religio-spiritual, geo-political and economic factors; and as with other components of development, morality is also shaped by multiple factors. In course of the life span development, the experiences of a child with his/her family, peers and other adults, influence his/her moral development substantially - in coordination with the physical, cognitive, emotional and social skills that matures with time. Moral Competence is the skill to do the right thing or it is the ability to consistently behave according to the accepted ethical principles. Moral Competence involves an array of moral traits which is shaped by multiple factors. One of the major determinants of moral competence is the Emotional Intelligence and the prevailing Emotional Intelligence traits of the Individual. Emotional intelligence helps individuals to identify, assess, and control the emotions of self and others which resultantly is hypothesized in this study as a major influencing factor of Moral Competence. This study was conducted with the specific objective of exploring the relationship between Trait Emotional Intelligence and Moral Competence in the global population. Sample of the study was collected online via simple random sampling and the sample consisted of 331 males and 645 females totaling 976. The mean age of the sample is 35.82 with a standard deviation of 13.63. The sample was collected from a global population with representation from Asia (N=376), Africa (N=25), Europe (N=121), Oceania (N=43), North America (N=401) and South America (N=10). Moral Competence and Moral Traits viz. Integrity, Honesty, Moral Courage, Trustworthiness, Responsibility, Humility, Altruism, Compassion, Self-Forgiveness and Other-Forgiveness formed the dependent variables; and the Emotional Intelligence and the EI Traits viz. including Well-Being, Self-Control, Emotionality and Sociability formed the independent variables.

12. PERCEPTUAL BIASES IN INTERTEMPORAL CHOICE

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Abstract: We studied the effect of perceptual biasing on decision making in an intertemporal choice task (ITC) in the first study. It has been observed that individuals, many a time, impulsively choose the sooner reward instead of comparing the utility of the sooner and the later rewards. Not saving for retirements is an example of such behaviour. In our experiment, we try to determine if it is possible to bias the participant towards the either option using an arrow as a perceptual cue. The experiment had three blocks in which the first block was the training block. Individuals were biased towards the sooner reward in the 2nd block and towards the later reward in the 3rd block. An arrow, pointing towards either the left or right direction, was the perceptual cue. To check whether perceptual biasing had an effect on intertemporal choice behaviour we determined whether the points of indifference obtained from blocks 2 and 3 were significantly different from one another. The experiment was administered on 17 individuals. The paired t test revealed that the points of indifference of the two blocks were not significantly different from one another (p value = 0.3). We can conclude, that the arrow did not the bias the participants in this experiment but only after rigorous modifications of the existing paradigm and subsequent testing can we conclude anything about the relationship between perceptual biasing and decision making in ITC. We determined whether participants preferentially focused on a particular ITC parameter in the second study using the Tobii Eye Tracker. The experiment was administered on 8 individuals. We looked at the time to first fixation and total fixation duration parameter and determined whether the average values of these two time parameters across the participants were significantly different from one another. ANOVA tests revealed a p value = 0.65 for the time to first fixation parameter and a p value = 0.33 for total fixation duration parameter. Again, the results were not statistically significant. The no. of participants in this study was quite small. We might observe different results on increasing participant no.

13. A LARGE SCALE CORTICO-BASAL GANGLIA MODEL TO UNDERSTAND THE NEURAL INTERACTIONS OF TARGETTED REACHING

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Abstract: We present a network model of the basal ganglia (BG) to highlight its role in performing simple reaching movements. The model consists of the following components: a 2-joint arm model (AM), a layer of motor-neurons in the spinal cord (MN), the proprioceptive cortex (PC), the motor cortex (MC), the prefrontal cortex (PFC) and the BG. The arm model has two joints each consisting of an agonist and an antagonist muscle pair innervated by a pair of motor neurons; the muscles in turn control the position of the arm in 2D space. The PC receives information about the muscle length and tension, thought to be originating from muscle spindles and Golgi tendon organs of the muscle. The MC then uses the sensory map information from the PC to develop a motor map of the arm. The MC activity is also modulated by the BG which uses reward information to make the arm learn to reach the target. The MC then sends these signals to the respective muscles of the arm via the motor neurons (MN) to perform the movement. Since the existence of maps has been well established in the cortex, the sensory map of the PC, and the map from PC to MC are modelled using the self-organizing map (SOM) algorithm. The motor command is thought to arise from the PFC, which chooses the goal to be reached. The MC therefore combines inputs from three sources: the PC, the prefrontal cortex (PFC), and the BG (specifically from GPi via the thalamus). To enable this summation dynamically, MC is modelled as a continuous attractor neural network (CANN), wherein each position of a stable activity bubble corresponds to a position of the arm in the workspace. Finally, to close the loop, the mapping between MC output and MN is also learnt offline. Training of the model proceeds as follows. A target (one of 3 discrete ones) is chosen by activating corresponding neurons in the PFC. The arm makes exploratory movements driven by the Indirect Pathway of BG. When the arm accidentally reaches the target it gets a reward. BG uses this arm position and the reward information to create a value profile over the work space of the arm so that the trained value peaks at the target positions. As value training proceeds reaching dynamics is aided by stochastic hill-climbing over the value function. Therefore, as the training of value function continues, the arm reaches the goal position faster and faster. Furthermore, whenever the arm reaches the target position, the connections from PFC and MC are also trained, so that the motor command can directly activate the motor cortex, thereby producing rapid movement, without the slow search conducted by the BG. The model exhibits stages of motor learning: slow movements dominated by the BG are seen in the early stages, while the cortically driven fast movements dominate the later stages.

14. STRESS RELATED DISORDERS AND METHODS TO ASSESS COGNITIVE FUNCTIONS IN BUILT ENVIRONMENT

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Abstract: Diabetes Mellitus (DM) increases risk of dementia. Potentially preventable factors are pre-diabetic metabolic and neuropsychiatric symptoms. Social and environmental interventions are logical targets (Cooper, 2015). The present proposal aims at extending the set of relations to an important domain of built environments. Built environments are design of spaces ranging from private to public to perform activities efficiently, failure of which affects health (Pasala & Pammi, 2012). Built environment regulates physical activity and neurological nourishment manifesting physiological and psychological conditions respectively (Pasala, Allam & Sridhar, 2010). Built environment factors for sleep, transportation etc. were assessed to body weight for individuals with DM to measure energy, anxiety, depression etc. Anxiety and depression levels were closely associated with fasting blood glucose and weight in males whereas in females with energy and anxiety (Sridhar et al., 2010). Built environment stressors are increasingly becoming the reasons for DM. Environmental enrichment seems to show promising results in prevention. Attention Restoration Theory proposes that performing activities against backdrop of environment contribute to stress and need to provide opportunities for rejuvenation. Prolonged use of directed attention leads to fatigue due to reduced availability of cognitive resources required to manage everyday demands. An environment that puts inhibitory mechanism of directed attention to rest, recovers the capacity of direct attention by improved cognitive resources. Natural environments provide relatively good opportunities however, restorative experiences can occur in built environments wherein activities are compatible within the limited time budgets (van den Berg et al., 2007). Aspects of cognitive functions relevant to built environments on human performance are attributes of social, cultural and physical surroundings. In the triad of daily human activities of work–travel–rest there is need to rejuvenate oneself from stress to get set for the subsequent day's daily activity. Scope for rejuvenation could best happen at rest places i.e. home. Because the predominant activity is routine at home requiring lesser cognitive loads it should replenish cognitive resources. Spatial organization and arrangements of relevant implements becomes important, similar to solving of Word Scramble and Jigsaw puzzle. Further, spatial organization for rejuvenating activities can be integrated to reinforce replenishment of cognitive resources. Methods adopted to assess cognitive domains could help in assessing built environments. Visuospatial and memory tests in assessing differences in illiterates (Ardila et al., 1989), spatial working memory task, attention to assess executive functions in frontal lobe dysfunction (Robbins et al., 1998) and MATRICS Battery for clinical trials of cognition-enhancing treatments may also aid in evaluation of cognitive remediation strategies (Nuechterlein et al., 2008). Disassociation principle to analyze neuropsychological variations in diabetic and normal subjects may demonstrate the functioning of the humans that can further reveal the functioning of normal brain. The study envisages the importance of new area of work in light of lot of infrastructure development in the country from last decade.

15. PULL IN THE REINS, DO NOT RACE: AN INHIBITORY MECHANISM OF STOPPING ACTION

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Abstract: Introduction: Revoking a planned action due to unexpected changes in the context is an important act of control that prevents unnecessary movements from happening. The ability to inhibit an action is often studied using tasks that basically require subjects to withhold movement in response to a stop-signal that infrequently appears after a random interval, called stop signal delay (SSD), following the appearance of the target. Race model that accounts for subjects' saccadic eye-movement behaviour in the countermanding task, assumes that a GO process races with a STOP process to reach a fixed threshold (Logan & Cowan, 1984). According to this model, a planned saccade is successfully cancelled if STOP reaches the threshold before GO does, and a saccade is generated if GO wins the race. An obvious criticism of this model is that while physiological evidence of GO reaching a threshold has been found in oculomotor areas of the primate brain, there is no reported neural correlate of STOP reaching the threshold when saccade is cancelled. Different alternatives of the independent race model have been proposed (Reviewed in Logan, Van Zandt, Verbruggen & Wagenmakers, 2014). Amongst which a

recent one is worth noting that refutes the idea of race between GO and STOP; instead suggests that the growth rate of GO progressively decreases depending on the speed of identification of the stop-signal (Salinas & Stanford, 2013). Although there is a common consensus that attention is critical for perception, and attention shifts before gaze shifts (Shepherd, Findlay & Hockey, 1986), surprisingly none of these models considers attention may be an important issue for inhibition. We examined roles that attention play in inhibition of saccade, and the underlying mechanism. Methods: We used a novel choice-countermanding paradigm in which subjects selected a target from identical alternatives based on either a central or a peripheral decision cue, and infrequently required to cancel eye movement in response to a visual stop-signal. A total of seventeen healthy human subjects participated in both tasks. Their eye movements were recorded using an infrared pupil tracker (ASL 60 Hz). The experiments were conducted under control of E-Prime software (PST Inc.). Simulation of model was done using Matlab (MathWorks Inc.). Results: (a) On average the error RT in stop trials was longer than the correct RT in no-stop trials in the peripherally cued task. Further, our data did not show any significant increase in error RT with increasing SSD. These findings contradicted the race model. (b) Analysis of saccadic RT suggested that the rate of GO processing increased in the peripherally cued task compared to the centrally cued task. To counter the speed of processing the threshold to generate saccade was raised to a higher level when the stop-signal appeared. (c) Simulation of two stochastic integrators, one that accumulated evidence in favor of shifting gaze, and inhibited by the other integrator accumulating evidence in favor of holding gaze accounted for subjects' behaviour. Discussion: We have evidence that presaccadic shift of attention influences inhibition. Our data suggests that when the saccade preparation is expedited by allocation of attention to the target, the threshold of saccade generation is raised higher to have enough time for exertion of inhibitory control. Acknowledgement: The author S.R. was supported by Wellcome Trust DBT India Alliance.

16. RELATIONSHIP BETWEEN SENSE OF COHERENCE, WORK ENGAGEMENT AND ORGANIZATIONAL COMMITMENT IN MANUFACTURING AND SERVICE SECTORS

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Abstract: This research explores the relationship between sense of coherence, work engagement and organizational commitment among the working population in services and manufacturing sector. The study was conducted through quantitative research. The study used the Orientation to Life Questionnaire (OLQ) to measure sense of coherence, the Utrecht Work Engagement Scale (UWES) to measure work engagement and the Organizational Commitment Scale (OCS) to measure organizational commitment. A biographical questionnaire was also used. The questionnaires were administered to a sample of 240 employees, 120 from service sector and remaining from manufacturing, with reference to the age hypothesis for each employee shall be more than 30 years of age, with minimum work experience of about 5 years in the same company. A theoretical relationship between the constructs was determined and an empirical study provided evidence of the degree of relationship that existed between.

17. HOW THE FIRING RATE OF UNDERLYING NEURAL DYNAMICS CONSTRAIN BOLD RESTING DYNAMICS: A COMPUTATIONAL STUDY

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Abstract: Resting state brain activity is considered as one of the important basal state that provides a direct link with brain function alteration in the diseased state. Functional connectivity (FC) at rest have been found to be highly structured and to be strongly related to the underlying structural connectivity (SC) between different brain areas (Deco et al., 2011; Deco et al., 2013). Different Resting state networks (RSNs) have been identified using functional neuroimaging methods (fMRI) those constitute brain networks primarily responsible for awake active stimulus processing. These networks (e.g. Visual, Auditory, Sensory-motor, Default mode, Fronto-parietal, Saliency) are the most prominent examples of functionally connected large-scale brain networks where dedicated processing is carried out by thousands of neuron groups during rest and active processing. Neuronal processing typically occurs in the timescale of milliseconds whereas blood level oxygen dependency (BOLD) is measured in the order of minutes. In spite of numerous modeling attempts it is still not completely understood how the firing rate of an individual brain area and their interplay is related to emergent BOLD dynamics. To address the above question systematically we have used here a recently proposed dynamic mean field model (DMF) to simulate the large scale brain dynamics. We have used the model for calculating the firing rate as a function of inter-cortical global connectivity (Deco and Jirsa et al., 2012). We have identified brain areas corresponding to different

population firing rate clusters (low, intermediate and high) and underlying connectivity within the clusters. It was seen that the number of areas that belong to low, intermediate and high firing rates values does not vary significantly for global connectivity values close to optimal operating point and that this behaviour is not sensitive to different range of low, intermediate and high firing rates. Areas belonging to low firing clusters are seen to be weakly connected in comparison to intermediate and high firing clusters. Brain areas that belong to intermediate clusters show the existence of two densely connected subnetworks that fall into two hemisphere of the cortex. We found that with high firing rates are strongly connected inter and intra-hemispherically. We believe that the difference in the firing rate depends on the global coupling parameter as well as SC that modulates the long-range excitatory input current to each connected brain area. In general, increase in neuronal activity in cortical areas being seen to relate to increase in the firing rate which essentially derives from the fraction of oxygen extracted by neuronal activity. Our clustering approach reinforce the logic that in general overt neural signatures at the population level on a faster time scale correlates poorly with the organization of BOLD hemodynamic response on a relatively slower time scales. References Deco, G., Jirsa, V. K., & McIntosh, A. R. (2011). Emerging concepts for the dynamical organization of resting-state activity in the brain. Nature Reviews Neuroscience, 12(1), 43-56. Deco, G., & Jirsa, V. K. (2012). Ongoing cortical activity at rest: criticality, multistability, and ghost attractors. The Journal of Neuroscience, 32(10), 3366-3375. Deco, G., Jirsa, V. K., & McIntosh, A. R. (2013). Resting brains never rest: computational insights into potential cognitive architectures. Trends in neurosciences, 36(5), 268-274.

18. ANALYSIS OF ATTENTION DEFICIT HYPERACTIVITY DISORDER WITH INTELLIGENT QUOTIENT FOR EDUCATIONAL PSYCHOLOGY

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Abstract: Abstract Educational psychology analyzes learning processes and individual differences like intelligence and motivation. Diagnosis of Attention deficit hyperactivity disorder (ADHD) symptoms has been challenging in adult ADHD patients [1]. The Diagnostic and Statistical Manual of Mental Disorders, 4th edition (DSM-IV) states that the category under the title Inattention have 9 symptoms exhibiting lack of attention, troubles in completing a given task, tiredness and daydreaming characteristics and the category under the title Hyperactivity have 9 symptoms like being active all the times, not being able to sit at a place for a longer duration and exhibiting constant energy. [2]. Combined category has major scoring patterns from Inattention and Hyperactivity category. Data Analysis An analysis of ADHD was conducted as a quiz on 25 engineering undergraduates, in the age group of 20. The test formulated on the basis of NICHQ Vanderbilt Assessment Scales for adults. Category A-Inattentive, in this category out of 25 students 24% of students might have ADHD and a lot of the symptoms of Inattentiveness and 76% of students are unlikely to have the Inattentive symptoms of ADHD. Predominantly Inattentive are not there. In Category B Hyperactive we observe that out of 25 students 32% might have ADHD with a lot of the symptoms of hyperactivity, 68% of students are unlikely to have the hyperactivity symptoms of ADHD. Intelligent Quotient (IQ) based on Angoff Linear Transformation Approach is computed as in Equation 1. $IQ\_i = 100 + Z\_i*15$ (1) where Z_i is the Z-Score of Sample i. We consider IQ in terms Wechsler scale [3] as specified in Table 1. Table 1: Wechsler scale of IQ Over 130 Very superior 120 - 129 Superior 110 - 119 High average 90 - 109 Average 80 - 89 Low average 70 - 79 Borderline Under 70 Extremely low/intellectually deficient Calculations of IQ of our samples are illustrated in Table 2. Table 2: Hyperactivity and above average IQ levels Inattention Score Hyperactivity Score IQ Academic Performance 11 25 107 62.95% 28 31 103 61% 16 26 107 70% 25 25 92 54% 25 27 84 51% 30 28 111 52% 32 29 73 55% 30 24 103 54% 22 25 92 64% We observe in Table 2 that those samples with Inattention and with Hyperactivity have poor academic performance with 80% having Second class marks and 20% having First class. Those samples with only Hyperactivity category have 33.33% in Distinction category and 66.66% in First class category. Also Hyperactivity only samples had Average IQ, whereas those with both symptoms had IQ ranging from Borderline IQ to Average IQ. These observations reflect that Inattention combined Hyperactivity can have implications on poor academics. We further analyze Inattention based samples with graphology [4] techniques for a sample write-up by students. Our analysis showed that out of 6 samples, 16.66% suffered from depression and 83.33% suffered from being sensitive to super sensitive. Thus sensitivity is a observation with Inattentive samples along with depression and related personality traits for our investigation in educational psychology. References [1]. Adult ADHD, http://www.adaa.org/understanding-anxiety/related-illnesses/other-related-conditions/adult-adhd [2]. DSM-IV , http://www.adhd-institute.com/assessment-diagnosis/diagnosis/dsm-iv/ [3]. How Do You Interpret The IQ Test Scores?, http://www.iqtestexperts.com/iq-scores.php [4]. Jess E Dines, "Handwriting Analysis- Made Easy", Sterling Publishers India, pp. 35-47, 2012

19. DOES COMMUNICATION AMONG INDIVIDUALS INCREASE CONTRIBUTION IN A PUBLIC GOODS GAME?

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Abstract: Economic theory suggests that a rational human being will always free ride by not contributing any money for the provision of the public good. Prior experimental research has found no significant evidence of complete free riding by participants. In this paper, I have tried to examine the complex behaviour of participants in a Public goods game, particularly the extent to which they 'free ride' in a single shot of the game. An experiment was conducted to test this tendency by fixing the valuation of the public good. In Task I, participants were not allowed to communicate with their group members. On average, participants contributed around 60% of their endowment in Task I. This is in contrast to the findings of Fehr et al (2001), where valuation of the public good was not fixed. I have also explored the role of 'communication' within a group in the Public goods game. In Task II, participants were allowed to communicate with their group members. The results suggest that communication plays an important role in increasing the voluntary contribution towards the public good. On average, participants contributed a higher amount in Task II, which might be due to their commitment towards their group members. Also, there is a tendency for conditional cooperation among participants. An interesting finding is that all the participants who were free riders in Task I, contributed their whole endowment in Task II. Thus, participants do not always free ride when they have to contribute towards a public good. The public good problem is not as bad as the theory predicts!

20. ALLOCATION OF ATTENTION TO THE STOP-SIGNAL IS NECESSARY BUT NOT SUFFICIENT TO CONTROL AN ACTION

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Abstract: Introduction: The ability to control a motor action is warranted in the dynamic world that may change suddenly to disqualify the action. The motor behaviour under inhibitory control is often examined using a stop-signal task, in which a go-signal instructs participants to make a movement, and an infrequent stop-signal instructs them to withhold the already planned movement. Different variants of the race model attempts to describe underlying mechanism of stopping by assuming that a GO and a STOP process race to reach a threshold (Logan & Cowan, 1984). If GO wins, a movement is executed; if STOP wins, the movement is cancelled. Another recent model suggests that the GO process decelerate when the stop-signal is presented, and the deceleration is dependent on the detection speed of the stop-signal (Salinas & Stanford, 2013). However, this model neither indicates the mechanism of deceleration of GO, nor takes any cognitive factor, such as attention into account. We manipulated attention to understand influence of visual perception on oculomotor control. Methods: We used a novel attention-blink-countermanding (ABC) task in which a series of English alphabet letters was presented in rapid succession at the center of the screen where participants fixated. Participants classified a number presented in every trial within the stream of letters as odd or even to shift gaze to a target either at left or right of the screen. Letter X was randomly presented in minority of trials as a stop-signal after a delay (SOA), which instructed participants to withhold the planned eye movement. At the end of each trial, participants reported whether the number was odd or even, and if letter X appeared in the stream of alphabets or not. A total of eleven healthy adult volunteers also participated in a modified attentional-blink experiment (Raymond, Shapiro & Arnell, 1992), and a modified countermand experiment (Hanes & Carpenter, 1999). Eye movements were recorded using an infrared eye tracker ASL D6 (60 Hz). Experiments were conducted using E-Prime software. Results: 1. In the countermand task, although the frequency of failure to cancel saccade in response to the stop signal increased with SOA, the average reaction time (RT) in those trials did not increase with SOA, which cannot be explained by the race model. 2. In the ABC task, correct detection of the stop-signal and successful stopping exhibited almost identical dynamics; nevertheless, correct detection of the stop-signal did not always ensure cancellation of saccade. In about 20% of stop-trials across SOA subjects failed to cancel saccade despite correct detection of the stop-signal. More surprisingly, in about 20% of stop-trials at shortest SOA, although subjects failed to report the stop-signal they cancelled saccade. 3. Proportion of error stop trials in which subjects successfully detected the stop-signal did not change across SOA. In contrast, proportion of error stop trials when subject failed to detect the stop-signal increased steadily with SOA. Conclusion: Results of the experiments suggest that perceptual detection of the stop-signal is necessary but not sufficient for stopping saccadic eye-movement. Pre-saccadic shift of attention from the location where the stop-signal appears, to the location of the target, may be a reason behind higher frequency of error in stopping at longer SOA. Acknowledgement: The project was supported by DST (Govt. of India), and author Indrajeet was supported by a fellowship from UGC.

21. DIRECTION DEPENDENT PROCESSING OF MOTION STIMULI IN TEMPORAL DOMAIN

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Abstract: Introduction: Attention helps us channelize our resources to behaviourally relevant information in our environment. Neurons in our brain are functionally compartmentalized to process different stimuli. The processing ability of our brain is limited. Two such limitations in temporal domain are: 'attentional blink' and 'repetition blindness'. In attentional blink, when two targets presented amongst the distractors come close in time (200-500ms), processing of the second target (T2) is severely impaired, provided the first target (T1) is correctly identified. Repetition blindness refers to difficulty in detecting repetition words or letters presented close in time. A range of stimulus types like, letters etc has shown these robust effects. Does this temporal limitation also extend to motion stimuli? Studies have shown that motion stimuli is integrated over space and time. If two target motion stimuli with similar directions are presented in close succession amongst distractors then, signal to noise ratio would improve and facilitate processing of the second motion stimulus and thereby its perception. As opposed to when two stimuli are of different directions then, the signal to noise ratio would be low and may compete for processing resources leading to impaired perception of the second motion stimulus. We tested this hypothesis by using a modified attentional blink paradigm. Methods: We conducted an experiment, in which a rapid serial visual presentation (RSVP) of black random dot pattern (91ms) was presented at the center of the monitor and alternated with a blank display (74ms). The black random dot stimuli were distractors and moved in different directions. Amongst distractors one or two targets were presented randomly, with any one of the four directions: UP/DOWN/LEFT/RIGHT. The second target was not presented in 20% of total trials (catch trials). In the remaining 80% of trials the second target was presented at three stimulus onset asynchronies (SOAs): 165ms, 330ms, 495ms corresponding to lags 1, 2 and 3. The two targets were 'white' random dot patterns and were differentiated between the distractors by their color. At the end of each trial participants reported the direction of the first target (T1) and then reported the presence or absence of second target (T2). If they report the presence of T2, then they indicated whether T2 was moving in the same, opposite or perpendicular direction compared to T1. Results: For each participant, performance for the correct T2 discrimination was evaluated separately when T2 was same, opposite or perpendicular to T1. There was no significant impairment of T2 processing, when T1 and T2 were moving in same direction at all lags. On the contrary, when T1 and T2 were moving in opposite or perpendicular direction to each other, there was a significant impairment in T2 processing at lag1. Majority of errors were the ones where participants reported that they did not see T2. The number of errors was minimum when T1 and T2 were of same direction and maximum when they were moving in direction opposite or perpendicular. Discussion: Absence of impairment of T2 processing when T1 and T2 were of same direction indicates absence of repetition blindness with motion stimuli paradigm and are also not in complete agreement with attentional blink. But it does support the hypothesis of spatio-temporal integration of motion stimuli. Acknowledgement: Cognitive Science Research Initiative (CSRI), Department of Science and Technology (DST) provide the funds and support for this study.

23. STROKE DETECTOR

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Abstract: A stroke, also referred to as a cerebrovascular accident (CVA) or cerebrovascular insult (CVI), is the loss of brain function caused due to the disturbance in blood supply to the brain leading to severe paralysis and disability. Early medication and treatment could reduce the effects drastically and sometimes even reverse it. Time is the major factor in cases of cerebrovascular accident (CVA). But the early diagnosis of a stroke is extremely difficult since the symptoms are very similar to less serious condition like vertigo. More than half the cases of brain stroke do not exhibit the symptoms in the early stages leading to misdiagnosis. Researches prove that a head impulse test is more accurate than even the most complex imaging techniques such as MRI for early diagnosis. Stroke severely affects the vestibular system thus affecting eye movement and cognition. An eye tracking system is designed to monitor the eye movement of the patient when the Doctor conducts the Head Impulse Test. The system is coupled with Electroencephalogram (EEG), Electrooculogram (EOG) to monitor any minute variations in the eye movement that could have missed due to the limitations of eye tracking system. The system can serve to be an accurate diagnostic tool for the detection of brain stroke.

24. ANALYSIS OF COGNITIVE EFFECTS OF MUSIC BASED ON COMPLEXITY MEASURES OF HEART RATE VARIABILITY

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Abstract: Music has great influence on an individual's life and society from the ancient era onward. It is due to the effect of music on human cognitive system. This thesis is a study of effect of music on Autonomous Nervous System (ANS) of human cognitive system in the light of Heart Rate Variability (HRV) analysis, which is a powerful tool that reflect its activity. An experiment was conducted on selected number of subjects and various HRV indices were calculated. Time, frequency and non linear HRV indices were compared under the influence of two musical types: a slow melody type and a fast rhythm type. The comparisons were also done based on presence and absence of music. Results indicate a clear information about the effect of music on human ANS through its reflections in HRV parameters. The parameters like SDNN, power spectral density and complexity measures were found to be the indicators of music effect. It was observed that slow melody improves the complexity of HRV, a desired feature of healthy heart. This study enlightens the scientific backbone for music therapy and its effectiveness on various pathological conditions as well as psychological and cardiovascular problems.

25. COLLECTIVE SYNCHRONISATION OF BRAINS IN REFLEX SPECIFIC ACTIVITY BASED ON MUSICAL STIMULUS
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Abstract: Music plays an integral role in everyday life. It has an important part to play in ontogenetic development and human evolution. Cognitive neuroscience of music is the scientific study of brain-based mechanisms involved in the cognitive processes underlying music [1]. These behaviours include music listening, performing, composing, reading, writing, and ancillary activities. It is also increasingly concerned with the brain basis for musical aesthetics and musical emotion. The idea is a pilot study which deals with the issue that whether music has true capability of synchronization across intra participants. Also can music tune our mood which can be reflected in emotional perceptual? It has been reported that inter-subject synchronization occurs at multiple levels in the information processing hierarchy – from sub-cortical and cortical auditory structures to fronto-parietal attention network and motor planning areas [2]. This saliency is examined by presenting extended excerpts of different theme of songs to 2 group of subjects. The first group is test group and another group is control group. Pre-test are carried out on both the groups. We started with Emotional Quotient Self-Score Questionnaire [3] to evaluate emotional status of participants and took EEG imaging N100 & P300 responses which can provide the resonances and signature of oscillations in brain areas for saliency of musical stimulus. Stratification of subjects in their group are done into either of three following states viz. Happy, Calm & Sad. For test group subjects who are in sad state of mind are given a musical stimuli of happy state of mind & vice-versa and for subjects falling in calm mood category are given either happy or sad musical stimuli. However for control group subjects, the same musical stimuli was presented as their emotional status. Now, post experiment Emotional Quotient Self-Score Questionnaire was conducted to test whether musical stimuli had any impact to swing their mood or not along with EEG imaging N100 & P300 responses. We analysed that the synchronized spatiotemporal activity patterns between listeners to find collective synchronisation of brain signals and compared them with pre and post survey results. Our results shows that a hierarchical distributed network is synchronized between individuals during the processing of extended musical sequences, and provide new insight into the temporal integration of complex and biologically salient auditory sequences. These signatures of synchronized brain activity across individuals in multiple hierarchically structured systems may underlie shared neural representations that facilitate our collective social capacity for listening and attending to music [2]. References: 1. Wikipedia: Cognitive neuroscience of music 2. Inter-subject synchronization of brain responses during natural music listening; Daniel A. Abrams, Srikanth Ryali, Tianwen Chen, Parag Chordia, Amirah Khouzam, Daniel J. Levitin, and Vinod Menon, Eur J Neurosci. 2013 May ; 37(9): 1458–1469. doi:10.1111/ejn.12173 3. Management Performance Solutions Ltd, Emotional Quotient Self-Score Questionnaire

26. A NEURODYNAMICAL APPROACH TO PRE-STIMULUS BRAIN STATE DEPENDENT OSCILLATIONS IN THE CORTEX
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Abstract: Signal processing in electroencephalography (EEG) or magnetoencephalography (MEG) involves resolving continuous or event related signals from the brain in terms of components characterized by frequency

ranges through Fourier decomposition. The common bunches of frequencies used in such practices are named as (4-8Hz), (8-12Hz), etc and they are also given cognitive importance by researchers. The most important question to ask here is whether these bands are just a matter of convenience or a result of some oscillatory activity model that the brain follows on its own. There have been attempts to connect the oscillatory activity to the spiking models of neurons commonly used in rate coding literature (Deco, et al., PNAS, 2009, Nakagawa et al, Neuroimage, 2012). However the question requires a more fundamental look at the mathematical properties of neural codes. Our understanding in recent years has moved beyond rate coding, and incorporates the the idea of time codes where spike timings and phase related information is needed for reliable transmission and processing of information in a cognitive agent. However most of these attempts look at post-stimulus neural processes (for instance with post-stimulus time histogram or PSTH method). In some recently emerging studies, researchers have studied the pre-stimulus oscillatory activity characterizing brain states in MEG and EEG based studies and have linked conscious detection of stimuli to prestimulus oscillatory brain activity (Keil et al.,Cer. Cortex, 2012, Weisz et al., PNAS , 2014). For example conscious detection of near threshold stimulus in visual domain implicates prestimulus frequency band in MEG based signals (Weisz et al., PNAS , 2014). In spite of these attempts the neurophysiological or theoretical understanding of such results remain largely obscure. In this paper, we show the theoretical possibility of a neural assembly giving rise to oscillatory dynamics as an emergent property than as a trivial result from Fourier transform properties. We characterize the properties needed for a neural assembly to give rise to oscillatory dynamics and test it with a neural mass model. Our work provides a clue towards not only understanding the importance of looking at the frequency bands like and ,but also gives a theoretical scientific basis for looking at the prestimulus brain states. References Deco, G., Jirsa, V., McIntosh, A., Sporns, O., and K̈otter, R. (2009). Key role of coupling, delay, and noise in resting brain fluctuations. Proceedings of the National Academy of Sciences, 106(25):10302–10307   Nakagawa, T. T., Woolrich, M., Luckhoo, H., Joensson, M., Mohseni, H., Kringelbach, M. L., Jirsa, V., and Deco, G. (2014). How delays matter in an oscillatory whole-brain spiking-neuron network model for meg alpha-rhythms at rest. NeuroImage, 87:383–394   Keil, J., M̈uller, N., Ihssen, N., and Weisz, N. (2012). On the variability of the mcgurk effect: audiovisual integration depends on prestimulus brain states. Cerebral Cortex, 22(1):221–231.   Weisz, N., Ẅuhle, A., Monittola, G., Demarchi, G., Frey, J., Popov, T., and Braun, C. (2014). Prestimulus oscillatory power and connectivity patterns predispose conscious somatosensory perception. Proceedings of the National Academy of Sciences, 111(4):E417–E425.

28. COMPUTATIONAL INVESTIGATION OF LOCATION DEPENDENT EFFECT OF CLUSTERED SPINES ON INTEGRATION IN STRIATAL MEDIUM SPINY NEURONS

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Abstract: The reward pathway in the brain is an important circuit for various behavioral and sensory-motor aspects of an organism. The nucleus accumbens (NAcb), which constitutes the major subdivision of the ventral striatum, plays an important role in the reward pathway. It is also considered as the major site of action for many drugs of abuse. Majority of neurons in NAcb are GABAergic Medium Spiny Neurons (MSN). At cellular level any changes in reward related behavior have been attributed to changes in the responses of the MSN. These neurons receive synaptic input over number of spines which are present on complex dendritic arbors. At microscopic level, dendritic spines appear as small protrusions of approximately <2 µm in length, with a bulbous, spherical head (0.5-1.5 µm diameter) connected by a narrow neck (<0.5 µm diameter) to the parent dendritic shaft. Properties of spines and synapses may cause distortion of the final output at soma and can create specific computational problems in MSN. These synaptic inputs are distributed in different patterns on the dendrites for e.g. in-branch localization, functional and anatomical cluster. Clustered plasticity hypothesis states that memory engrams are preferentially formed at spines that are clustered on a dendritic branch and thus suggest that clusters are form of long term memory storage. These spatiotemporal clustered inputs helps in generating the dendritic spike making it act as a separate integration unit and thus enhance the computational capacity of a neuron and encodes spatial and temporal input synchrony. In our current work we have attempted to investigate the role of spines in shaping EPSPs through computational simulations using the model of MSN. Our simulations were carried out using a multicompartment stylized model of the MSN with biophysical properties constrained by in-vivo intracellular recordings and was built using the NEURON simulation platform. Results of our investigation show that dendritic spine affects the amplitude and half width of EPSP. Stimulation of a single spine showed that amplitude of EPSP at spine PSD is different than that of its parent dendrite. We also tried to find out effect of cluster of spines on temporal integration window, time period over which AP may be generated as a result of integration of synaptic inputs. It was found that, high input resistance spines alter the EPSP amplitude and width and hence found to be affecting synaptic integration pattern. Also, the location and clustering of the spines influences the EPSPs. When simulations were

carried by activation of a cluster it was found that the somatic potential increased with number of spines in a cluster. Also, when potentials recorded by stimulation of proximal and distal cluster (4 spines) compared with that of uniform distribution, it was found that spine EPSP for uniform distribution is smaller when spines were clustered proximally and larger for distally clustered spines. When temporal integration was measured, it was found that activation of a single spine resulted in temporal window (47 ms) which is wider as compared to the temporal window (35 ms) resulted by activation of clustered inputs. Also, when temporal window was compared for proximal and distally located cluster, it was found that proximally located cluster resulted in wider temporal window.

29. MANIPULATION OF LOSS AVERSION BY MONETARY ENDOWMENT AND AFFECT: AN EVENT-RELATED FMRI INVESTIGATION

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Abstract: Kahneman and Tversky (1979) demonstrated that the gains must be much larger than the losses in order that subjects would choose to play a mixed gamble involving both gains and losses. This is referred to as loss aversion suggesting that individuals are more sensitive to losses than to gains. Empirically it was shown that normal individuals show a persistent aversion to losing - Loss Aversion Coefficient (LAC) of 2. In this study we study how risky financial decisions are influenced by sudden anticipated shocks to wealth, employing both behavioural and neurobiological measures. We conduct an experiment, in which each individual decides sequentially whether or not to accept 256 gambles, using a paradigm based on that used in Tom et al. (2007). Subjects begin with an initial endowment of 20 Euro. During the task, we subject their endowment to shocks. After 64 trials they experience a wealth shock of -10 Euro, and after 64 more trials there is a positive shock of 20 Euro. In our baseline setting, the changes in endowment are independent of the actual choices that subjects make.In our experiment, we manipulate the emotional response to the change in wealth resulting from the shock. In addition to the baseline treatment described above, called DME, we conducting a second treatment, called EME. In EME, we induce the belief that the changes in income are a result of unlucky choices of the participants. Actual Changes in endowment are the same in EME and DME, allowing behavioural and neural measures to be directly compared between treatments. We hypothesized that individuals would become more loss averse after a negative shock under EME than under DME, since under EME they would experience task-induced emotion from their choices. We verify that the emotional response is different between DME and EME, using behavioural and functional MRI measurements. The behavioural results from loss aversion coefficient showed significant difference between EME and DME when there was a shock (loss of 10 Euro) compared to gain and no-gain runs. The functional MRI results revealed common neural loss aversion network comprising of bilateral striatum, right amygdala and dorsal anterior cingulate cortex across EME and DME tasks. However, the right ventral frontal cortex, right primary somatosensory cortex and right superior occipital cortex showed similar trends as behavioural loss aversion results i.e., brain activations significantly higher in these areas due to shock compared gain and no-gain condition. These results indicate that the striatum is subserving loss aversion independent of experimental manipulation, however the ventral frontal cortex codes the experimental manipulations especially due to wealth shock.

30. FUNCTIONAL MRI INVESTIGATION OF DEFAULT MODE NETWORK MODULATIONS AND INTERACTIONS DURING EMOTION PERCEPTION

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Abstract: Psychological constructivist perspectives of emotion perception conceptualize emotional experience as a result of basic psychological processes that interact to construct the emotional experience. In the realm of

neuroimaging, the above perspective enables to map emotion perception to a network of brain regions with each region corresponding to the basic psychological process in the construction of emotion. An interesting observation owing to the constructionist perspective is the involvement of the default mode networks in emotion perception. Default mode network (DMN) consists of brain regions that are found to be primarily active when individuals are not focussed on any specific task. Earlier attempts to identify the neuralsubstrate of emotion revealed substantial activity in the brain regions that constitutea subnetwork of the DMN regions. Importantly, the roles of ventromedial prefrontal cortex (vmPFC), the dorsal anterior cingulate cortex (dACC) and the subcortical regions (bilateral Amygdala, Medial temporal Gyrus (MTG)) in emotional processing are well documented. It has been proposed that vmPFC serves as a structural hub that connects with many brain regions involved in encoding the affective quality of an event along with other functions. Although, these type of findings emerge, it remains unclear as to how and what capacity the default mode networksinteracts with other cortical and subcortical regions during the processing of emotions.Specifically, how activity in the subnetworks of the DMN is modulated while perceiving emotions of varying valence. The present study aims to address these issues. The participants were asked to view pictures of emotional scenes while they lie in the scanner. Three types of emotions (pleasant, neutral, and unpleasant) were used with varying valence ratings while matching for arousal ratings of Indian population rated IAPS pictures. The first level statistical model was carried out to identify voxels activated for each emotion condition compared to the baseline. Additionally, the voxels which were active for the saliency and valence contrasts have been identified. RFX analysis of the saliency contrast showedmedial orbitofrontal cortex, right dorsal amygdala,subgenual anterior cingulate, right anterior insula, posterior cingulate gyrus, bilateral middle temporal gyri activations. The regions such as bilateral anterior insula, bilateral inferior parietal lobule,bilateral middle frontal gyrus, medial frontal gyrus showed decreased activity in saliency. Based on these results, time series form the regions that encode saliency have been extracted using ROI analysis. In order to assess the functional connectivity, pairwise correlations between these regions were calculated. The results revealed significant correlation between theselected ROIs. Further analysis focuses on understanding how within DMN and outside DMN activity is modulated by the type of emotion being processed based on the patterns of functional connectivitybetween regions such as medial orbitofrontal cortex, right dorsal amygadala, bilateral middle temporal gyrus. Our method may provide systematic insight on how the DMN regions modulate the Frontal-amygdala functional connectivity during emotion saliency processing.

31. DEVELOPMENT AND VALIDATION OF PLAY BASED MOTOR TASKS FOR EXECUTIVE FUNCTION IN PRESCHOOL CHILDREN.

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Abstract: Movement proficiency development in pre-children provides a potential window for assessing executive function and it's an underutilized area in developmental action neuroscience. The purpose of the investigation was to develop and evaluate the factor structure and reliability of the play based functional tasks to assess the following domains of executive function i.e., inhibition, sustained attention, social thinking and regulation of affect.Forty two typically developing preschoolers (age range : 4 to 6 years) performed fifteen play tasks on above four domains and scores were obtained for the achieved levels of each play items.Content validity of executive function play tasks was established by expert interviews and consider for inclusion if an each items had good satisfaction rate of above 50% . Cronbach's alpha coefficient (= 0.844) presented a high degree of reliability for cumulative fifteen play items or tasks of four domains.Correlation matrix indicated suitability for factor analysis (with many above r = 0.3 correlations) and the Determinant was 4.686E-006. Bartlett's test was highly significant (p < 0.0001), and the Kaiser-Meyer-Olkin measure of sampling adequacy was 0.73. There was communality in executive function task demands across all play items ranges from 0.46 to 0.93. Analysis supported and extracted four core factors with Eigen value above 1, which accounts for cumulative variance of 73.98%. Eventually, these 4 factors with reliable

15 play items were adopted to establish preliminary battery for testing EF in preschoolers. This study open avenues for assessing executive function through play based activities in pre-schoolers.

32. FACTORS AFFECTING REWARD BASED DECISION MAKING : A COMPUTATIONAL STUDY

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Abstract: Basal Ganglia (BG) are known to be responsible for action selection, decision making and reward based learning in a changing environment. We present a biologically plausible decision making model of BG and attempt to examine if action selection is affected under the influence of certain external factors with respect to stimulus representation. The model is a reference implementation of Guthrie et al, 2013 [1]. When presented with two differently rewarding stimuli at the same time, the model learns to select a stimulus associated with a higher reward. We allow the model to learn, eventually to select a higher rewarding stimulus always. We analyze the impact of visual salience of the stimuli, temporal difference in the appearance of stimuli and other possibilities while learning itself. We test the model presenting the worst choice (lesser rewarding stimulus) with more visual salience than that of the best choice (higher rewarding stimulus). Early results show that the model, despite having learned, could make a bad decision choosing the worst choice if its salience is greater than that of the best choice by a certain difference. In another attempt, the worst choice is presented first and the best one after a certain time delay. Though the delay is considerably small compared to the total time of stimuli presentation, it is observed that the worst choice could be selected if the best choice appears after a certain delay. The difference in salience or time of presentation which cause the model to take a bad decision is observed to be associated to the difference in reward values of the choices presented. We also studied the possibility that BG learns to associate the reward not just to the cognitive aspect (shape) of the stimuli, but also to the position of stimuli which fetched the reward. Such a learning is observed to reduce the overall performance accuracy of the model, making more number of bad decisions. References: [1] Martin Guthrie, Arthur Leblois, Andr e Garenne, and Thomas Boraud. Interaction between cognitive and motor cortico-basal ganglia loops during decision making: a computational study. Journal of neurophysiology, 109(12):3025–3040, 2013.

33. LARGE-SCALE CORTICAL CONNECTIVITY IN AUDITORY PROCESSING

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Abstract: Auditory processing is one of the most important functions in human brain. Bilateral auditory cortex processes auditory information and also plays a major role in audio-visual multisensory integration. Few previous studies (Ross et al., 2005; Shaw et al., 2013) report that the bilateral auditory cortices function is not symmetrically distributed in functional brain areas. A key question is how both hemispheres are engaged in auditory processing. Does hemispheric laterality depend on laterality of auditory stimuli (binaural or monaural)? And why do we get this type of functional laterality in auditory processing? Is there any neuronal network responsible for this functional asymmetry? Does the network clustering depend on neuronal oscillatory frequencies during auditory processing? In this study, we are trying to answer these questions by using functional connectivity analysis. We recorded 64 channels EEG of normal healthy participants with high sampling rate (1 kHz) into resting state (baseline), binaural 40Hz, monaural left 40Hz and monaural right 40Hz tone for 200 seconds each. We calculated correlation and imaginary coherence among all channels (64 cortical locations) for all the four stimulus conditions for Alpha, Beta and Gamma frequency ranges. After that we mapped connectivity among all-to-all channel for these frequency ranges. By setting appropriate significance level (p=0.05) we found that right hemisphere is more activate in case of binaural stimulus. The right hemisphere is getting more activated in case of left monaural stimulus and left hemisphere in case of right monaural stimulus. But in case of left monaural stimulus right hemisphere is more activated in comparison to the left hemispheric activation by right monaural stimulus. In all the three stimuli and resting state conditions, we found that network clustering is more distributed (less localized) for lower frequency ranges of EEG. For higher frequency ranges the distribution of network clusters are going to be decreased and they are more local near the primary auditory cortices. In these distributions the connectivity strength is also increasing as we go from lower to higher frequency EEG components. Thus, these findings strongly suggest that the brain shows right hemispheric dominance in auditory processing. In stimulus conditions, the auditory processing networks which are more localized over auditory region dominate the resting state

networks distributed over large area. The networks responsible for auditory processing are more local for higher frequency components. References: 1. Ross, B., A. T. Herdman and C. Pantev (2005). Right hemispheric laterality of human 40 hz auditory steady state responses.. Cereb Cortex 15(12), 2029–2039. 2. Shaw, M. E., M. S. H¨am¨al¨ainen and A. Gutschalk (2013). How anatomical asymmetry of human auditory cortex can lead to a rightward bias in auditory evoked fields. Neuroimage 74, 22–29.

34. A SIMPLE MODEL OF ASTROCYTIC MODULATION OF SYNAPTIC PLASTICITY

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Abstract: The contribution of astrocytes in the modulation of synaptic plasticity has been a topic of discussion during the recent years. In particular, the shift from Long Term Potentiation (LTP) to Long Term Depression (LTD) in synaptic plasticity has been shown to be influenced by astrocytic activity, even when the presynaptic and post synaptic activities are fixed. This 'plasticity' of synaptic plasticity is termed as metaplasticity and is traditionally assumed to be solely neural activity dependent. We propose a simple model that elucidates how astrocytic activity can influence synaptic plasticity. The proposed model constitutes the tripartite synapse with presynaptic, postsynaptic and astrocytic compartments. The gliotransmitters released into the synaptic cleft bind to the postsynaptic NMDA receptors, which leads to an influx of Ca++ ions into the intracellular region of the postsynaptic neuron. Plasticity is dependent on the calcium influx into the postsynaptic compartment and is described on the lines of the calcium control hypothesis. The calcium control hypothesis suggests that higher levels of calcium in the postsynaptic compartment lead to LTP, while moderate levels produce LTD. Experimental data suggests that astrocytic modulation of synaptic plasticity, which is manifest in terms of alteration in the threshold at which LTP becomes LTD, arises primarily due to two astrocytic transmitters: glutamate and D-serine. The model thus describes how these gliotransmitters influence synaptic plasticity. The model first simulates the release of glutamate into the synaptic cleft by the presynaptic neuron. This glutamate binds to the mGluR receptors on the astrocyte, which in turn leads to calcium influx into the astrocyte via the IP3 pathway. The gliotransmitter glutamate is released by the astrocyte via the astrocytic calcium dependent pathway. Thus the glutamate present in the synaptic cleft has two sources, namely the presynaptic neuron and the astrocyte. Similarly, the gliotransmitter D serine is also released into the synaptic cleft via the glucose dependent pathway. The astrocyte converts blood glucose to L Serine, which in turn is converted to D serine. Now, glutamate and D serine act as co-agonists for the NMDA receptors present on the postsynaptic neuron. The influx of calcium into the postsynaptic neuron depends on the voltage-dependent magnesium blockage and NMDAR conductivity. The model could possibly account for the following experimental results: • The LTP-LTD shift due to glutamate and/or D serine released by the astrocyte • The shift in synaptic curve for lactating rat compared to the virgin rats. In summary, the model proposed reconciles the role of the different gliotransmitters in modulating synaptic plasticity by shifting the threshold of neuronal activity required to go from an LTD to an LTP regime.

35. INTERACTION BETWEEN NATURAL (ALPHA-BAND) AND EVOKED BRAIN OSCILLATIONS DURING VISUOSPATIAL ATTENTION

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Abstract: Alpha oscillations are natural brain oscillations that occur between 8-12 Hz. Steady state visually evoked potentials (SSVEPs) are evoked brain oscillations that occur in response to rhythmically flashing stimuli. In this study we tried to find out the interaction between the alpha oscillations and SSVEPs, and to characterize their variations in strength with the contrast of input stimuli. The task paradigm consisted of 4 vertically oriented, circular gratings presented around a fixation cross. These gratings were presented at an eccentricity of 6 degrees, at an elevation of +/- 20 degrees and +/- 45 degrees. The gratings on opposite sides of the screen (left versus right)flickered at different frequencies (f1 and f2) with top and bottom gratings on each side appearing in counterphase; such a configuration is known to enhance the SSVEPs[1]. Contrasts of the left and right grating were pseudo randomly varied. In addition, a central cue indicated one of the four gratings as a target for attention. The subject had to fixate on a central cross while attending covertly to the left or to the right, and making perceptual judgements about the cued grating. To measure the interaction between SSVEPs and alpha oscillations, we employed a recently-developed technique known as Denoising Source Separation (DSS)[2]. DSS identifies the

dimensions of the data in the sensor space that maximizes some desired property of the time series. In this approach the data is first whitened to make it decorrelated along its principal dimensions. Then this whitened data is rotated to align it along the dimensions that maximize the variance of the data at the SSVEP frequencies. This process produces a time series corresponding to a linear combination of data from a subset of electrodes that exhibit maximal SSVEP power. From this SSVEP-biased timeseries, alpha power was estimated with multitaper spectral analysis. Upon analysis of the common mode referenced EEG data, SSVEPs corresponding to the distinct frequencies (f1 and f2) were observed over the occipital region contralateral to the respective grating. In general SSVEP power was greater for the left hemifield stimulus. In addition, SSVEP power increased systematically with increasing contrast of the contralateral grating, consistent with previous observations[3]. Surprisingly, SSVEPs showed no apparent modulation with the contrast of the grating on the ipsilateral hemifield. Moreover, SSVEPs corresponding to the right hemifield stimulus showed strong modulation with attention, whereas those corresponding to the left hemifield stimulus were not significantly modulated by attention, possibly due to a"ceiling effect". Induced alpha power systematically decreased with contrast of the contralateral grating and, surprisingly, was consistently higher on the side toward which the subject paid attention. Alpha is widely hypothesized to index suppression of visual processing. Hence, we expected to find a negative correlation between alpha power and SSVEP power. Although SSVEP and alpha power did encode grating contrast differently, both alpha power and SSVEP power were similarly modulated by attention. The results indicate the need for further investigating the precise nature of the dynamic relationship between naturally occurring alpha oscillations and stimulus-evoked SSVEP oscillations. References: 1. Vanegas et al (2014). J. Neurophys. doi: 10.1152/jn.00774.2014 2. Sarela & Valpola (2005) J. Machine Learning Res. 6, 233-272 3. Russo et al (2002). Steady-State VEP and Attentional Visual Processing in The Cognitive Electrophysiology of Mind and Brain, Academic Press Inc.

36. CREATIVITY DIFFERENCES BETWEEN MIDDLE AND HIGH SCHOOL STUDENTS OF C.B.S.E. AND STATE BOARD SCHOOLS IN CHENNAI

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Abstract: The current generation, who are still in schools, will face a job market that demands innovation and out of the box thinking. Hence, creative thinking becomes a skill necessary to be employable. Creativity is the ability to generate ideas or products that are both novel and appropriate to the circumstances. One of the factors affecting creativity is educational format and system. Education expands the mind and exposes it to opportunities where creativity can be fostered. In Chennai, there are many different education boards – two of which are taken into consideration here – schools that follow the syllabus given by the Central Board of Secondary Education (C.B.S.E.) and those that follow Tamil Nadu's school education system (Samacheer Kalvi). The former focuses more on skills of analytical thinking and the latter places an emphasis on depth of knowledge. The purpose of the study is to compare creativity scores of middle school children and high school children of schools in Chennai following these syllabi. Middle school children, studying in classes 6 to 8 (ages 11 to 13 years), and high school children, studying in class 9 to 12 (ages 14 to 17 years), were compared. The sample size was 140, with 70 children from Central Board schools and 70 children from Tamil Nadu State Board schools. Middle school children and high school children were equally represented in the sample. The creativity test used was the Indian adaptation of the Wallach-Kogan Creativity Test (Paramesh, 1971). The Indian adaptation includes modifications of certain components of the verbal and visual items of the test to suit the Indian setting. Statistical analysis was carried out using independent measures t test to measure whether there were significant differences in creativity between the children belonging to the different Boards. Age differences were also studied. The results of the study and the implications are discussed in the paper.

37. EFFECT OF VARYING PRESENTATION SPEED IN P300 BASED ODDBALL TASKS

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Abstract: P300 waveform is elicited in the process of decision making. Fixed sequence sustained attention to response task that involves counting of rare targets in a sequence of events was used in our study. Geometrical shape stimuli are presented to subjects at two different speeds. We used two stimulus presentation duration with a

constant inter stimulus interval. 5 students, 3 female and 2 male of age 20-25 participated in our study. P300 – ERP component that elicit a positive peak 300-400ms after the onset of stimulus duration was used to examine distinctive cognitive components. Selective attention and information processing abilities can be evaluated based on p300 component. Alpha activity of different regions of the brain is examined. Changes to the duration of stimulus presentation and its impact on brain were tested

38. PARTICLE SWARM OPTIMIZATION IN WIRELESS SENSOR NETWORKS LOCALIZATION: A SURVEY

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Abstract: In Wireless Sensor Network (WSN), There are two main aspect one is wireless sensing and other is data networking. To solve the issues of WSN like route recovery, task allocation, target tracking, localization of WSN nodes are very important. So to be a viable framework, it is appreciated that every node of WSN must know its location perfectly. Particle Swarm Optimization (PSO) is a computational system that advances an issue by iteratively attempting to enhance a hopeful arrangement as to a given measure of value by social behavior of bird hocking or fish schooling. The PSO system initialized with a population of random solution and search for optima by updating generations. In PSO the potential solutions called particles are impacted by its neighborhood best referred position which is upgraded when better positions are found by different particles. PSO is an optimization algorithm which can be used to solve the issues of wireless sensor networks hence it is well suited for the highly resource constrained WSN environment. In this paper, we aim to study and analyze the way PSO is used to improve localization techniques in WSN.

39. QUANTIFICATION OF LEARNING FROM MEMORY DECAY: A WORKING MODEL

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Abstract: Learning depends on task complexity and time taken in retrieval of learnt information from the memory. Task complexity and delay in retrieval dependent memory fading is the basic phenomenon during learning process. Remembering requires recognition of the object and space in which it exists. Ebbinghaus suggested that as time lapses there will be memory decay. The important aspect of memory decay is also due to object (task) complexity. That is,with increasing difficulty of the object chances of decay also increase. This process does not happen in "vaccum", as there is always a trace of learning that takes place. The present design helps to quantify whether task complexity or time delay, effects memory decay in two categories of memory tasks (meaningful and meaningless). Both these categories are further divided into two sub-categories upon which the stimuli is designed, they are: Task constant and Time constant. In this process of memory decay how much of residual memory is left over for usage (learning) is the problem of the model. The significance of the present design is to understand the learning process during memory decay.

40. COMPUTATIONAL MODEL OF THE VENTRAL TEGMENTAL AREA (VTA) AND ITS ROLE IN LEARNING BASED ON REWARD-PREDICTION ERROR (RPE)

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Abstract: Computational model of the Ventral Tegmental Area (VTA) and its role in learning based on reward-prediction error (RPE) Pramod Kaushik(1), Dipanjan Roy(1), S. Bapi Raju(1,2) Cognitive Science Lab, IIIT Hyderabad, Hyderabad School of Computer and Information Sciences, University of Hyderabad, Hyderabad Dopaminergic neurons in the Ventral Tegmental Area (VTA) are found to be involved in the reward circuitry of the brain and it is hypothesised that they are the source of reward-prediction error (RPE). RPE is an essential signal utilized in Temporal Difference (TD) learning schemes that have been used for modeling classical conditioning (Schultz, 2015). But the role of the VTA in Temporal Difference learning is not clear. Recent evidences have suggested specific type of neurons in the VTA being involved in the computation of reward prediction error (RPE) (Uchida et al., 2012). The GABAergic neurons in the VTA seem to play a key role in estimating the expected reward that is a vital component in the calculation of reward-prediction error. While there have been many attempts at modeling classical conditioning using TD learning (for example, see Schultz, Dayan and Montegue, 1997; Schultz 2015), these models do not explicitly account for the neuron subtypes in the VTA and their role in

TD learning. This paper presents a biologically plausible model of the VTA that implements classical conditioning. In particular, the model tries to explain the existing results achieved using the TD model and map them to the recent physiological data that implicate GABA as the expectation signal. We shall look at the implications of GABAergic sculpting of reward-prediction error and its role in TD models of classical conditioning. References: Schultz W, Dayan P, Montague RR, 1997. A neural substrate of prediction and reward.Science 275: 1593–1599. Schultz, W. 2015, Neuronal reward and decision signals: from theories to data. Physiological Reviews Uchida et al (2012) Neuron-type-specific signals for reward and punishment in the ventral tegmental area. Nature

41. INVESTIGATING HUMAN VISUAL SEARCH/COGNITION STRATEGY IN KINSHIP MATCHING – FACE MATCHING EXPERIMENT.

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Abstract: Abstract The human visual and cognitive performance in face recognition or matching by extraction of features with sparse and transient data in very noisy signals (angle of presentation of the face, illumination and day-to-day changes) is unparalleled by any automated system. To gain insights into the feature extraction process followed by humans in the specific kinship matching task, 20 (17-26 years, avg:19.9, stdev: 3.25) participants were shown 6 sets (from a total of 12: 6 known, 4 unknown and 2 celebrities). Each slide had 2 photos of the parent on the left and 4 of the children on the center and right of same display size with background removed. Eye fixation position during the visual matching process was recorded using an eye tracker (Tobii X120) with stimulus (webpage/HTML) presented on a 22 inch monitor placed 65-70 cm distance from the subject. For each set the participant had to choose the first and second most prominent features based on which the match was decided. The preliminary data points to : a) The data from the heat maps and the prominent features selected by the questionnaire indicate eye, nose mouth and chin in that order and for incorrect answers the shape of the face was the most prominent feature selected, though heat_maps were the same feature location as for the correct answer. b) Gaze pattern analysis of parent showed a gender related difference with people considering the eye area for the mother while it was the mouth/chin region for the father and this was consistent for all 12 sets. There was no such preferred region for children photographs. We plan to expand this work to isolate individual features from one parent at a time in a cut-back experiment. The results will be used to generate a human vision based face matching model to be tested with equivalent computer vision algorithms. Results In the known group for 2 sets, 80 % of the participants matched correctly, while the rest (4) only 30 % got it correct. In the unknown category, 2 sets were matched correctly by 70% of the participants while the remaining two were below 20%. When the most prominent features selected in the questionnaire were the eyes and nose, correct selections were the maximum on an average followed by mouth and chin area. Interestingly, the eye seems to be the most important feature for mother's face while area around the mouth for the father. But there was no gender bias of eye gaze for the children. The heat_maps and the features selected for the choices are predominantly the eyes, nose and mouth/chin area and not so much the forehead or hair region. Sample analysis from 2 sets : Set2 (unknown): 80% correct. The prominent features selected were shape of face, mouth and chin and eye in that order. The heat-map shows maximum fixation at the mouth area for the father, eye for the mother and mouth/chin/nose on the correct child is maximum. Set10 (known): 90% correct. The eye, nose, mouth/chin are the selected options and this is reflected on the heat-map. The feature focus is distributed between the parents and child. The initial data alludes to the fact that people consider physical features including color/pigmentation and social indicators (religious markings, jewellery, dress sense) which can be parametrized.

42. AGE DEPENDENT CAUSALITY CHANGES IN CORTICAL HUBS OVER LIFESPAN

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Abstract: Gradual decline of cognitive functions with aging is associated with decreased functional connectivity in Resting State Network (RSN) hubs[1]. Tracking changes in topological properties of these hubs can provide insights on information segregation and integration at different age[2]. Here we inspect structure-function correlation in various regions and observe changes in their topological metrics over age. We also investigate directional connectivity of hubs to find out their causal influences over different age groups. The main objective of this study was to assess pairwise structural-functional correlations and causality dynamics of mPFC-PCC-IPC

default mode network. Subsequently, to chart systematically the variability of granger causality index across subjects using multivariate analysis with varied age (young ,middle aged and elderly cohorts). The specific hypotheses tested were: (1) mPFC-PCC connectivity will be reduced in aging; (2) regions correlating with mPFC-PCC coupling strength will be located in areas of high age-related vulnerability; (3) Change in causality statistics of these regions should be able to explain the 'direction' of damage in SC-FC coupling with aging. Resting-state fMRI and DTI (Diffusion Tensor Imaging) scans were acquired from 50 healthy participants(age range:18-81, mean:41.5 ± 18.44yr). Structural (SC) as well as functional (FC) connectivity matrices were calculated from preprocessed data. We investigated SC-FC (structural-functional) correlation using Pearson Correlation for each pair of ROIs. We found high correlation for regions which are part of 1. DMN PCC/MPFC/IPC 2. Salience Network- dACC/insula and 3. Central Executive Network -dlPFC. Applying Partial least square (PLS) regression with age revealed decreased SC-FC connectivity in DMN as well as decreased modularity (cingulate cortex, parietal cortex, occipital cortex) with aging. Moreover,systematic reorganization of FC was observed within distant module pairwise correlations suggesting age dependent variability of functional brain networks. We then explored causal influences between each pair of ROIs using Granger Causality Index. PCC seemed to influence all other regions and had highest granger causality index followed by other default mode hub regions. PCC also remained the least affected hub with respect to age. The pattern of causal relationships of hubs changed significantly with aging. Disrupted causality dynamics of important hubs (mPFC, MTL) can explain their gradually vanishing roles in function integration with aging. Change in causality of hubs might prove in future an important biomarker for various neurodegenrative diseases. References [1] Tomasi, Dardo, and Nora D. Volkow. "Aging and functional brain net- works." Molecular psychiatry 17.5 (2012): 549-558. [2] Betzel, Richard F., et al. "Changes in structural and functional connectivity among resting-state networks across the human lifespan." NeuroImage 102 (2014): 345-357.

43. EPISODIC MEMORY INVOCATION STUDY IN CHILDREN USING TASK BASED VISUAL STIMULUS DESIGN

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Abstract: Children in the 4-6 age groups are in a rapid growth phase. Their awareness increases with the amount of new experiences they are subjected to. These experiential episodes are instrumental in decision making as well as in knowledge accumulation. The importance of episodic memory is that, they are formed as a result of single exposure to stimulus. Hence, a study of the formation and maintenance of episodic memory in the formative years of childhood is vital in understanding learning. It has been established that, FmTheta (frontal midline theta) rhythms are reliable representations of episodic memory access operations [1]. In children What-Where-When Test, Free recall, Cued Recall, Unexpected question are the prevalent tests done to test episodic memory [2]. A novel method to invoke and study episodic memory in 4-6 year old children using task based visual stimulus is attempted. The episodic memory invocation is done by exposing the subject to a designed visual stimulus set. The visual stimulus is associated with a recall and counting task. The stimulus exposure is administered in the working memory temporal domain in two stages. The stimulus is made up of 6 images that are predicted to invoke episodic memory in children. In stage one, all the 6 images arranged in a 2 X 3 matrix is presented for 10 seconds to the child. After a gap of 500 ms gap, a blank screen is flashed, stage two starts. Here, the images are flashed one by one in random order for 500 ms interspersed with 1000ms gaps. The subject is required to count the number of times a target image is flashed. The inter-stimulus gaps are blank white images. In stage 2, the position of the images that were in stage one are maintained, with rest of the images removed. In stage one; it is perceived that Episodic memory will get kindled. In stage two, P300 evocation is observed for. In this study, correlations between eyetracker information and Electroencephalograph (EEG) signals for the administered stimulus are attempted. In addition to the fmTheta characteristics and its bearing on P300, the microstates [3] through which the subject's brain transits, is studied. The relationship between gaze data, fmTheta, P300 and the microstates are studied to understand Episodes and Episodic memory. FZ,FCZ,CZ,CPZ,PZ,POZ,OZ,O1 and O2 are the electrode

sites. The electrodes are placed with emphasis on the frontal midline and the occipital lobes since it is a visual based stimulus. The outcome of this exercise will produce a set of visual stimulus that will ensure invocation of episodic memory in 4-6 year old children. The analysis part will yield the pupillometry information when episodes are being accessed. The microstates, as a factor of the EEG signals will depict the episodes that were invoked. References: [1] W. Klimesch *, H. Schimke and J. Schwaiger, Episodic and semantic memory: an analysis in the EEG theta and alpha band, Electroencephalography and clinical neurophysiology,1994. [2] Lucy G. Cheke , Nicola S. Clayton, The six blind men and the elephant: Are episodic memory tasks tests of different things or different tests of the same thing ?, Journal of Experimental Child Psychology, 2015. [3] Melanie Genetti, Juliane Britz, An electrophysiological study of conscious visual perception using progressively degraded stimuli, Journal of Vision, 2010

44. COGNITIVE MODELED SPEED CONTROLLER FOR PMSM DRIVE

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Abstract: The proposed controller is designed from limbic system of mammalian brain to control speed of an electrical drive. It is known fact that limbic system plays a vital role in process of decision making such as in balancing movements, speech, fear etc., which is also known as centre of emotions. The consequent concept can apply for an electrical drive, where this system consists of stator and rotor windings and a controller. With external and internal disturbances the characteristics of the machine get disturbed, as non linear change in stator currents with the variations of load and change in speed setting the electromagnetic torque developed in machine changes abruptly. In the applications like variable speed, variable load, traction and hybrid vehicles where small change will repellent on machine characteristics and its parameters to achieve this it needs a controller which reacts at faster rate with accuracy. Different types of controllers are designed P, PI and PID as conventional, intelligent controllers as Fuzzy logic controller, Neural networks and optimization methods as Genetic algorithms, ant bee colony method, bat algorithm etc., these controllers have their own advantages and disadvantages some of them are easy to design and also gives good results. In spite of these features a controller which is easy to design and implement and reacts faster with disturbances occurred, compare to other controllers is required. Limbic system consists of Sensory cortex, Amygdala, Thalamus, Orbitofrontal cortex (OFC) and motor cortex as main parts. Amygdala and OFC plays a major role in decision making process, where individual learning processes are carried out in each and their output fed to the motor cortex. Motor cortex gives a final viable decision as output, called as emotional output; this output is difference of amygdala and OFC. The proposed controller, emotional cue is generated based on emotional signal "speed" to control the speed of the drive. The Performance of this controller analyzed at different speed settings and for different load values and the results are compared with the PI and Fuzzy logic controllers. The simulation results show the proposed controller robust and fast response with respect to change in motor parameters, load and speed. The proposed system enables the designer to use for multiple objects of their choice.

45. ROLE OF EMOTIONS IN MORAL JUDGMENT: EXPLORING DIMENSIONS

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Abstract: Conceptual Framework of Paper Emotions are considered as significant while making moral judgment. Many discrete emotions like anger, fear, disgust, joy, pride are closely associated with decision making in the contour of morals. Emotions are very crucial in impeding many judgments like affection towards someone, uneven attention and partiality with someone etc. Emotions are more complex and differentiated states (anger, disgust, fear, joy, pride) with both affective qualities and conceptual qualities (C. Daryl Cameron, Kristen A. Lindquist, and Kurt Gray, 2015). The study by Joseph M. Paxton, Leo Ungar, Joshua D. Greene, 2011 reflect upon two factors of moral reasoning: argument strength and deliberation time. The study argued that in general, reflectiveness manipulation increased utilitarian moral judgment. There are many studies indicating the relationship between moral judgment and emotions (Antoine Bechara, 2004, David Pizzaro, 2000). However, some of the studies explore more on relationship (C. Daryl Cameron, Kristen A. Lindquist, and Kurt Gray, 2015) and emphasize constructivist approach to emotions while discussing moral judgment. Meta-analysis will be used as research methodology for the present paper.

46. MAPPING OF SENSORY MOTOR FUNCTIONAL CONNECTIVITY USING RESTING STATE FUNCTIONAL MAGNETIC RESONANCE IMAGING (RSFMRI) IN PREOPERATIVE AND POSTOPERATIVE DIFFUSE LOW GRADE GLIOMA (DLGG)

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Abstract: Purpose : The objective of the present study was to evaluate the pre- and post- operative modifications of sensory motor (SM) functional connectivity networks in diffuse low grade glioma (DLGG) using resting-state functional Magnetic Resonance Imaging (rsfMRI). Materials and Methods : First, we evaluated the feasibility of rsfMRI technique, by mapping temporally coherent sensory-motor (SM) networks in 27 DLGG patients (19 males and 8 females), by means of spatial Independent Component Analysis (ICA). These SM networks were evaluated during three time points of DLGG (before DLGG surgery, immediately after surgery and three months after surgery). Second, we studied the longitudinal alterations in the topographic organization and strength of SM networks in pre- and post- operative DLGG by means of network based graph theoretical analysis using CONN software. Results : Statistically significant (P<0.05) differences in the degree of SM functional connectivity was noticed postoperatively from preoperative baseline, with an intial dip immediately after surgery followed by a subsequent recovery after three months. Discussion : Our findings demonstrated that SM connectivity in the contralesional hemisphere was increased immediately after surgery, and this increase was related to compensational capability of unaffected hemisphere. Similarly, functional connectivity was substantially increased in the affected hemisphere after three months except in 3 DLGG subjects, indicative of progressive functional recovery. Conclusion : The mechanisms resulting in functional connectivity alterations after glioma surgery remain to be elucidated. Importantly, our findings indicate that intra and inter hemispheric sensory-motor connectivity would be susceptible to alterations in pre- and post- opérative DLGG

48. EVOLUTION OF COOPERATION WITH REPUTATION AND IMITATION

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Abstract: In social interactions individuals do not have same information about social norms; even there is information is available individuals might internalize same information differently. In the face of complexity of internalizing social norms, individuals might imitate others behavior, if the behavior rewarding. In general, social interactions are a result of heterogeneity of internalization of social norms and imitation of others actions. The proposed model is inspired from Standing Ovation Problem (SOP), which considers signal and imitation dynamics in modulating human behavior. We consider reputation driven cooperation in the frame work of indirect reciprocity. In this frame work, individuals gain reputation by helping a good reputed individual (who helped others in the past) and penalizing the individual who do not helped others in the past. The underling logic of indirect reciprocity is helpful actions were rewarded by third parties and defectors were penalized by third parties. We consider a heterogeneous population with different capability of internalizing social norms, i.e. different perceptions of reputation or image scores of individuals and different criteria to imitate others actions. In the model, donors offer helpful actions either if the receiver's score is more than donor's threshold value or sufficient number of individuals are helping at the time of cooperative actions. In the model each individual has his/her own threshold value to imitate others actins. By considering heterogeneity at the level of perception of scores and at the level of imitation of critical number of actions, we calculate cooperative probabilities of donors. Given donor i is interacting with receiver j in the eyes of donor j^{th} reputation score is $R\_ji = (rep(j)–(i))$, where rep(i) is reputation of receiver and (i) is threshold value of the donor. If $n\_C/g(i) >1$ and$R\_ji>0$ then donor cooperates with high probability, where n_C represent the number of individuals who already cooperated and g(i) is the ith critical value to imitate others actions. Probability that i^{th} individual cooperating with individual j^{th} individual is given by $p\_(ij)= 1/(1+exp(-(R\_ji+ n\_C/g(i))*))$ where is noise term. Each individual acts as a donor and as a receiver with a randomly chosen individual but do not interact twice with the same individual. We use agent based modeling to understand evolution of donation rates. After the end of each generation, population is updated by using a pair-wise comparison process; selection is done on random pairs, in which a higher payoff individual is replaced with lower payoff individual. In this process, individual inherit reputation discrimination thresholds values to the next generation and as generations progresses, individuals improves the discrimination of others reputation scores. After each generation the new generation starts by setting individuals payoffs to zero. The

process is done synchronously at the same time. By considering imitation of actions of cooperative individuals and reputation discrimination thresholds (donation rates) resulted in much higher donation rates. The heterogeneity in discriminating image scores and heterogeneity imitation of others actions probably an important considerations and might provide an insight into the importance of social learning and in understanding evolution of cooperation.

49. HOW THE EXCITATION-INHIBITION (E/I BALANCE) MECHANISM CAN BE USED FOR OPTIMIZING TDCS PROTOCOL: A COMPUTATIONAL INVESTIGATION

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Abstract: This study presents a computational modeling approach aimed at studying the effects of transcranial direct current stimulation (tDCS) on neuronal populations. tDCS is a type of non invasive brain stimulation which has been shown to modulate cortical neural excitability and activity. It plays a potential role in modulating the cortical excitation/inhibition (E/I) balance which may result in improvements but can also cause maladaptive outcomes. The synaptic efficacy in excitatory and inhibitory pathways is also dependent on the individual brain state, information about which can be obtained from techniques like electroencephalography (EEG). However, tDCS presents challenges in terms of optimization of stimulation parameters especially in cases of heterogeneously damaged cortical structures. Thus, in this study, we use patient-specific head models which can optimize tDCS of the targeted brain location. The computational model presented in this work allows for the simulation of EEG signals under tDCS, which suggests that this modeling approach can be used to predict and compare changes occurring on the brain state with respect to stimulation configurations and its effect on excitation-inhibition balance in targeted sites, thus creating a trained model which predicts the required parameters for anodal and cathodal tDCS that can achieve target E-I balance. Our results confirm that there was a signifcant increase in alpha power in simulated scalp EEG signals under the tDCS condition as compared to the no-stimulation condition. Computational results also show that modulation of strength of inhibitory feed back (E-I or I-E synapses) modulated the alpha band amplitude and power while modulation strength of excitatory-excitatory synapses affected population firing rate.

50. WHAT IS LACKING IN COMPUTATIONAL MODELS OF OBJECT VISION?

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Abstract: Computational models of object vision have been widely studied in the context of both neuroscience and computer vision. Some of these models are biologically inspired (Neural networks, Gabor filter-bank and HMAX) whereas others models have hard-wired and 'engineered' features. Previous studies have shown that these models explain patterns of dissimilarities in human IT and monkey IT measured using fMRI and neurophysiology. Recent studies have closed the gap in object recognition performance between humans and computational models using convolutional neural networks (CNN) trained on millions of natural images. Even though computational models are catching up with humans in tasks like object recognition, the reasons for the consistent gap in their performance remains unclear. In this study, we systematically compared the performance of many computational models with a large set of human perception data. We measured perceived dissimilarity between objects in humans using a visual search paradigm. Specifically, we used the reciprocal of reaction time (RT) as a measure of perceived dissimilarity between target and distractor objects in a visual search array. In this way, we collected visual search dissimilarity data for 26,675 pairs of objects using ~2800 images with 269 human subjects across 32 experiments. The set of images varied widely in their information content from simple and abstract silhouettes to complex, natural and grayscale objects. The search data was highly consistent with significant correlation between data from two random groups of subjects ($r = 0.91$, $p < 0.00005$). We then used various pixel-based (Sum of squared error & coarse footprint), Boundary-based (Curvature Scale Space, Fourier Descriptors …), Feature-based (SIFT, Scene Gist …), Cortical Network based (V1, HMAX and CNN) and Statistical models (SSIM & Texture synthesis) to explain human perceived dissimilarities. In general, all models were able to explain perceived dissimilarities for many pairs of objects with the best model (CNN) achieving a correlation of 0.67 ($p < 0.00005$) with human perceived dissimilarity data. Surprisingly, there were systematic deviations between all models and perceived dissimilarities. These deviations tended to occur when the pair of objects were related by sharing of parts. Specifically, dissimilarity between objects with shared parts were consistently over-estimated by all models. This indicates that all computational models lack the notion of part-based representation. We propose that the

performance gap between computational models of object vision and humans can be reduced further by explicitly including some form of part-based representation.

51. IS MIND-BODY PROBLEM PSEUDO PROBLEM OR A REAL CHALLENGE TO FOR SCIENTISTS AND PHILOSOPHERS?

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Abstract: Old age problem of philosophy of mind which dates back to Descartes is still could not be said to be solved completely. Many things has changed since Descartes but the problem remains. Can it be the case that it is not a problem at all, it is just the result of faulty picture of mind and body lead to the swamp of problem? Dynamic approach towards cognition suggests that there is no such duality of mind and body and understood by Cartesian tradition because human beings are not aliens to the environment but they are situated in this world and very much part of it. As Gilbert Ryle has suggested that it is because of our category mistake we think the notion of mind and body differently. Or as Ludwig Wittgenstein has given us clues that this problem could be just because of bewitchment of language. But there are also other aspect as highlighted by David Chalmers who has problem of consciousness into easy and hard one, the mind-body problem falls in category of hard problem that's why we are still not able solve in despite our scientific advances in the area of brain research and neuroscience.

52. DOES NAP DEFERENTIALLY MODULATE OBJECT SPECIFIC RECOGNITION MEMORY?

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Abstract: Daytime napping is a frequent habit of many individuals. Research findings suggest beneficial effect of nap on declarative memory consolidation in humans (Nishida M et.al. 2008). Study also shows that naps including both SWS and REM led to performance enhancement of affective stimuli (Kensinger & Schacter, 2006, Mednick S et al. in 2003, Christy A, Divya M. et. al., 2015). The present research was aimed to investigating object specific emotional memory, by measuring the delayed recognition of affective stimuli (face, scene) followed by nap or wakefulness retention interval of 60 minutes. Data: Ten healthy participants (22.5 years) divided into nap and control group volunteered for the study. On experimental day participant arrive at laboratory at 12.00 h performed encoding (learning phase) of behavioral task followed by nap/wakefulness retention interval of 60 minutes & subsequent retrieval phase. Results: Mixed model ANOVA [2 (nap, wake x 2 (face, scene) repeated on 2) revealed significant main effect for nap [$F (1, 9) = 8.687$, $p = 0.018$, $\mu2 = 0.52$] & object [$F (1, 9) = 8.51$, $p = 0.019$, $\mu2 = 0.51$].Sleep analysis of nap subjects reported 62.56% sleep efficiency with stage 2 and REM stage domination. Correlation between REM stage & memory accuracy (= .65 scene and = -.28 face) were reported. Conclusion: Recognition memory accuracy is enhanced by napping, scene as compared to face shown better performance.

53. INVESTIGATION OF PRIMITIVE INTELLIGENCE IN THE AUDITORY CORTEX THROUGH BINAURAL RHYTHMS

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Abstract: The mismatch negativity (MMN) is a differential brain response to violations of learned regularities. The MMN reflect the brains ability to perform automatic comparisons between consecutive stimuli and provides an electrophysiological index of sensory learning and perceptual accuracy. MMN is also said to reflect the existence of a memory trace of the frequent standard stimuli at the moment of presentation of the infrequent deviant stimuli. This reflection is explored using binaural rhythms as the auditory stimulus. A total of 10 participants selected for the study and were made to listen the binaural rhythms. There was a frequent 'standard' alpha rhythm and an infrequent 'deviant' pattern presented in a random order. The deviant patterns were delta, theta, beta and gamma binaural rhythms. The experimental results bear the implication that MMN is due to both adaptation and lateral inhibition

55. THE ENACTIVE EQUATION: EXPLORING HOW MULTIPLE EXTERNAL REPRESENTATIONS ARE INTEGRATED IN THE MIND, USING A FULLY CONTROLLABLE COMPUTER INTERFACE AND EYE-TRACKING

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Abstract: Multiple external representations (MERs), such as models of phenomena, equations, and graphs, are used extensively in science and engineering for concept, phenomenon and procedure understanding, problem solving, modeling and design. Representational competence (RC) is defined as "the ability to simultaneously process and integrate MERs in that domain". Several studies report difficulties in student learning, owing to problems in working with MERs. Studies comparing experts and novices in various domains show clear differences between the two groups in their understanding, usage and generation of MERs. Further, conceptual understanding is tightly correlated with learners' ability to generate multiple representations of concepts, situations and phenomena, and transform between these representations. Students understand, and are able to use and generate graphs and equations independently. However students often have difficulty understanding how the two representations are related and can be used together, and possibly how they relate to the phenomenon. These results indicate that there is a clear need for development of RC among students. Computer interfaces have been used extensively in science and engineering learning typically for the learning goals of improving conceptual, phenomenon and procedural understanding using MERs. Interfaces specifically targeting the development of RC among learners are few and far apart. The effectiveness of available computer interfaces for learning, particularly learning RC, has been mixed. One possible reason for this is that interface design in these domains is currently guided by information processing theories of cognition, wherein the role of the interface is to decrease the learner's cognitive load, particularly working memory load. However emerging theories of cognition, such as distributed and embodied cognition, postulate that the roles played by external representations are wider than decreasing cognitive load. For instance, external representations can support operations that are difficult, and sometimes impossible, to do in imagination. Further, actions could be a way of promoting integration. Understanding the RC problem using these new approaches to cognition could help in developing novel interaction designs that help students integrate MERs. Here we report the design of an interface where this approach was followed. In this paper, we report a fully controllable interface, designed to help school students develop RC. Further, as the design emerged from the application of distributed and embodied cognition theory to the RC problem, it also seeks to shed light on the cognitive mechanisms underlying the integration of MERs. Here we report a preliminary eye and mouse tracking study, which sought to develop a detailed understanding of how students interacted with our interface, under self and text-guided exploration conditions. We also examined how the interaction process related to students' ability to integrate the representations in the interface. The results indicate that students tend to focus on certain modes of representation (in this case the equation) more than others. Our interface and study are the first targeting the development of RC by including interaction features emerging from embodied and distributed theories of cognition, and studying the development of RC using eye and mouse tracking.

56. BIASES IN THE ORGANIZATION OF ASYNCHRONOUS OBJECT MOVEMENTS: IMPLICATIONS FOR PERCEIVED INTENTIONALITY

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Abstract: Goal-directed intentionality and animacy under a relatively impoverished environment devoid of a social context have been the subject of several studies specifically aimed at identifying motion cues that trigger these percepts, from the earliest (Heider and Simmel, 1944 and Michotte, 1963) that drew attention to the existence of these phenomena to those that have found evidence for a dissociation in the brain's response to the detection of animacy versus intentionality (Gao et al, 2012). Gao, McCarthy and Scholl (2010) have also found evidence for a novel social cue to animacy in a series of studies where random movements of a group of objects that maintain a common orientation lead to a strong percept of an animate "Wolfpack" to the extent of interfering with the perception of an actual 2 object "chase" embedded within this scene. A more recent line of study undertaken by Takahashi and Watanabe(2015) has drawn attention to the nullifying impact of synchronous motion on the perception of animacy. The present study examines the impact of introducing minimal synchrony-disrupting asymmetries in the spatial and temporal attributes of a pair of moving objects on their subjective perceptual organization. We began with a pair of discs moving synchronously against a featureless background along identical linear trajectories barring a small displacement between their initial positions. Thereafter asymmetries in the form of pauses and lags in the path of one of the objects were introduced such that the spatial and/or temporal

structure within the scene was either preserved or weakened. Where spatial and temporal structure were preserved, pauses and lags of one object were coordinated with direction changes of the other. Subjects were required to observe the pair of moving objects and provide verbal descriptions of the scenes under Realtime and Recall conditions. Several organizational biases in subjects' verbal protocols were observed with implications for the way in which domain symmetries are recruited in the formation of scene representations. There was a strong and consistent tendency to describe object movements in relative terms. Further there was an asymmetry in the choice of the reference object such that the anchoring object was always the one that either initiated movement of change in direction. These types of actor-responder assignments imply an early pre-intentional representation of the scene and suggest that the appearance of 2 (or more) objects within the same context may automatically trigger the availability of relational concepts (spatial, temporal or intentional) for use in representing the scene. In keeping with findings of the Takahashi and Watanabe study the perfect synchrony case elicited no relative descriptive terms and by implication no intentional descriptions. Coordinated pauses/lags increased the use of intentional descriptors such as "following" while uncoordinated pauses/lags had the reverse effect. Events in subjects' Recall descriptions were ordered in time despite the fact that Recall descriptions are in no way constrained to adhere to any kind of ordering. These organizational biases suggest a tendency to construct "compressed" representations using symmetries that characterize each domain (spatial, temporal, intentional) with intentional terms being triggered by a combination of asynchrony and spatial relatedness.

57. OSCILLATORY CORTICAL DYNAMICS IN CURSOR CONTROL BASED EEG-BRAIN COMPUTER INTERFACE

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Abstract: Several paradigms in brain-computer interfaces use steady-state visual evoked potentials (SSVEP) to look at periodic activity generated in the brain following a an oscillatory external stimulus. However, there are spontaneous oscillatory activity in the brain can be generated by endogeneous measures during sleep, training, somatosensory perturbations or various near threshold pre-attentive detection tasks (Pineda, 2005; Weisz et al., 2014). The motor training paradigms are known to elicit mu (8-12 Hz) and beta (18-26 Hz) rhythms around the motor cortex. In the current work we intended to use a cursor control paradigm to study such endogeneous activity following a motor paradigm training. The participants were asked to perform an one dimensional cursor control task for a horizontally moving cursor in order to hit a stationary target within a finite amount of time. The subjects were trained offline for half an hour before being recorded in the EEG. The data was recorded with the help of a portable 23 channel NCC medical supplied EEG machine. The participants were six healthy male individiduals aged 18-24. The visual display of the cursor on the monitor was controlled with a touchscreen interface using right index finger by the participants. As common spectral techniques are inadequate for tracking amplitude/phase relationship of continuous amplitude variations, we extracted the characteristic mu rhythms of participants using matched filters and autoregressive analysis. The effectiveness of the method was checked with a cross-correlation based classifier. The trained participants showed modulation of alpha/mu band (8-12 Hz) activity over the sensorimotor cortex. This provides a clue towards the functional significance of mu/alpha rhythms in conscious voluntary human activity. References: Jaime A. Pineda (2005), The functional significance of mu rhythms: Translating "seeing" and "hearing" into "doing", Brain Research Reviews, 50, 57-68. Weisz, N., Wuhle, A., Monittola, G., Demarchi, G., Frey, J., Popov, T., and Braun, C. (2014). Prestimulus oscillatory power and connectivity patterns predispose conscious somatosensory perception. Proceedings of the National Academy of Sciences, 111(4):E417–E425.

58. THREE DIMENSIONAL FINITE ELEMENT MODEL TO STUDY THE EFFECT OF VOLTAGE DEPENDENT CALCIUM CHANNEL ON SPATIO-TEMPORAL CALCIUM DISTRIBUTION IN CYLINDRICAL SHAPED FIBROBLAST CELL

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Abstract: Fibroblasts cells closely resemble with cylindrical shape. These cells play a pivotal role in wound healing, tissue regeneration and tissue growth. The specific Spatio-temporal calcium concentration patterns are required by the fibroblasts cells to maintain their structure and functions. Thus the three dimensional modelling of calcium signaling in cylindrical shaped fibroblast cell has become more sophisticated. The main objective of this work to study the effect of buffers, source amplitude and channel permeability on three dimensional cytosolic calcium profile in the form of diffusion equation. The important parameters like buffers, Channel permeability, source amplitude, voltage dependent calcium channel, diffusion etc. have been incorporated in the model. Appropriate initial and boundary conditions have been framed. The finite element method has been employed to obtain the solution. A MATLAB program has been developed for the entire problem and simulates to compute the results.

59. TARGET PRIMING CONFERS A FIXED BENEFIT IRRESPECTIVE OF SEARCH DIFFICULTY

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Abstract: We constantly search for objects in our day to day lives, whether it be a bunch of keys, or a pair of socks. During the course of these searches, we have a template of what the object (target) looks like and we go about searching for it among other irrelevant objects (distractors). There have been studies which show that the strength of the template, set up by showing a cue prior to the search, affected the time it took for subjects to search for the target among distractors. A word cue ('RABBIT') led to longer search times when compared to pictorial cues (a picture of the target rabbit) shown just before the search array. In addition, studies have seen that the effectiveness of the cue increased systematically with the search difficulty i.e. the difference in search times between the cued and uncued conditions was larger when the search was hard than when it was easy. Here, we quantified the relationship between search difficulty and cue efficiency. Considering reaction time (RT) of a search to be the time taken by the salience signal to accumulate to threshold, it can be seen that the salience signal would be proportional to the reciprocal reaction time (1/RT). In this study, we explored how previewing the target prior to a search affects the salience signal. We studied this using a visual search task where the subjects were instructed to search for an oddball target among distractors. In half of the searches, the subjects viewed a 'white square' (uninformative cue) prior to the search and in the other half they viewed the target object. In the former, the subjects had no information about the target and hence had to search for the oddball whereas in the latter case, the subjects knew exactly what to look for. We plotted the salience for uninformative cue searches against the salience for target preview searches to see how the knowledge of the target affects the salience signal.   We observed that previewing the target added a fixed amount of salience to the search irrespective of search difficulty. To see if this effect generalizes to other stimulus sets, we ran the same paradigm on sets of alphabets and animals. We observed the same result for both the stimulus sets thus confirming our findings. We interpret this effect as a constant additive top-down benefit to the existing bottom-up salience signal.

60. EFFECTS OF TECHNOLOGY ON THE BRAIN

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Abstract: We are constantly surrounded by technology – multichannel TV, video games, MP3 players, internet, wireless networks, the list goes on. Every single bit of information is now available to us thanks to Google. We have drugs like Paxil as an antidote for shyness, Ritalin to improve concentration, an electronic chip that would allow a paralyzed patient to move his limb by thinking about it! With our customary reliance on the internet every day, our originality and higher order thinking is diminishing, "We are evolving from cultivators of personal knowledge into hunters and gathers in the electronic forest…dazzled by the Net's treasures, we are blind to the damage we may be doing to our intellectual lives and even our culture" (Nicholas Carr)1. What then, is the extent of damage that this gadget-filled, pharmaceutically enhanced 21st century has done to our brains? Experts in China scanned the brains of 17 young web addicts and found disruption in the way their brains were wired up. Specialized MRI brain scans showed changes in the white matter of the brain - in web addicts, compared with non-addicts. There was evidence of disruption to connections in nerve fibres linking brain areas involved in emotions, decision making, and self-control. So how does this technological overload affect our brain? The results also suggest that Internet Addiction Disorder (IAD) may share psychological and neural mechanisms with other types of substance addiction and impulse control disorders. Through this paper we would like to explore the extent to which The internet's 'cacophony of stimuli' and 'crazy quilt' of information have given rise to cursory reading,

hurried and distracted thinking, and superficial learning – in contrast to the age of the book, when humans were encouraged to be contemplative and imaginative. The brain is very sensitive to any kind of stimulation, and from moment to moment, there is a very complex cascade of neurochemical electrical consequences to every form of stimulation. If you have repeated stimuli, your neural circuits will be excited. But if you neglect other stimuli, other neural circuits will be weakened. The online world so taxes the parts of the brain that deal with "fleeting and temporary stuff" that deep thinking becomes increasingly impossible. Our ability to learn suffers, and our understanding remains shallow. It affects our imagination and creativity and our social skills and mental processes. Possible solutions elaborated: Brain exercise- Highlighting the Nocebo effect- The power the mind has on the brain and subsequently the body. Puzzles, pattern recognition exercises, Sudoku and various exercise to keep the mind alert. This also includes brain training activities like physical exercises. Meditation: Strict times for use of technology, discipling yourself in its use, reducing and complete stoppage after a certain time in the evening. This allows the mind to unwind / settle down and prepare for sleep. This also prevents some unforeseen agitation that may occur due to the receipt of a message just before sleep.

61. ARE CHILDREN CAPABLE OF IMAGINING COUNTERFACTUAL SITUATIONS?

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Abstract: If the earthquake did not take place in May 2015, at Nepal thousands of people would not have died. If the driver was not busy talking to his wife over phone while driving the car he would not have met with an accident. If there was no storm then the tree would not have fallen. If I did not waste my time I would have scored more than 80% in the examination. All the above mentioned statements have a common structure; they are of the form "if A had not occurred C would not have occurred". A careful analysis would show that all of these statements are not about facts but about situations that are 'contrary-to-fact'. In reality the earthquake did take place in Nepal in May, 2015 and due to that thousands of people died. The driver was busy taking over the phone while driving and hence met with an accident; etc. Such statements which are about contrary-to-fact situations are called counterfactual statements. Adult human beings in their daily life often utter statements which are about contrary-to-fact situations and reason counterfactually. Counterfactual reasoning plays a major role in determining the cause of an event. From the statement 'if the earthquake did not take place in Nepal in May 2015, thousands of people would not have died' we infer that the earthquake is the cause of death of thousands of people. Counterfactual thinking is most often used in determining the cause of an event where repeated observation (between the two events in which a causal relation is to be established) is not possible. In this paper we reported an experiment where we tested 3 to 5 years old children's ability to imaging a situation contrary to what they witness. For example, if a child witnesses that 'Ravi stepped on the banana peel and fell down' is it possible for the child to imagine a situation where 'Ravi had not step on the banana peel' and hence draw the conclusion 'if Ravi had not stepped on the banana peel he would not have fallen down'. To test children's ability to imagining contrary-to-fact situations we played small movies to children which usually depicted a causal scenario where one event caused the occurrence of another event. Then they were asked to imagine a situation contrary to what they observed and answer some very simple questions. The questions brought out children's capability of imagining facts contrary to the original situation depicted in front of them. Children aged 4.0 years to 4.11 years performed well in this task but children of age group 3.0 years to 3.11 years were not good at imagining a contrary-to-fact situation and thus answering the question. Further analysis of the performance of the 3 years group showed that the performance of children aged above 3.6 years were much better compared to children aged below 3.6 years. Thus we concluded that a striking development to imagine a situation contrary to what is observed takes place between 3 to 4 years of age.

62. ANATOMICAL CHARACTERIZATION OF THE CENTRAL EXECUTIVE NETWORK: A DIFFUSION IMAGING STUDY

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Abstract: The prefrontal cortex (PFC) and parietal cortex (PPC) are key nodes of a functionally coupled central executive network (CEN) that play a critical role in controlling attention in the brain. However, the anatomical basis of this functional coupling network remains to be fully characterized. Here, we used diffusion weighted imaging (DWI) and functional MRI (fMRI) to characterize patterns of connectivity bilaterally within the CEN. Diffusion MRI data was collected in a 3T Siemens Skyra scanner (Health Care Global Hospitals, Bangalore). A 10-15 minute DWI scan was acquired either along 20 directions (2 repetitions, 6 subjects) or 64 directions (single

acquisition, 5 subjects) for b values typically ranging from 1000-2000. Eddy correction was applied to DWI data after aligning to the ac-pc aligned T1 image using Vistasoft. Constrained Spherical Deconvolution (CSD) tractography algorithm was used to generate a whole-brain connectome (collection of white matter tracts) containing 500,000 tracts. The whole brain connectome was then processed using MRtrix to filter the tracts between specific spherical ROIs (Left-PFC, Left-PPC, Right-PFC, Right-PPC) using appropriate Talairach coordinates. Functional ROIs were generated by independent component analysis of resting state fMRI data acquired for the same subjects to ascertain the validity of the ROIs used for tractography. LiFE (Linear Fascicle Evaluation), that enables statistical validation of the results of tractography algorithms was applied to generate an optimized network of connections. For each pair of regions, the number of tracts thus remaining were averaged across both directions of connections, and taken as an index of strength of connectivity between the respective regions. This procedure produced a matrix of the strength of connectivity between PFC and PPC across the left and right hemispheres. We observed strong connectivity between PFC and PPC in each hemisphere (Left-PFC - Left-PPC and Right-PFC – Right-PPC). Specifically, the connectivity between the Left-PFC and Left-PPC was significantly greater than that between the Right-PFC and Right-PPC. In contrast, connectivity between PFC and PPC in opposite hemispheres (Left-PFC to Right-PPC and vice versa) was considerably weaker. Surprisingly, homologous regions (PFC and PPC) in the opposite hemispheres exhibited strong connectivity. In general, Left-PFC to Right-PFC connections were considerably stronger than Left-PPC to Right-PPC. PFC and PPC in each hemisphere generally co-activate as a functionally coupled network. The observed strong intra-hemispheric anatomical connections between PFC and PPC could underlie the functional coupling between them. We also observed strong inter-hemispheric anatomical connections between the left and right PFC as well as between the left and right PPC. However, no previous study (to our knowledge) has reported functional co-activation of the bilateral PFC or bilateral PPC, as distinct networks. This pattern of connectivity is consistent with predominantly intra-hemispheric excitatory connections between PFC and PPC, versus predominantly inhibitory inter-hemispheric interactions between PFC and PPC. The results also urge caution when using anatomical connectivity as a benchmark for validating functional connectivity algorithms. Future work will investigate the marked asymmetry of connection strengths across the left and right CEN and across the homologous PFC and PPC regions and the potential functional significance of these connections.

63. CONTEXTUAL INFLUENCES ON OBJECT DETECTION IN NATURAL SCENES

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Abstract: Objects in real life are seldom seen in isolation but instead occur in a meaningful context. e.g.; cars in parking lots or people in houses. Visual search is believed to involve matching the information in a search template with information contained in the scene. The nature of the evidence that is accumulated while we try to match search template information with the scene, and the involvement of context information on this matching process isn't well understood for real world scenes. A related and unanswered question is the nature of the information contained in the visual search 'template' when we try to find targets in real world scenes. In real life scenarios, scene processing and object detection happen seamlessly at very short time scales and we study these inter-related problems in the appropriate context of rapid scene processing where the visual information processing is believed to be bottom-up and depends largely on the visual content of the scene. We propose that evidence for the presence of a target should contain information about (a) actual visual appearance matching the target (b) coarse structure or layout of the scene that is likely to co-occur with the target. We hypothesize that any evidence for the target should increase both target detection accuracy as well as target detection speed when scenes actually contains instances of the target object, conversely weaker forms of such evidence should slow down correct rejections and decrease accuracy when scenes do not contain any instance of the target object. We investigate these questions using a combination of behavioral experiments as well as computational models. Speed and accuracy information are recorded in a behavioral task where a subject attempts to detect instances of either only cars or only people, in a diverse set of briefly presented real world scenes. We use state of the art computer vision methods to learn models for the actual visual appearance of the target object. We find that both matches of the learnt templates to actual instances of targets in scenes (hits) as well as matches to scene regions that do not contain the target but bear a similarity to the target shape (false alarms), are able to predict target detection speed and accuracy in a significant manner. This shows that the visual search template explicitly holds information matching the visual appearance of the target object. In a complementary experiment using coarse scene representations that lack detailed object information, we find that features which correlate with slower rejection times when the target is absent in a scene, also predict speed up of target detections when target instances are actually present in a scene. Since this model

learns only context information and is not trained on target appearance, this result shows that there is target category evidence in coarse scene layout and this is used actively in visual search. Together the two results suggest that real world visual search involves matching both the explicit visual appearance of the target as well as the context information that is likely to co-occur in a scene along with the target.

65. IS VALUE FUNCTION IN PROSPECT THEORY MAGNITUDE DEPENDENT? RE-VISITING THE AFFECTIVE VALUATION OF SMALL GAINS AND LOSSES

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Abstract: According to Prospect theory's value function, the affective value associated with gains is always less steep compared to losses. In contrast, Harnick et al. (2007) found that gains loom larger than losses for anticipatory judgments regarding low magnitudes of money. Some other studies like Mellers et al. (1997) also did not find evidence for loss aversion in judged feelings. In an insightful paper addressing these deviations, McGraw et al. (2010) suggested that the above mentioned studies could not capture loss aversion probably because of the way it was measured. According to these authors, a bipolar scale or a between-subject design does not allow losses to be weighed from a common reference point in comparison to gains, and hence is not viable to capture loss aversion. They suggested that a unipolar or comparative rating scale is apt to measure loss aversion. Thus, it was not clear whether loss aversion could be magnitude dependent or whether studies that did not find loss aversion was due to measurement errors. In study 1, using a 2 (frame: gain vs loss) x 8 (magnitude of amounts: 5, 10, 25, 50, 75, 100, 250, 500) within-subject design and a unipolar response scale, we asked participants to rate the intensity of gains and losses for the different magnitudes of money that they could hypothetically earn or loose in a game. All participants performed two judgment ratings for each amount (one for gaining and another for losing; counterbalanced in order). A main effect of amount was observed $F(3.59, 208.75) = 186.37$, $p< .001$, $2= .76$. There was no significant effect of framing, $F(1, 58) = 2.68$, $p = .10$, $2= .04$ but descriptively, overall gains were rated higher than losses (Mgain = 2.64, Mloss = 2.55, 95%CI [-.02, .21]. Importantly, there was a significant interaction between frame and amount, $F(4.88, 283.47) = 8.37$, $p< .001$, $2= .12$ thus showing that gains loom larger than losses for low magnitudes but not for higher magnitudes. In study 2, a 3-item relative intensity scale was used for measuring the responses (gain>loss, gain=loss and loss>gain). For 5 INR, out of 60 respondents, 47 (78.33%) participants stated that gaining versus losing would have the same effect, 9 (15%) said gaining would have more effect and 4 (6.67%) said losing would have more effect. For 500 INR, out of 60 respondents, 6 (10%) participants said gaining versus losing would have same effect, 15 (25%) said gaining would have more effect and 39 (65%) said losing would have more effect. These results show that loss aversion is indeed magnitude dependent. Thus, the computation of value function in prospect theory is contextual. This has important implications for multiple other theories that take the psychological finding of losses looming larger than gains as a fact. Given that multiple labs use different response scales and magnitude values to measure loss aversion, our result hold important ramifications because depending on both response formats and monetary values used, the affective psychology of small gains and losses could change.

66. NEUROCINEMATICS : THE INTELLIGENT REVIEW SYSTEM

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Abstract: There has been an explosive growth in the entertainment industry of India, with a major contribution coming from the film industry. While watching a film, the viewers undergo an experience that evolves over time, which grabs their attention and triggers a sequence of processes, which is perceptual, cognitive, and emotional. Each producer invests crores of rupees in a film, with the great uncertainty of getting the invested money back (leave alone the profit). Therefore a method of taking pre- release live review for a film, using specially coded headsets has been proposed, which is the first of its kind. This article proposes to use the advancements in the EEG to address the above problem, at the same time retaining the merits of the existing methods such as FMRI and facial expressions based review technique. The idea is straight-forward, wherein the specially designed headbands with the platinum electrodes are placed onto the viewers heads in the form of a headphone, thus eliminating the problem of having an additional device to scan your brain, at the same time recording the brain signals of several viewers. An algorithm is devised to map the obtained readings to a normalized scale, taking into consideration, the stress level, the emotional levels, and anxiety levels of a normal person. This could pave

the way to further developments in the field of Neurocinematic studies. We propose that EEG studies of brain and its mapping will act as a fail-proof coating for each film and help the producers to bring out what they intended. What we have proposed is one of the methods of accessing the viewer's brain activity and scaling the readings for an effective output. All these studies together, might provide a major breakthrough in the field of Neurocinema. It is also to be noted that cognitive approach to get live reviews is not a new concept theoretically, as it has been in the research since 1980's. We propose that EEG analysis can contribute to the cognitive aspect of film theory, analogous to contributions that Neuroscience has made to cognitive and social psychology. As far as our measure is concerned, it gives the live review of a movie by analysing the various factors stated earlier, and we do not claim that it is the central measure .This method cannot be used to measure other aspects of a film. Different film makers may have different opinions about the movie they intend to design and they might have varying ideas to impact the viewers, therefore we propose this method, only to see the overall reach of a film. The complete review of each film is beyond the domain of this project, and it is left to the critics and the viewers. And finally, the first set of data obtained from this project is sure to open the scope of further research with the same and hence it can never be termed as a final conclusion. All the results obtained from this experiment are solely indented to bridge the gap between mind of a viewer and the film he is viewing.

67. BCI BASED COGNITIVE ASSESSMENT TESTS

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Abstract: BCI uses neurophysiological signals as input commands to control external devices. The capability of usage of Brain Computer Interface based cognitive assessment tests for neurotypical and ALS subjects to assess Cognitive deficits. The Comprehensive battery of cognitive science assessment has never been implemented even though the new technologies have been used recently to enable communication. We have conducted two different tests i.e Posner test and Flankers test on neurotypical and ALS subjects. Posner test is also known as the Posner Cueing test. The Purpose of this test is to measure manual and eye-movement reaction times to the target stimuli. The experiment is designed in such a way that every trial starts with the fixa¬tion point in the middle of the screen. After 700 ms, two equally sized boxes were displayed, followed by anyone of the four cues (endogenous valid, endogenous invalid, exogenous invalid cue, exogenous valid). After displaying the cue for next 100ms, the cue was made to disappear. After 50 ms the object is made to appear in any one of the boxes. The subject needs to respond to the object position by pressing 'z' or 'm'. The trails appeared randomly and equiprobably. The exogenous cases were 25%, endogenous cases were 25% and neutral cases were 50%. The results we got as response time taken by the ALS subject is 50% more when compared with neurotypical subjects. The BCI built for neurotypical subject should be fine tuned to the standard battery prepared from posner test, so that ALS can use the BCI effectively. Flankers Test is set of response inhibition tests used to assess the ability to suppress responses. The target is flanked by non-target stimuli which correspond either to the same directional response as the target or to the opposite response or neither (neutral flankers). The subject needs to respond to the decision by pressing 'z' or 'm'. The goal of this experiment was to demon¬strate that the arrow stimuli can indeed elicit visuospatial movements of attention in a reflexive way. Every trial in over all 256 started with the presentation of fixation point in the middle of the screen. After 700 ms, the arrow cues were added for duration of 500 ms followed by an empty screen for 50 ms. Then the subject has to respond by pressing let¬ter Z or M depending upon on the side of central arrow. The result we got as response time taken by ALS subject is more when compared to neuorotypical subjects.

68. HOW ORIENTATIONS COMBINE IN VISUAL SEARCH ?

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Abstract: Even though orientation is an extremely simple feature in vision, combinations of orientation can create several emergent properties such as angles and parallel lines. Here, we systematically investigated how multiple orientations combine in visual search. We created objects made out of two oriented line segments attached on either side of a horizontal stem. The orientations of the line segments varied independently from -30 degrees to +30 degrees in steps of 10 degrees with 0 degrees as the vertical reference. With 7 levels of orientations varying

independently on two spatial locations, we created all possible 49 (= 7 x 7) two-orientation objects. With this design, we were able to get a wide variety of objects showing properties of symmetry, parallelism and closure. We used visual search to measure perceived dissimilarities between pairs of two-orientation objects. Specifically, we used the reciprocal of the search reaction time (1/RT) as an index of perceived dissimilarity. We collected visual search data for all possible 1,176 (= 49C2) pairs of two-orientation objects from 12 naïve human subjects. The visual search data was extremely consistent with a significant correlation of 0.92 between two random halves of subjects. We explored two mathematical models to explain the observed data. The first model was a linear model with orientation difference at corresponding locations, opposite locations and within object locations as regressors. Along with a constant, this model had 7 parameters. The second model was an indicator model which indicated the presence of a particular combination of orientations at corresponding locations, opposite locations and within object locations. With 7 levels of orientations, there were 21 (= 7C2) regressors in each subgroup. In total, this model had 64 (= 21 x 3 + 1) parameters. We estimated the weights for both models using linear regression and found that the second model outperformed the first model even after penalizing for number of free parameters (model 1: r = .86, p < 0.00005 and AICc = -3.9632e+03; model 2: r = .92, p < 0.00005 and AICc = -4.575e+03). This indicates that just the differences in orientation cannot explain perception. We further explored the pattern of estimated weights and residuals in the second model. Surprisingly, we found that the estimated weights had a linear relationship with orientation difference and showed mirror confusion. In other words, the estimated weights behaved as dissimilarities. Also, we observed that all the three sets of parameters are significantly correlated with each other indicating the presence of a common set of dissimilarities modulated by location. In addition, we observed systematic deviations in the predictions of the model for symmetric, mirror-related and closed objects. These results indicate that multiple orientations combine linearly provided emergent features are taken into account.

69. CAN A SOLITARY INDIVIDUAL BE A RULE-FOLLOWER?

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Abstract: ABSTRACT Can a solitary individual be a rule-follower? This question is closely related to the view that in order to speak a language one must follow rules. The private linguist might claim that for Crusoe there is no harm in following a rule and he can follow his own rule in isolation. If this is the case, then how can Crusoe correct his mistake? It is not the case that he will always follow his rules those are formulated by him only correctly. To correct his mistake, he will depend upon his memory only. It is also the case that sometimes our memory fails to decide the correctness of things which are remembered. Then, how can Crusoe follow his rule solitarily and also correct his mistake by the help of his memory only? A solitary individual like Crusoe never follows any rule. His rule-following cannot be considered as a rule-following because rule-following is a custom. Following a rule is a practice based on the agreement of the community and this practice implies a set of norms being followed by people in a regular fashion. Accordingly, there are two types of view concerning Wittgenstein's account of rule-following, namely, the community view and the regularity view. These are two similar views regarding the concept of following a rule. But, these two views are only different in their claims whether necessary conditions for following a rule can be met independent of a community. In the case of the community view 'the consensus of action' and in the case of regularity view 'the regularity of action' – both are similar and both are determined by the rule under consideration. Malcolm has given importance to the consensus of action and, on the other hand, Hacker and Baker have given importance to the regularity of action. I find an important point in Wittgenstein's writings that following a rule does not usually consist of interpretation at all. For example, when a teacher teaches a rule, he/she is teaching a practice and when a child follows the rule applies what is taught. Since a practice need not rely on any further justification, the absence of this justification does not mean that I am free to interpret and then follow a rule whatever or whenever I choose.

70. THE ERP STUDY TO MEASURE INHIBITION TASK IN CENTRAL EXECUTIVE FUNCTION OF WORKING MEMORY WITH NEURONAL CORRELATION

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Abstract: Working Memory (WM) is short term memory which is responsible to process the information for limited time period. Broadly it involves two parts one is temporary storage system and another is information processing system. The temporary storage system is divided into small chunks and information processing system is further divided in three subsystem phonological loop, visual sketch pad and central executive function (CEF). CEF is responsible to play several important roles during performing cognitive task. In the CEF inhibition process refers to the ability to consciously inhibit dominant, automatic and proponent response when necessary.   In this study our objective to examine the role of central executive function during inhibition process. We measured the activity of fronto-parietal lobe in form of Event-Related Potential (ERP) with the help of Neuroscan, EEGLab, sLORETA tools. A paradigm design of inhibition task was conducted by providing a set of visual stimuli to the subject and responses were recorded in specific period of time. The measurement of activation of brain areas in individuals were analyzed by gender discriminative comparison of positive and negative amplitude peaks of ERP. The cognitive experiment was performed on thirty healthy control subjects with certain parametric constraints to judge behavior based on average responses in order to establish relationship between ERP and local area of brain activation. We found that numbers of correct responses were higher in males in comparison to females. We also found that lower peak amplitude activity of brain area in males than females which reveals that males utilize less activation of brain areas to perform inhibition task better than females corresponding to their same brain areas. Findings from this study will give a better understanding of CEF and brain activity in males and females. It will also help us to understand the concept of CEF in general. In addition, it might also help to understand the neural correlates of inhibition process.

71. INVESTIGATION OF LOCALITY EFFECTS IN HINDI-URDU LANGUAGE PRODUCTION

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Abstract: Gibson's Dependency Locality Theory (DLT) [1] is an influential account of language comprehension. It proposes that due to working memory constraints, the complexity associated with the processing and comprehension of a sentence is directly linked to the length of its syntactic dependencies, i.e., the longer the dependencies in the sentence, the more difficult it is to process. It has been supported by a variety of language comprehension experiments involving reading time measurements using eye-tracking or self-paced reading paradigms. Temperley extended this theory to language production for English [2], and showed via a corpus study that English production choices also appear to be influenced by considerations of dependency length minimisation. This paper investigates whether and to what extent language production in Hindi-Urdu (a language with freer word-order than English) is influenced by locality considerations. We use the Hindi-Urdu Treebank (HUTB) [3] corpus to study specifically whether dependency length is a significant predictor of syntactic choice even in the presence of other cognitively grounded control predictors, such as word expectation effects (evaluated using n-gram models) and shallow syntactic structure. We set up a binary classification problem where corpus sentences are to be distinguished from non-corpus variants. For instance, consider the following example sentence from the HUTB: [ ] [   ] [. .   ] [ ] [   ]   This sentence has a total of 5 constituents pre-verbally, so 5! = 120 different competing sentences can be created by permuting these 5 constituents. A few possible variants are shown below.
. .   . .   . .   The contributions of different features to syntactic choice have been examined both individually and in combination, using a logistic regression model to integrate information from different features for the choice prediction task. Our results suggest that the dependency length hypothesis is a plausible determinant of Hindi-Urdu word order, though to a lesser extent than for English. Across the over 13,000 sentences in the HUTB, which generate over 2,00,000 variants, a model with a dependency length feature achieves a 0.3% cross-validation accuracy increase (from 86.5% to 86.8%) over a model with only the other features; in absolute numbers, nearly 600 more variants are rejected in favour of the actual corpus sentences. Thus locality effects appear to have some importance in Hindi-Urdu, though their exact interplay with expectation effects, and the integration of both these into a single cognitively motivated framework, remain subjects for future study. References [1] Edward Gibson. Linguistic complexity: locality of syntactic dependencies. Cognition, 68(1):1–76, 1998. [2] David Temperley. Minimization of dependency length in written English. Cognition, 105(2):300–333, 2007. [3] Rajesh Bhatt et al. A multi-representational and multi-layered treebank for Hindi/Urdu. In Proceedings of the Third Linguistic Annotation Workshop, ACL-IJCNLP '09, pages 186–189, Stroudsburg, PA, USA, 2009.

72. DECISIONS FROM EXPERIENCE: REASONS FOR STOPPING SEARCH AND PROBABILITY PERCEPTION

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Abstract: Recent literature in the area of decision making has shown that people's choices, and the weightage they assign to the probability associated with an outcome, vary between description and experience based decisions. People are found to overweigh small probabilities in the former case and underweight the same in the latter case. Such a difference in the pattern of probability weighting has been termed as the description-experience (D-E) gap (Hertwig et al., 2004). An important goal of this study is to investigate the role of value (gain/loss) and probability (high/loss) of outcome in experience-based decisions. We used the sampling paradigm, where the decision maker makes a choice in two stages: a) sampling options, where the outcomes occur according to a particular probability distribution and outcomes are non-consequential, ; and, b) making a final choice after a respondent's sampling of options, and where outcomes are consequential (Weber et al., 2004). An interesting aspect within the sampling phase of the paradigm is to investigate when and why people stop searching for information before making a consequential final choice. A number of reasons may exist to account for the why people stop information search. However, researchers have not documented this in the context of sampling paradigm. Therefore, one of the goals of the current study is to investigate the common reasons for people to stop information search and how do valence and probability influence such stopping rule. To do so, we presented the participants with several possible reasons for stopping information search and then ask them to select the reason(s) that could explain their stopping decision. The results show that the proportion of choosing the stopping rule, 'perceiving the outcomes of both the options of similar size', was significantly higher for gains compared to losses, and higher for high compared to low probability conditions. Also, higher proportion of people chose 'cognitive cost' as another stopping rule for low compared to high probability condition. Another goal of the study was to obtain an objective measure of probability weighting which is absent in the current literature on experience based decisions. To investigate this, we quantitatively defined underweighting of rare events as judged probability measured by asking the participants to provide an estimate of the probability associated with each outcome of the decision alternatives. A comparison between perceived and actual probability conditions showed underweighting of high probability problems and overweighting of low probability problems. In addition, perceived compared to actual probability was found to be slightly higher for loss than gain domain problems.

73. TRAINING THE ARCHITECTS BRAIN: AFFORDABLE VIRTUAL REALITY ENABLED LEARNING SOLUTIONS FOR TRAINING INTUITIVE DESIGN SKILLS

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Abstract: Space or Akasha, respected as a fifth state of matter in Indian tradition, (Narayan, 2007) forms the quintessential reference frame for all events, (along with time), whether happening in the material outer reality or inner mental conception. Planning, management and economy of space is an inevitable part of the human life. Architects as professionals are engaged in this activity ensuring the planning of domesticating the spatial continuum into bound or unbound built space. They primarily aims at ensuring functionality, stability and aesthetics (Gwilt and Pollio, 1826) while also secondarily attending to extended sets of associated properties and parametric requirement's like sustainability, psycho-social impact etc. Space is the Gestalt of Architectural structure, like air in the middle is to a ring or doughnut. Designing and Building walls or visual boundaries limit and define space, giving it specific spatial configurations. While space is an extremely elusive concept, with the subtleties of its design having both tangible-physical and intangible- intuitive nuances, the current system of training Architectural /Spatial design has major limitations.It falls short in easily training the subtleties of concepts, knowledge, approaches and values in spatial design. Many times architecture schools uses a merely corrective and brute force approach like that of 'teaching swimming by throwing someone into water', leaving many of the skills and knowledge sets as expected to be picked up by the learner 'on the go' if the he/she is fortunate to stumble upon them in the struggle. While the current methods of teaching key spatial design concepts and on 'how to design' in this way are not completely failing, there is a need for supplementary solutions in architectural pedagogy to fill in the gaps of the existing system. This study intends to develop human centred and advanced immersive spatio cognitive pedagogic solutions (Bhatt and Schultz, 2015) virtual reality (VR) and augmented reality (AR) applications, for filling the methodological gaps in teaching spatial design. It tries to develop digital design tools and VR/AR based e-learning solutions to train some essential skills like sense of spatial dimension's, and transfer spatial design concepts by interactive virtual interfaces like virtual-walk-around-learning-laboratories. Now having the cost of VR and AR solutions steadily coming down, there is an excellent opportunity of using this toolsets for personal and collective e-learning solutions (MacIsaac, 2015; Oculus, 2015). Recent researches in neuroscience and cognitive science (Eberhard, 2008; Mallgrave, 2010) has brought about fresh information into the brain processes of artists and designers on their creative approaches and also on how others perceive design. This

research also intend to be informed by these works in its pedagogic approach in creating toolsets and e-learning media This study is a part of an ongoing Ph.D. Research and further intends to test and validate the efficiency of such tools in teaching key concepts and training key skills in the architecture school from a mind/brain science perspective. It intends to use VR based eye-tracking head-mounted-displays, and positional tracking within virtual environments as well as post usage user feedback to study efficiency of the solutions in their pedagogic goals. -(References deleted upon word limit exceeding)-

74. NEUROAESTHETICS : WHAT IS BEAUTY FOR 4-6 YEAR OLD CHILDREN ?.

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Abstract: Neuroaesthetics aims to understand the beauty appreciation centers in the brain. The pursuit is two fold. It attempts to study the mind of creators as well as the effect of those creations on individuals. Here, mostly, the stimulus which happens to be a work of art, is a multisensory input. In Neuroaesthetic studies, Visual and adutitory stimulus, like works of art and music have garnered attention. Sense of touch and taste in neruoaesthetic studies are catching up as well. Mostly, adults have been the center of the studies done. In this paper, an attempt is made to understand the concept of beauty held by 4-6 year old children. In Neuroaesthetic parlance, the role of beauty is also claimed to be a means to undertand the novelty and specificity of an object. The role of episodic memory in appreciation of beatuy in children is explored in this paper. Appreciation of beauty is disscussed to be a parley between past experiences, contextual sensations moderated by attention and stimulus complexity that stimulates the "where" and "what" visual pathways. An eyetracker and EEG based study to create such conditions for 4-6 yearolds is done. Visual stimulus are designed to understand the effect of V.S. Ramachandran's "peak shift principle" and "symmetry" in children. The stimulus will have a set of 3 images. Each of the picture shall have 6 copies. Each copy shall have a particular aspect of the image is elaborated. From the first to the 6th image, the eloboration shall be done incrementally. The task for the children is to state the image that they find beautiful. The same shall be repeated for all the three images. This same procedure shall be done to test effect of symmetry as well. The stimulus are presented in the working memory domain. The stimulus are flashed for 500 ms and there is an inter stimulus blank screen for 1000ms. The EEG signal, Frontal midline Theta (FmTheta : 4-7 imagesHz) acquired from FZ electrode site is a well established marker for episodic memory operations. P300 event related potentials produced in PZ electrode site are influenced by pre and post stimulus FmTheta. The correlation between the gaze data, FmTheta and P300 for the images claimed to be beautiful would yield important information about the aspect of beauty appreciation in children. Invariably, pupil dialation and P300 eliciation are supposed to be governed by Anterior cingulate cortex, and FmTheta finds its roots in the hippocampus. This apparently establises the interplay between affect, contextual experience and attention in beauty appreciation. The result of this study would establish a set of correlations between object parameters-gaze, pupilometry data and EEG signal correlations in 4-6 year old children.

75. UNDERSTANDING IMPACT OF CAUSE RELATED MARKETING (CRM): A NEUROSCIENTIFIC RESEARCH APPROACH

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Abstract: Corporations invest their resources in marketing and advertising their products, with an aim to increase awareness among the consumers, build brands to gain competitive advantage, to communicate their message to their stakeholders, capture a viewer's attention, increase the consumer awareness about the product, and induce consumer's behaviour to purchase an endorsed product etc. The Cause related marketing has recently began to gain ground as large corporation have started adverting the initiatives taken by them toward the causes supported by them for e.g. Procter & Gamble (P&G) has chosen to fight for the cause of 'education' and runs a series of campaigns to promote its cause with a famous tagline, 'Padega India to badega India', meaning if Indian kids are imparted education, they will lead the future growth of the country, and after the commercial , it is announced that for every purchase of their product, they (P&G) will contribute some money for educating unprivileged Indian kinds .In this paper we provide the findings of the previous researches, analyzing both of these kinds of advertising trends. This paper, for the first time, at least in the Indian context, propose a neuro scientific framework to understand the impact of advertisements involving CRM on the consumer decision making. We discuss the neuroscience tools which can be used to investigate such type of research questions. We then discuss the results of our experiments which recorded the EEG data of the subjects when they were asked to participate in an experiment which was designed to understand the impact of CRM activities on their brains. The results gives us insights into

the information processing and decision making of the consumers when they come across different type of marketing practices.

76. PARAMETRIC SENSITIVITY ANALYSIS OF SUBTHALAMIC NUCLEUS MODEL IN PARKINSON DISEASE

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Abstract: Parkinson Disease (PD) is a neuro-degenerative pathology which affects basal ganglia, due to which the information patterns are altered along the moment related pathways in Brain.This causes tremor at rest and instability in posture. Experimental results performed on rats shows that the activity patterns changes from single spike activity to mixed burst mode in PD.However the cause to this discharge pattern is not yet completely understood. In this paper,we have studied a two-stages conductance based model which focus on those nuclei involved in the origin of PD motor symptoms and able to copy the quantitative data from different in vitro physiological analysis. This model show highly nonlinear electrical behavior which stem from the interaction between some specific ionic currents when we change some particular parameters.We focused on the activity patterns generated in subthalamic nucleus (STN), the main nuclei responsible for the non-linear behavior in PD. Our focus was on the hyper-direct pathway of basal ganglia. Cross-Correlation at different parametric values has been found out to check the sensitivity of the model.

77. THE RELATIONSHIP BETWEEN ACTION EXECUTION, IMAGINATION AND PERCEPTION IN CHILDREN

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Abstract: Neural simulation theory (Jeannerod, 2001) is said to be a unifying mechanism for processes associated with motor cognition, including the imagination and perception of action. This notion is supported by neurophysiological data that demonstrates motor system activation in imagination and perception and also by behavioural data demonstrating temporal similarities between actual, imagined and perceived actions. Specifically, Fitts' speed-accuracy trade-off (Fitts, 1954) has been shown in imagined movements and in action possibility judgements. This relationship has also been seen in the imagined movements of young children and imagined movement time (MT) has been shown to approach actual MT as age increases. The relationship between action execution, imagination and perception, however, has yet to be evaluated in children. The purpose of the current study was to evaluate imagined and perceived MT in relation to actual MT in late childhood and adolescence. Children executed, imagined and completed action possibility judgements on the same manual pointing task. It was predicted that imagined and perceived MT should similarly approach actual movement times as age increases due to their shared mechanism (action simulation). Fitts' law was demonstrated in imagined and perceived movements of all participants. Imagined MT was consistently greater than actual MT and remained stable as age increased. In the perceptual task, the youngest children underestimated MT (overestimated their abilities), but perceived MTs became more consistent with actual MT as age increased. This difference in the developmental trajectories of imagination and perception reflects differences in the use of action simulation in action imagination and action possibility judgements.

78. PRELIMINARY COMPARATIVE ANALYSIS OF ACTIVATIONS DUE TO CONTROLLED DEEP-BREATHING AND RESTING-STATE IN REGIONS COVERED BY MAJOR ARTERIES – A FMRI STUDY

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Abstract: Abstract The brain's main blood supply are provided by the posterior (inferior,medial surfaces of the temporal ,occipital lobes and cerebellum), middle (lateral surface of the temporal and occipital lobes.) and anterior (medial surface of the frontal and parietal lobes) cerebral arteries. We investigated the regions and intensity of activation during controlled deep-breathing and compared it with resting-state data. The goal was to investigate a) comparative activations in regions covered by the arteries in the two conditions and b) functional connectivity dynamics between IC networks. Towards this fMRI deep-breathing task and resting-state data from 11 subjects (21 to 28 years) was analyzed using ICA method and pair-correlations of time-courses. The time courses of the ICs showing activation in the posterior default mode network (anterior cerebral artery,ACA) and cerebellum (posterior cerebral artery,PCA) were correlated with temporal lobe (posterior/middle cerebral artery), parahippocampal gyrus and parietal lobe. The findings point to a) cerebellum-parietal (PCA ,ANA respectively) to be negatively correlated

during deep-breathing and positive in resting state in normal respiratory condition, b) the FNC plot between DMN and parahippocampus is oscillatory for breathing-task and nearly zero for resting-state, c) the correlation is similar for cerebellum/pDMN with temporal lobe. The data suggests that deep breathing increases activation in the limbic lobe, cerebellum and parietal covered by PCA and MCA and the activation be applied as confounds in task-related fMRI data. The deep-breathing activations along the main arteries confirm previous findings that fMRI BOLD method can be used to investigate clots in blood vessels. Background In a previous study on breathing subjects were asked to take deep breathe at random times during a 60sec period. The breathing data was compared to the activations isolated using the Independent Component Analysis (ICA) from a subsequent reading task and it was found that the former physiological task results in high activation in the prefrontal areas covering the same areas required for reading and comprehension (Vemuri.K,2012). The results suggested that breathing need to be applied as confounds in task data. In this study, we extend the above with a timed breathing exercise and compare to resting state data, of particular interest was to compare the differential activations in the prefrontal, cerebellum, limbic lobe, temporal and motor cortex areas covered by the three main arteries (PCA, MCA and ACA, book: Duvernoy, 1999) areas reported to be highly active for breathing task (Colebatch et al., 1991; Ramsay et al., 1993, McKay et al.,2003). Breathing-task fMRI data for clinical diagnosis of conditions like vascular dementia, to identify blood clots has been investigated as alternative to the acetazolamide or CO2 test (Kastrub et al.,1998) Methods MRI data were acquired on a 3 Tesla Philips Achieva scanner located at the National brain Research Center, Gurgoan, India. A total of 60 functional volumes for the breathing exercise and 90 for the resting state were acquired. Post preprocessing was done on 11 subject data using SPM toolbox a group ICA was committed and 11 ICs were isolated. The regions were labeled using the anatomy toolbox and cross-referenced with artery regions (Duvernoy,1999) and dynamic functional connectivity on the time courses of the spatial networks. The deep breathing experiment required the participants to take a deep-breath and release (inhalation: 2 +- 1s and exhale: 4 +-1s) followed by a 3 minute resting state condition.

79. EVALUATION OF 360° USER-INTERFACE DESIGN WHILE PERFORMING SPATIAL TASK

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Abstract: Emerging technologies in surveillance, security or entertainment are aiming to enhance our perception, cognition and action experiences. 360° vision would be one of such experiences that might change the face of visual interface in applications ranging from surveillance to entertainment. Despite growing research on 360° vision to support local area awareness (LAA), very few studies have evaluated the effect of 360° user-interface (UI) designs on spatial understanding. Comparatively poor 360° orientation mapping has been observed with seamless interface vs. visual boundary, in previous study (Boonsuk et al., 2012). Unlike other studies, no difference has been reported between gamers' and non-gamers' spatial understanding while using 360° UI. The discrepancy could be because of the differences in evaluation metrics, i.e. 'effectiveness vs./ and efficiency' of UI designs. Previous study might lack the assessment of 'efficiency' of 360° UI designs, which is the focus of current study. We aim to evaluate the efficacy and efficiency of orientation and cognitive mapping across 360° UI (varied from 90° x 4 to 360° x 1; similar to Boonsuk et al., 2012) by measuring accuracy and speed of processing. Gaming experience and its relationship with speed of processing was further tested with varying time pressure as well. If gaming experience affect spatial understanding, then gamers are expected to show advantage in orientation mapping across 360° UI designs under time vs. no-time pressure. An experiment was conducted by employing pointing and map placement task to assess the orientation and cognitive mapping respectively. Both the tasks were performed in serial order across 360° UI designs. 360° video feeds were simulated using a game engine by employing first person shooter perspective. The experiment was randomized, single blind, mixed group design: 3 (360° UI designs: 90° x 4, 180° x 2, and 360° x 1) within group X 2 (time pressure: with time and without time) X 2 (gaming experience: gamers and non-gamers) between groups. In addition, subjective experience was collected to evaluate ease of interaction with 360° UI design. Currently, we reporting a preliminary data observed in the experiment. The current result show 1). Consistent with Boonsuk et al. study (2012), visual boundary vs. seamless 360° UI showed reduced pointing errors 2). Self-report on UI preferences, i.e. 180°x2 interface, didn't match with their orientation accuracy, indicating the differences in ease of performing a task. 3). Contrary to Boonsuk et al.

(2012), least errors in 180°x2 interface map task, suggesting a relationship between ego-centric and exo-centric spatial mapping within environment. 4). Gamers vs. non-gamers showed better and faster orientation, supporting our hypothesis. 5). Novel factor, time vs. no-time pressure showed reduced pointing error, consistent with our hypothesis. Factorial Analysis and eye-tracking data analysis will be conducted to evaluate 360° UI while performing spatial tasks with and without time pressure. Current findings will enable us to evaluate the limitations/ strength of 360° UI designs for tele-operation systems.

80. WHY ARE SOME PEOPLE NON-RIGHT HANDED?: A NEUROPSYCHOLOGICAL PERSPECTIVE

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Abstract: Handedness is a tendency to use one hand more skilfully in preference to other. If a person use their left hand more proficiently to do skilful task than right hand, known as Left-handedness as similar a person get better results with their right hand in skilful task in preference to left hand, called Right-handedness (Meyer, 1998). A verity of studies suggests that 70-90% of the world population is Right-handed, rather than Left-handed or any other form of handedness (Holder, 1997). It means as compare to right handed, left handed and any other type of handedness people are very small i.e. near about 10-15%. People are searching answer from near about hundred years back that why people have a preference for right-hand larger than left and why the left is chosen such a marginal (Franklin, 2008). The facts for the grit of right-handedness has been endorsed to brain functioning, society norms or heredity and figures of different sorts have been used in attempts to create one facts or other. The objective of this review is to identify the neuropsychological causes or the brain functioning involves in human handedness and to elaborate the neurological or psychological cause that, how do they play role in development of handedness from the time of birth to adolescents' age. There are some factors reviewed in this article like Genes, Sex, Fetal Development, Brain Development, Modelling, and Bain Damage. According to Better health channel and some other related articles above mentioned factors play role in this way like, Genes: genetic factors predispose a child to favour the right hand. A single gene might be passed from parents to children to influence which hand a child favours. If a particular version of this gene is inherited, the child may be more likely to be left-handed, depending on reinforcement and other environmental influences. Recent research suggests it is more likely that lots of different genes 'add up' to produce a lefthanded person. Sex – slightly more boys than girls are left-handed. This suggests to some researchers that the male hormone testosterone has an influence on right and left-handedness. Fetal Development – some researchers believe that handedness has more of an environmental influence than genetic. They propose that environmental factors in the womb (hormones) may influence whether we favour the right or left hand later in life. Brain Development: Some of the research also indicates that due to brain development ones prefer hand to do skilful task. If right hemisphere developed more as compare to left hemisphere then person will be left handed because of cross connection of our body and hemispheres. Modelling: children learn to choose their right or left hand by copying parents and other significant caregivers. However, this doesn't explain why right-handed parents sometimes have left-handed children, and vice versa. Brain damage: small percentage of researchers theorise that all human beings are meant to be right-handed, but some type of brain damage early in life causes lefthandedness. For left-handers and parents of lefthanders, it is important to note there is no hard evidence to support this rather controversial theory. Finally we would conclude that neurological and psychological factors play a magnificent role to define and develop handedness in human being but we can't deny the evolutionary perspective in this regard.

81. A COGNITIVE ANALYSIS FOR BUILDING DETECTION FROM HIGH RESOLUTION SATELLITE IMAGES

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Abstract: High resolution satellite images are new sources of data for geo-spatial information. In order to automate the process of extraction of information from satellite images emulating human experts, an understanding of the human cognitive processes involved in information extraction from images are required. The objective of this research work is to emulate the human cognitive capabilities by integrating cognitive task analysis for extraction of data from satellite images. Initially, preliminary knowledge about the sequence of cognitive processes which human being utilizes during the interpretation and classification of images was collected. When human beings visualize a natural scene or image, they initially segment the image based on the attentive and non-attentive objects in the image before the interpretation of image. Thus, multiresolution segmentation method was used for image segmentation based on different parameters. Information acquired in the previous stage is used for representing the knowledge. Here, rule based approach for the representation of the knowledge which is obtained

from the visual interpretation of image by the human beings. Defined rules are used to determine the buildings in the satellite images using the mixture tuned matched filtering algorithm (MTMF). MTMF is based on the concepts of signal processing algorithm which can detect specific land cover type on the basis of their spectral properties. The binary view of the input image is obtained and the detected target pixels are highlighted and overlaid on the rule image. Now different Parameter and filter options are set for each target based on the prior knowledge and the size of the target. Further, during knowledge elicitation the domain knowledge which is based on the visual interpretation of human beings is grouped together which used for the training the nearest neighbour classifier. The images were classified into two classes i.e., building and non-building. The potential of the methodology was determined using four different sets of World View-2 high resolution satellite images with different resolution which have three bands (RGB). The images are selected in a manner so that it can represent different building feature namely shapes and size of buildings. For quantitative analysis and verification, classified image is compared with the image obtained after building detection using three standard quality measures precision, recall and F1 score. The overall average of precision and recall are computed as 99.08% and 75.85%, respectively. Further, the calculated F1-scores for all the images are 85.66%, which indicate promising results for such a challenging set of images. However, qualitative assessment of the method is performed using visual interpretation. The proposed cognitive method for detecting objects from satellite images can be used in several of automated applications. The proposed cognitive method can detect buildings from high resolution satellite images irrespective of their geometrical parameter. However the approach is not able to perform the clear separation between the building and non-building areas having similar spectral values. For future work, overall accuracy for detection of building is needed to be improved.

83. COMPARATIVE STUDY OF FEW SALIENCY BASED METHODS FOR SEGMENTATION OF SATELLITE IMAGES

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Abstract: Human mind is supreme in making judgment and image interpretation and understanding is best accomplished by human visually. In spite of evolution of technology and research of these many years, still the systems available for image interpretation and understanding are not as efficient enough for intelligent decision making as human can. Thus development of systems having human visual interpretation capacity for cognitive image interpretation has become a need of now a day for achieving the above goal. Stepwise approach towards cognitive image interpretation requires the segmentation of images initially. Humans also first perceive any scene, then cognitively interpret and finally understand the whole scene. In this way for implementing any cognitive image interpretation technique, perception is required as pre-requisite. Therefore, perceptual or psychovisual approaches based segmentation may be used as an input for cognitive interpretation of images. Salient feature detection is a psychovisual approach which selects most relevant or "Salient" or "Attentive" part of scene. Saliency helps in prioritizing the visual scene objects as human does and high priority objects contribute for cognitive image interpretation and understanding. Thus saliency can be used for segmentation of images as initial step for cognitive image interpretation. In short, the whole idea here is like "to perceptually segment an image to achieve cognitive interpretation", in similar way as human do. In past several years of research some saliency methods have been developed for segmentation for indoor and outdoor images but there is still a lack for perception based segmentation of satellite images. Therefore the objective of the work is to focus over different saliency based methods and then segmentation of image based on them. In this paper few saliency models are implemented for salient regions extraction for the satellite images and the significance of results have been discussed for satellite and terrestrial image interpretation. A threshold based methodology has been used for the work. The salient areas beyond a threshold level have been extracted and then the segmented area has been analyzed. Before implementing on satellite images these saliency based segmentation have been implemented for terrestrial data. The terrestrial image dataset contains human inspired ground truth images in which hand labelers concentrate only on the attentive areas of image rather than emphasizing over pure object's boundary. Hence this is more likely as humans actually see any scene for interpretation and understanding. As there is no reference image available for satellite image for perception based segmentation; a reference image has been created by manual filter. This filter makes perceptually relevant area as foreground and omits the rest as background. F-1 score has been used for comparison of both types of data sets with their respective ground truth images. Results show that one saliency based segmentation method may fit for terrestrial images but the same need not to perform well for satellite images. Also the results suggest that as in satellite image not every object contributes in the overall meaning of image, saliency based segmentation helps in prioritizing the objects of image. This process is similar to human

visual perception, which again an essential part for forming cognitive decision. Negotiable threshold value and circumference of salient area can be said as limitation of this study which can be further improved.

84. HOW EXPERTS & NOVICES NAVIGATE CHEMISTRY REPRESENTATIONS? AN EYE-TRACKING STUDY

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Abstract: Chemistry deals with complex systems, entities & phenomena that often cannot be directly perceived (e.g. atoms, chemical reactions, etc.) These imperceptible systems are understood at multiple levels of detail (electronic configuration, stereo-chemistry, stoichiometric ratios etc.), using multiple external representations (MERs), such as reaction mechanisms, molecular diagrams, graphs & equations, at each level. The ability to generate & use these MERs in an integrated fashion (for conceptualization, discovery & communication) is indicative of expertise in chemistry. This skill-set is collectively known as representational competence (RC) in chemistry (Kozma & Russell, 1997). Many problems & difficulties in teaching/learning chemistry are attributed to difficulties in understanding the different MERs in chemistry (Johnstone, 1991, 1993; Kozma & Russell, 1997; Gilbert & Treagust, 2009). Development of RC is central to chemistry education. Our approach seeks to understand the cognitive mechanisms underlying the processing of MERs, using recent cognitive theories such as distributed & embodied cognition. In this study, chemistry professors (experts) & undergrads (novices) view & categorize MERs. Using eye-tracking, we capture fine-grained data about participants' gaze patterns while they view given MERs, which we then correlate with the quality of categories they generate as well as justifications they provide for those categories. Preliminary results include (a) the nature of categories experts and novices make in the first trial of categorization, and the justifications they provide for those categories, (b) statistical analysis of the fixation data on static representations (graphs and equations), and (c) fine-grained data of MER viewing process. The professors tend to form chemically meaningful relationships between MERs than do undergrads. Eye-tracking data reveal differences between the two groups, in navigating chemical equations. Based on a paper to be published in the proceedings of EPISTEME-6, Sixth International Conference to review research on Science, TEchnology and Mathematics Education, HBCSE, TIFR, Mumbai, Dec. 2015.

86. SELF MOTION ENABLED BRAIN CONTROL OF NAVIGATION IN PRIMATES

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Abstract: Brain-machine-interface (BMIs) is a technology that allows a paralyzed individual to use neural activity from his intact brain substrates to control artificial limbs or other external actuators. Up to date, only noninvasive BMI approaches, mostly based on electroencephalography (EEG), have been utilized to enable direct brain control over navigation in a powered wheelchair. Although intracranial BMIs hold promise to offer a superior performance over noninvasive systems and approximately 70% of paralyzed patients are willing to accept surgically implanted electrodes in their brains to gain control over their assistive devices, intracranial BMIs have not been applied yet to wheelchair control. It is currently unknown whether cortical ensemble activity could be used to operate a BMI for whole-body navigation. In this study we establish for the first time that intracranial wireless cortical ensemble recordings can be harnessed to control whole-body navigation in a mobile device such as a robotic wheelchair. Here we show that rhesus monkeys can learn to navigate a robotic wheelchair while seated on top of it, using only their cortical activity as the robot control signal. Two monkeys were chronically implanted with multichannel electrode arrays that allowed simultaneous wireless recordings from ensembles of premotor and sensorimotor cortical neurons. Then, passive navigation, while monkeys remained seated in the robotic wheelchair, was used to train a linear decoder to extract wheelchair kinematics from cortical activity. This BMI training approach has obvious clinical significance since severely paralyzed subjects cannot produce overt body movements to train a BMI decoder. We observed that, after passive navigation was employed to set up the decoder parameters, animals significantly improved their navigation performance through learning, likely mediated by widespread cortical plasticity. It is important to emphasize that, different from previous BMI studies in which animals were trained by

performing actual movements on an actuator such as a joy stick, here the entire animal's body was passively transported by the actuator (wheelchair) during training of the BMI decoder. This implies that an integration of vestibular, proprioceptive, visual and auditory inputs influenced the choice of our optimal decoder settings, something that had not been tried before in the BMI field. Thus a self-motion based training of the BMI decoder was employed for the first time. In the brain control mode the monkeys employed the wireless BMI to translate their cortical ensemble activity into the robotic wheelchair's translational and rotational velocities, without production of overt body movements. Over time, monkeys improved their ability to navigate the wheelchair toward the location of a food dispenser which delivered a grape reward. The navigation was enacted by populations of cortical neurons tuned to whole-body displacement. We observed distinct differences in neuronal firing patterns during passive navigation and when monkeys were switched to the BMI control phase of our experiments. Most notably, cortical neuronal tuning peaked prior to the wheelchair movement during BMI control, likely indicating a causal relationship between cortical activity and the type of navigation pattern generated by the animal. We also noticed the presence of a cortical representation of target distance. The finding that cortical ensembles can adapt to a whole-body navigation task propels BMIs to a new dimension and creates innovative avenues for exploration of this approach's clinical relevance in the future. These results demonstrate that intracranial BMIs could restore whole-body mobility to severely paralyzed patients in the future.

87. POWER SPECTRUM AND COHERENCE STUDY OF VERBAL LEARNING TASK

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Abstract: 10 subjects will be given learning task from an audio player. First, all the 10 subjects will undergo a baseline EEG study. After that, two stories will be played for an audio player. In one of the stories the subjects will be informed that they will be asked questions from the story after completion of the story. Then the subjects will listen to questions pertaining to mathematical calculations. The subjects have to do the calculation and give their response. EEG will be recorded for all the three learning tasks. Power spectrum and coherence will be analyzed from the EEG data. This is to study the activity of various parts of the brain while performing a verbal learning task.

89. IMPACT OF SLEEPLESSNESS ON COGNITIVE ABILITIES AND BRAIN WAVE PATTERNS: AN EEG BASED STUDY

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Abstract: One third of our life is spent in sleeping. Sleep can be defined as "state of mind characterized by altered consciousness, relatively inhibited sensory activity, inhibition of nearly all voluntary muscles, and reduced interactions with surroundings" according to Macmillan dictionary. As the definition says it's not unconscious but different state of consciousness. The changes of brain and its activity during sleep are fascinating. There are many researches taking place on these aspects. The studies suggest that sleep has role in memory consolidation, emotional stability and many higher executive functions. However, there are many people around us due to shift works, competitions and many other modern day challenges don't get even the average sleep time. So, this research was conducted to study the impact of sleeplessness on the cognitive abilities. For this, two volunteers were selected who were willing to participate and to remain awake for 72 hours. Brain wave patterns were recorded before the experiment period starts. After the experiment started, brain waves were regularly recorded at time interval of 24 hours, 48 hours, and 72 hours. Pre and post testing was done using for of working memory and long-term memory i.e., n-back test, kind of working memory test, is conducted before and after the experiment period to understand any changes in working memory due to sleeplessness. Changes in their baseline pattern of brain waves were tested using 20 channels EEG equipment. Volunteers' long term memory was tested by asking to recall words that they had made to practice before the experiment. Observers had a watch on volunteers during experiment period and recorded some behavioral changes in volunteers. Analyses of wave patterns are discussed in detail in the paper.

90. 'AN ENCOUNTER WITH MEMORY ' , FUNCTIONAL MRI PARADIGM DEVELOPMENT AND IMPLEMENTATION FOR EVALUATING MEMORY ENCODING & RECALL

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Abstract: INTRODUCTION Memory is described as the process of encoding, registration, storage, consolidation and retrieval of information in brain. Memory relies on the synergistic functioning of explicit and implicit memory systems entailing intricate neural activity. Memory evaluation primarily deals with memory encoding and recall tests. Healthy memory and its subsistence is important for the normal well being of a person, but it gets affected in clinical conditions like Amnesia, Alzheimer's disease and other Dementias. Material-specific memory deficits are also observed co-morbid with neurological disorders such as Epilepsy, Stroke and Parkinsonism. Therefore memory evaluations are vital for clinical assessment. Besides neuropsychological assessment, validation of neural correlates of memory is also significant to study the impairment. Functional-MRI facilitates effective memory mapping by employing sophisticated paradigms and image processing techniques. Memory paradigms are fundamental in analyzing BOLD responses in specific anatomical substrates of learning and recall viz. declarative memory systems. The current work is a pilot study designed to explore the efficacy of memory-fMRI paradigms in assessing the neural underpinnings of memory encoding/retrieval in cognitively normal healthy individuals. PURPOSE i.To develop MRI paradigms to standardize task activation for Memory encoding and recall. ii.To evaluate the neural correlates of memory encoding/recall to study paradigm efficacy in localization and lateralization of material specific memory viz. verbal and visual. METHODOLOGY fMRI-paradigms were developed for word lists, word paired associate-Malayalam, face and design learning and recall. Functional MRI scans were acquired while participants (cognitively normal healthy controls aged 20-40yrs) performed memory encoding/recall task. The data was acquired using Siemens-Avanto 1.5T MRI scanner from 10 participants. In the encoding task-block design paradigm, we utilized pictures of 10 Indian-faces,10 Malayalam-word pairs and 10 coloured-designs. Participants were told to perform a deep encoding task. During the recall session done within scanner after 1hour, the encoded stimuli is randomly shuffled with semantically unrelated distracters and presented by employing an event related paradigm. Here the participants were instructed to indicate whether they remembered the stimuli or not using a button response pad while supine in the scanner. The echo-planar images are acquired for fMRI-post processing and button response is recorded to analyze the stimuli based response. The Memory paradigm was designed using Presentation software and the image processing was done with SPM toolbox of Matlab Software. RESULTS On group analysis maximal BOLD activations for encoding (p<0.01) were evident over bilateral-fusiform gyri for faces, left-occipitotemporal regions for words and right-fusiform and brodmann-7,40 bilaterally for designs. For recall task essentially based on "yes-no" recognition strategy using event-related paradigm, right-fusiform and left-hippocampal BOLD activations were maximal (p<0.05) for faces, left parahippocampal region and Brodmann-10,40 for words and bilateral activations in precuneus and fusiform for designs. Unique material-specific activation profiles were thus demonstrable utilizing culturally and socially relevant paradigms with average scanning times of <45min. To conclude, this fMRI study is the first of its kind in the country utilizing encoding/recall strategies with in-house paradigm combining box-car and event-related design demonstrating robust activation profiles. The results highlights left lateralization over occipitotemporal regions in verbal paradigm and right side/bilateral activation for face and designs. This methodology require validation in larger group of healthy controls and its relevance in memory lateralization/localization has to be gauged in patient group with memory pathology notably in hippocampus as evident in patients with mesial temporal lobe epilepsy with hippocampal sclerosis.

91. EFFECTIVENESS OF DANCE/MOVEMENT THERAPY ON SOCIAL SKILLS AMONG CHILDREN WITH AUTISM

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Abstract: Dance/movement therapy is a psychotherapeutic intervention technique that is designed on the principle that the mind, body, and spirit are interconnected. It is an especially useful technique for individuals who are largely non-verbal, as a majority of the communication is through the unique movement exhibited by the person. There has been limited research in the past that illustrates the effect of dance/movement therapy on social skills among children with autism. This study examined the effectiveness of dance/movement therapy on social skills among children with autism. The study incorporated a quasi-experimental quantitative research design. The sample

size was 30, with 15 children with autism formed the control group and 15 other children with autism formed the quasi-experimental group using the purposive sampling method. The study was conducted using the TRIAD Social Skills Assessment Tool to assess social skills. The data was interpreted using an Independent Sample 't' test that was conducted on the Problem Behaviour Rating Scale. The Mann-Whitney U test was used to interpret the results of the Social Skills Survey scale. The results indicated that there was no significant difference in the social skills among children with autism who have and have not undergone dance/movement therapy (t=0.683 & U=0.653 > 0.05). This result can be used to modify, evaluate, and update sessions of dance/movement therapy as an additional therapeutic tool to enhance social behaviour of the children. Effective therapeutic intervention techniques such as the continuous, proper facilitation of dance/movement therapy sessions must be conducted.

92. IN-TYPE RELATIONS IN MARATHI: A COGNITIVE SEMANTIC APPROACH

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Abstract: The paper investigates the spatial relations encoded by the 'IN' type Marathi postpositions using Talmy's (2003) framework. Bowerman & Pederson's (1992) Topological Relations Picture Series (TRPS) is used to collect the spoken data of Marathi from ten undergraduate students. It is observed, as in other languages, the postpositions in Marathi such as -t 'in', -madhe 'at the center' or 'between' etc encode the semantic functions like 'inclusion' or 'containment'. But it is also observed that the Marathi speakers construe the relations like 'the ring on finger' as 'IN' type relations, unlike English, as in example (1). The shoes/ clothes wearing is also construed as 'IN' type relation as in example (2). (1) GND FIG EXIST bo--t agi he. finger.N3SG-OBL-PP ring.F3SG be.PRS 'The ring is in the finger (Lit.)' (2) GND FIG EXIST py--t bu he. foot.M3SG-OBL-PP shoe.M3SG be.PRS 'The shoe is in foot (Lit.)' References 1. Bowerman, Melissa & Eric Pederson. 1992. Topological Relations Picture Series. In Stephen C. Levinson (eds.). Space stimuli kit 1.2: November 1992. 51. Nijmegen: Max Planck Institute for Psycholinguistics. 2. Talmy, Leonard. [2000] 2003. Toward a Cognitive Semantics. Cambridge: MIT.

94. COMBINATION OF FREQUENCY DOMAIN TECHNIQUE USING GABOR TRANSFORM AND SUPPORT VECTOR MACHINE IS USED FOR PREDICTION AND DETECTION OF BRAIN TUMOR CAUSE DUE TO DIABETES

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Abstract: Healthy environment is one of the most important factors to keep health wealthy. Due to rapid development of industry revolution has made environment full of pollution. This causes various diseases. This may lead to complex group of diseases called as diabetes. It is occurs due to different factor such as, high ratio of sugar or glucose in blood ,less proportion of insulin in blood & may cause due to metabolism, etc. There are different types of diabetes i.e. type-1, type-2 and gestational diabetes, etc.Type-1 diabetes occurs due to damage of beta cells which is useful in generation of insulin with the help of pancreas.Type-2 diabetes cause due to combination of different factor based on condition of muscles of body, cells in liver, fats and carbohydrates are unable to used insulin in proper way. It may leads to obesity and physically inactive, genetic susceptibility, making insulin resistance power low & generation of abnormal glucose cell by liver. It may also lead to metabolism disorder which leads to high blood pressure, improper working of cell signaling and their regulation. Gestational diabetes is caused due to change in Harmon during pregnancy. It may create various problem such as skin complication, food complications,hypertension,strokes,etc.Due to this food complications, it leads to shortage of supply of protein C, protein S, protein Z & enzymes to the brain. These results to form a tumor in brain and diseases like polydipsia, polyphagia, lethargy, & stupor. To overcome this problem there is need to develop biomedical instruments or software for doctors which will help them easily to detect the brain tumor caused due to diabetes. In this research work, "Combination of Frequency Domain Technique Using Gabor Transform and Support Vector Machine is used for Prediction and Detection of Brain Tumor Cause Due To Diabetes" is going to be discussed.

95. MAPPING MEME COMPLEXES

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Abstract: The paper discusses an empirical approach to capture and analyse a memeplex. A meme in simple terms is anything – a song, phrase, habit, story, picture etc. – that is copied or imitated, and passed on by humans. A memeplex is a group of closely related and connected memes. Capturing a memeplex can help in gaining valuable insights to human psychology, consumer decision making process etc. – which have some really useful and interesting applications in areas such as marketing, behavioural studies, philosophy or any field that is affected by the actions of humans, whether directly or indirectly. The concept of a memeplex is explained followed by its intrinsic relationship with the social network theory the concepts of which can be translated to a micro-memetic

level represented by meme-maps. Meme-maps can then be visualized using the node and arrow model explained based on which several quantitative variables have been defined. A 'Double Funnel' model has been introduced that facilitates the analysis of memes and meme-complexes in a quantitative manner.

96. OBSTACLE DETECTION FOR VEHICLES IN INTELLIGENT TRANSPORT SYSTEM

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Abstract: Vehicular ad hoc network (VANET) is a part of Intelligent Transport System (ITS) which provides inter-vehicle communication and improves traffic efficiency. In this system, safety becomes vital, especially when a machine has to detect an obstacle instead of a human to avoid accidents while driving. Processing on captured images can detect obstacles by observing change in the sequence of frames of the front scene while the vehicle is moving. This paper focuses on related work done for detection of objects, which can be useful to detect obstacles coming in the way of vehicles so that accidents can be prevented. We provide review of various obstacle detection techniques with their limitations that are proposed by various researchers in recent years.

97. EFFECT OF DEFAULT MODE NETWORK FUNCTIONAL CONNECTIVITY CHANGES IN COGNITIVELY NORMAL CONTROLS, MILD COGNITIVE IMPAIRMENT AND ALZHEIMER'S DISEASE

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Abstract: Background/Objectives Resting state functional connectivity in default mode network (DMN) has been shown to decrease in Alzheimer's disease (AD) and Mild Cognitive Impairment (MCI). Here we investigated functional and structural connectivity changes in the DMN networks in AD, MCI and normal controls using resting state fMRI (rsfMRI) and Diffusion Tensor Imaging (DTI) respectively. Method All subjects (7 MCI, 5AD and 10 controls) were underwent detailed neurocognitive assessment and neuroimaging using rsfMRI. Resting state data were analyzed using FMRIB's software Library (FSL version 4.1). After preprocessing (motion correction, removal of non brain structures and spatial smoothing) the data was decomposed into 32 components using ICA and the relevant network was identified. Also the functional network analysis measures of the DMN of the subject groups were examined using ROI to ROI approach. Dual regression was performed on the DMN and threshold free cluster enhancement (TFCE) were implemented with a significance of $p<0.05$. The structural integrity was analyzed by voxel wise statistics using Tract Based Spatial Statistics (TBSS) with a liberal threshold of $p<0.001$, uncorrected. Results Functional connectivity analysis revealed maximum connectivity between left and right lateral parietal cortices in the DMN of control groups (t score= 7.81, intensity=16.54, $P<0.009$, FDR corrected). Also left lateral parietal cortex showed strong connection to medial prefrontal cortex (t score= 5.24, $P<0.007$, FDR corrected), and posterior cingulate (t score= 3.49, $P<0.026$, FDR corrected) region. While right lateral parietal cortex in controls revealed a decreased connectivity to posterior cingulate (t score= 3.02, $P<0.03$, FDR corrected) and medial prefrontal cortex (t score= 2.95, $P<0.03$, FDR corrected). Whereas in MCI, decreased connectivity was observed between posterior cingulate and medial prefrontal cortex (t score= -13.6, $P<0.0001$, FDR corrected) and left lateral parietal lobule and medial prefrontal cortex (t score= -21.23, $P<0.000$, uncorrected). While AD group failed to reveal any significant resting state functional connectivity in any of the regions in DMN. Also, whole brain voxel-wise TBSS analysis could not find any significant structural changes in MCI and AD. Moreover, altered brain network properties exhibited correlations with cognitive dysfunction in AD and MCI. Conclusion The present connectivity study proved that brain functional connectivity patterns are impaired in AD/MCI patients. Our results also suggests that functional disruption precedes over structural changes in patients.

98. BODY SCHEMA AS A COLLECTION OF MANIFOLDS

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Abstract: Body schema of a cognitive agent is a representation of its body that allows it to infer the position and orientation of its limbs relative to its world, and to move and perform actions in that world. Traditionally, body schema of animals is described in terms of a distributed representation in the brain, whereas for robots it is usually represented in terms of explicit motion parameters. These models fail to explain how sensorimotor integration happens in the brain or in a robot. To this end, we propose a manifold-based computational model that is learnt by the agent in the early stages of its life by performing random motions and observing their outcomes (motor babbling) and is grown and adapted to deal with more and more complex situations and perform complex tasks. The proposed model is driven by the observation that in spite of the very high dimensionality of the sensorimotor input (e.g. when the agent is looking at its hand as tries to reach an object), there are only a few governing parameters for different limb motions – as many as the degrees of freedom of the moving limbs – and hence all the sensory impressions of limb motions lie on a much lower dimensional subspace of the sensorimotor input space. Each subspace is a manifold, a collection of which constitutes the body schema. An action involving one or more limbs of the body then corresponds to a path on the joint manifold of the composite limb motions. We demonstrate that this type of modelling of the body schema is particularly useful for robots as a way of bootstrapping sensorimotor learning and can be used to perform actions such as reaching and grasping objects, avoiding obstacles and working through narrow passages.

99. RESTING FMRI CAN SERVE AS A BETTER OPTION FOR ANALYZING LANGUAGE NETWORKS: A COMPARATIVE STUDY OF LANGUAGE FMRI VERSES RESTING FMRI, IDENTIFICATION OF LANGUAGE NETWORKS AND ITS CONNECTIVITY IN 10 HEALTHY CONTROLS.

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Abstract: ABSTRACT Introduction: As far as human beings are considered, the brain and its most important function, language makes them unique among living things. The most challenging factor for a neurosurgeon is to preserve specific functions related to language during resection. The main areas related to language are Broca's area and Wernicke's area. In language based functional MRI, we are able to get activations from language areas by applying the language paradigms such as visual verb, word pair, word generation, sentence comprehension etc (1, 2). The same activations are still there or correlated activities are present even when the subject is not executing any particular task and when subjects lie relaxed in the scanner. This is so called resting fMRI, in which we are able to get the low frequency fluctuating signals and their processing yields correlated activation called networks. So it may be worth effective to study the language networks obtained through task based language fMRI and resting fMRI. Objective: The initial objective of the study is to compare and correlate different language areas obtained by language fMRI and rest fMRI. The second objective of the study is to conduct the group analysis using the techniques such as seed based analysis, graph analysis, Granger Causality and found out the significant activations after these analyses. Hypothesis: Resting fMRI can serve as a substitute for language fMRI for analyzing the language functions. Materials and Methods: 10 healthy volunteers having age between 20-50yrs have undergone resting fMRI and task based language fMRI in 1.5Tesla Siemens MR Machine. The paradigm, visual verb was used to obtain language fMRI. The major regions related to network were analyzed. So the ROIs of interest were Broca's area (pars opercularis, pars triangularis and pars orbitalis) and Wernicke's area (Angular gyrus, Supramarginal gyrus and superior temporal gyrus). Results Single subject as well as group analysis was done to yield language networks. One sampled t test was conducted in SPM software to test whether the groups have any significant activation. Monte Carlo stimulation was done to consider the probability of false positive detection. The Seed-to-Voxel connectivity maps, ROI-to-ROI connectivity matrices, graph properties of connectivity networks, Voxel-to-Voxel measures, correlation matrices etc were obtained through graph analysis

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100. ASSISTIVE COMMUNICATION APPLICATION FOR ALS PATIENTS

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Abstract: Eye tracking is the advanced techniques which enable the people with Amyotrophic lateral Sclerosis (ALS) and other locked-in diseases to communicate with normal people and make their life easier. The majority of existing eye-tracking computer input systems use cameras to capture images of the user's eyes to track pupil movements. Our software application is an assistive communication tool designed for the ALS Patients, especially people whose communication is limited only to eye movements. The design of this system's GUI (Graphical User Interface) is made in such a way that it can be used by physically impaired persons to convey their basic needs through pictures using their eye movements. The prototype is user friendly, reliable and performs simple tasks in order the paralyzed or physically impaired person can have an easy access to it. The application is tested and the results are evaluated accordingly.

101. EEG-BASED ESTIMATION OF MENTAL FATIGUE DURING MOTOR IMAGERY

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Abstract: Mental Fatigue is a cognitive state which is an outcome of labour or protracted exercise finally leading to downgrading of mental performance. This leads to reduction in efficiency and disinclination of motor skills. Analysis of mental fatigue thus becomes momentous for assessing one's capability. The aim here is to track the development of mental fatigue during motor imagery task over time. Mental Fatigue is associated with increase in frontal theta and parietal alpha power. Decrement of arousal level, working memory and information encoding have been proven to be associated with increased theta power . Increase in alpha power indicates increased mental effort to maintain vigilance level . When participants are experiencing fatigue, their attention, concentration and vigilance level decreases for which they need to put more attention which leads to increase in alpha power. We exploit these EEG oscillatory rhythm fluctuations to model EEG-fatigue relationships. For experiments motor imagery data from BCI Competition IV Dataset 2a is used. It consists of EEG data from 9 subjects . 22 EEG channels and 3 EOG channels are used to record EEG data on two sessions on two different days. Each session comprises of 6 runs separated by short breaks. One run consists of 48 trials each of 6 sec long yielding a total of 288 trials per session. Only the first session is taken for the experiment keeping in mind the notion that the next day the participants will get more acquainted with the task and thus will experience less fatigue. Average power in the theta and the alpha bands are measured at the electrodes Fz and Pz respectively. We consider the first and the last runs of the session to be the 'cornerstones' of mental fatigue i.e. the first run to be the alert state and last run to be fatigue state. There was no increase in theta power in case of subjects 1, 3, 7 and 6 ; indicating these subjects may not have experienced any fatigue. Hence, we track the growth of fatigue for the subjects 2, 4, 5, 8, and 9. A statistical classifier can be used to model EEG fatigue relationships accurately. With Kernel Partial Least Square–Support Vector Machine classifier output we track the EEG signs of development of fatigue with time.

102. COGNITIVE ASPECTS IN RELATING SECOND LANGUAGE ACQUISITION AS A LANGUAGE TRANSLATION PROCESS

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Abstract: Extended Abstract Previous Work: Natural language translation is one of the first tasks taken by computer scientists and one of the most challenging tasks in the modern era of research. Computer scientists have provided various algorithms and techniques to solve the problem based on the computational models. On the other hand, linguistics have always been interested in studies of language translation and acquisition. A significant amount of work is carried out in the field by proposing and developing the cognitive models that can explain how the human brain is capable of acquiring a language [1, 2]. Lisa Pearl [3] have applied computational modeling in language acquisition research. The work involves developing computational models using cognitive algorithms that can match the human learning mechanism in the task of language acquisition. Many generative linguists have argued that children have at least an innate, domain-specific bias. This controversial hypothesis has been supported

by studies on language acquisition and complex language phenomena, such as rules on long- distance wh-dependencies, the so-called "Syntactic islands". Authors in [4] emphasize/claim that model not only learns syntactic islands, but also simply assumes more plausible and developmentally realistic biases than the probability-based models. Proposed Work: Inspired by the developing computational models of language acquisition and comparable results with human learning systems, we propose to develop the computational models for relating second language acquisition by children with the process of language translation. The process of acquiring the second language in humans, is not based on learning the rules and syntax of both the languages and performing the technically correct translation to generate the second language. While it is more related to phrase-wise translation and then arranging these phrases in the second language in best probable forms. Our proposed model combines the cognitive approach adopted by human learners with the computational model to train the system for the task of language translation. Instead of going by purely statistical way of Machine translation approach, we propose to build the translation engine based on phrase-wise n-grams mapping in two languages. The process is combining the plausible combination of the translations of the different phrases present in the sentence. Initial work in this field has been reported in [5]. In this work the authors had shown an improved translation score by simplifying the complex sentences having relative clause. The system would be trained using Connectionist model. However, to be effective, models must not only mimic observed data. They must also be transparent, grounded, and plausible to be accepted by the developmental psychology community. Therefore a rigorous amount of result validation and testing work have to be carried out in later phases of the implementation. Keywords: References: [1] Krashen, Stephen D., and Tracy D. Terrell. "The natural approach: Language acquisition in the classroom." (1983). [2] Clahsen, Harald. "Constraints on Parameter Setting: A Grammatical Analysis of Some Acquisition in Stages in German Child Language." Language acquisition 1.4 (1990): 361-391. [3] Pearl, Lisa. "Using computational modeling in language acquisition research."Experimental Methods in Language Acquisition Research (2009). [4] Tomida, Yu, and Akira Utsumi. "A Connectionist Model for Acquisition of Syntactic Islands." Procedia-Social and Behavioral Sciences 97 (2013). [5] Saini, Sandeep, Umang Sehgal, and Vineet Sahula. "Relative clause based text simplification for improved English to Hindi translation." In Advances in Computing, Communications and Informatics (ICACCI), IEEE, 2015.

103. EMOTION AND HUMAN ERROR IN MEDIA-MULTITASKING ENVIRONMENT

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Abstract: Media-multitasking in general refers to simultaneous consumption of two or more media. An important context of media-multitasking scenario is that of using multiple devices. In using technological devices, individuals are often involved in diverse contexts of multitasking. For instance, users involve in multitasking using a single device such as a computer with several windows open on the screen. On the other hand, users could be in a situation that involves juggling of media with different devices like working on computer and talking on a cell-phone. Hence, in both these scenarios it can be argued that the underlying emotional processes ought to play a role in human error. Brave and Nass [1] have found that variation in emotional states of the users influences their interactive behavior and work performance. For instance, positive emotion encourages individuals to adopt a flexible, fluid style of thinking, while negative emotion leads us to engage in more rigid processing [4]. According to Hudlicka [2], the increasing frequency of accidents and incidents attributed to human error in variety of settings could be reduced by considering user's emotional aspects. Thus, the present study aims to examine the difference between single-device and multi-device media-multitasking scenario and to explore the role of users emotion in terms of human errors occurred during query task. The study will employ three experimental conditions namely, positive emotion, negative emotion and control. Images from International affective picture system (IAPS) [3] will be used to present the emotional stimuli. Through randomization these three groups will be assigned either to single-device or multi-device media-multitasking scenario. In these scenarios participants will be asked to perform query task through Query Task Modulator (QTM) experimentation system. Data will be analyzed in terms of human errors committed by the participants. The study involves development of an experimental paradigm to study media-multitasking and will throw light in understanding a context of multi-device media-multitasking which has received little attention in the literature. It is proposed that user's performance during query task will be influenced by their emotion and a nature of media-multitasking scenario.   References: [1] Brave, S., & Nass, C. (2003). The Human Computer Interaction Handbook. New Jersey: L.Erlbaum Associates Inc. Hillsdale. [2] Hudlicka, E. (2003). To feel or not to feel: The role of affect in human-computer studies. International Journal of Human-Computer Studies, 59, 1-32. [3] Lang, P.J., Bradley, M. M., & Cuthbert, B.N (2008). International Affective picture system (IAPS): Affective ratings of pictures and instruction manual.Technical Report A-8. University of Florida, Gainesville, FL. [4] Stroessner, S. J., & Mackie, D. M. (1992). The impact of induced affect on the perception of variability insocial groups. Personality and Social Psychology Bulletin, 18, 346-554.

104. DIRECT BRAIN TO BRAIN COMMUNICATION: PAST, PRESENT AND FUTURE

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Abstract: In the last decade, technology has advanced so much, and in such a rapid manner that we are inching closer and closer towards communicating without the use of verbal or non-verbal language or any of the sensory inputs such as vision, audition, smell, taste and touch. This paper traces the development of such technology that has been a stepping stone to development of current brain to brain interfaces (BBI). Humankind has always had a fascination with telepathy. This can be seen in science fiction books and movies. Indeed, scientists for ages have tried to make this a reality. While not wholly successful in doing what they sought, they have invented devices that have nevertheless contributed to the welfare of society or can be used as a building block for BBI. For instance, Hans Berger who set out to make telepathy a reality had invented EEG. Technology has developed much since then and current technology, in fact makes this possible. Recently researchers have been successful in direct transmission of information to one human brain to another human brain non-invasively- Rao and colleagues used EEG to record brain signals from one participant who acts as sender and then used TMS to deliver that information to the other participant or receiver; the pair of participants cooperated to achieve the desired goal in a game involving visuo-motor tasks. The sender was able to see the computer game in which sometimes a pirate rocket is fired on a city, in which case it must be stopped by firing a cannon on the pirate rocket, or sometimes friendly supply airplane flew across, in such a scenario the cannon must not be fired. The sender did not have any device to control the cannon. The receiver had the device to control the cannon but could not see the game. Using BBI (EEG and TMS), the participants could cooperate and perform well on the task. Similarly, Grau and colleagues succeeded in transmitting information between participants separated by great distance. They used EEG to record the brain signals of a participant, the Brain-Computer Interface emitter in India who thought of words hola and ciao. Then the data was automatically sent via email to France where, the Computer-Brain receiver or the other participant was located. Using neuronavigated, robotic TMS, the receiver was able to decode the words hola and ciao. While such technological advancements will happen and are necessary, people anticipate positive or negative implications; and thus addressing concerns of laypersons and media about such research becomes an important issue since it may affect funding. While some laypersons are excited by this and wonder if this can help the visually impaired see, or if they can tell what their infant children and pets think, or aid as a better lie detector aiding in prevention of crimes and terrorism, there are some who are paranoid about invasion of privacy and loss of control. Clarifying beforehand about the intention and purpose of developing such technology-for instance, aiding paralyzed patients communicate with their caretakers, would help allay such concerns. The growth of such technology, concerns of laypersons and addressing such ethical issues are explored in this paper.

105. MULTISENSORY STIMULATION AND ITS EFFECT ON WORKING MEMORY

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Abstract: Multisensory Stimulation and Its effect on Working Memory *Chhadva, D., **Kacker, P. ABSTRACT Working memory (WM) enables us to store information for short periods of time. For children, it plays a special role in learning as well as maintaining attention in classroom. It is found that children with developmental disorders typically show problems with working memory. However, these problems may occur even in absence of any diagnosed disorders and hence can result in poor academic performance. Studies show that Working Memory capacity can be increased, given the right kind of training. A number of approaches have been used to improve WM; these approaches include ones that focus on the ability to maintain specific kinds of information such as phonological or visuo-spatial information and those that focus on executive/attentional control skills. The present study proposed to check whether Multisensory Stimulation (visual, auditory and tactile) can enhance the working memory of children. Sample included 30 normal children aged 9-11 years who were divided into three groups based on the type of intervention they received. A pre test using the PGI Memory Scale and the Stroop test was conducted on all the three groups, followed by visual, auditory and tactile stimulation for a period of 15 days respectively. Hence, one group received one type of stimulation of 30 min per session and so on. Post test scores using the PGI Memory scale and Stroop test were recorded for all three groups. Pre and post intervention scores of all the three groups were compared using descriptive statistics. Results and analysis are discussed in detail in the full paper. *Disha Chhadva, Clinical Psychologist, Redbrick School, Ahemdabad, Gujarati Email: dshchhadva11@gmail.com **Dr. Priyanka Kacker, Assistant Professor, Gujarat Forensic Sciences University, Gandhinagar, Gujarat

106. "IS YOUR OVERWEIGHT BURDENING YOUR COGNITION?" EXPLORING THE EFFECT OF BODY MASS INDEX ON COGNITIVE COMMUNICATIVE ABILITIES

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Abstract: Cognitive communicative processes are group of processes which include communication related attention, perception, memory, and executive functions. Cognitive processes, in genera, are known to be affected in conditions like tumors, strokes, closed head injuries, infections, neurotoxins, obesity (Steckl ,2015). Obesity is defined as an abnormal or excessive fat accumulation that may impair health. Body Mass Index(BMI) is a person's weight in kilograms divided by square of height in meters. BMI 25 is overweight & BMI 30 is considered to be obese (WHO, 2015).Raised BMI is a major risk factor for non-communicable diseases like hypertension, cardiovascular diseases, musculoskeletal disorders. Effects of obesity on health related issues are studied and established but there are inconsistent reports of association between obesity on cognitive communicative processes (Li, Dai, Jackson & Zhang, 2012). An association, would suggest health related alarm for the affected individuals. and might provide a feedback regarding the additional hazards of high BMI as a function of age in long run. The study was aimed at exploring the effect of BMI on the cognitive communicative abilities in young adults. The objectives included evaluation of the significant differences, if any, between individuals with high and optimum BMI on communication related short term memory, prospective memory, working memory, and problem solving-reasoning tasks. A total of 30 young adults participated in the study. They were divided into 2 groups of 15 each on the basis of their high BMI (mean BMI=30.93 SD = 2.13) and optimum BMI (mean BMI=19.40 SD=2.57) scores as per the WHO classification system. The participants of both the groups performed 3 experimental Prospective memory tasks (color judgment, number judgment, and letter judgment), 6 Short term memory tasks (face recall, name recall, object recall, first name second name association, face name association and face object association), 4 working memory tasks (digit ordering, letter ordering and digit letter ordering tasks and spell the word) and 4 problem solving and reasoning tasks (multistage linguistic and practical problem solving, syllogistic and analogical reasoning). All the tasks were designed and administered through licensed version of paradigm experiment software version 2.1. Descriptive statistics and independent T tests was applied to the data through SPSS version 16.0. There was no significant difference between the high BMI(mean=118.73 ,SD=10.250)and optimum BMI(mean=121.40 ,SD=8,846) group for the total scores (p>0.05). However domain specific analysis suggested that the group with high BMI performed significantly poorer as compared to optimum BMI group for the Short Term Memory tasks[(t(28)= -4.626,p=0.000]. These differences were observed for both the recall [t(28)=-3.616,p=0.001]and association tasks[t(28)=-4.203,p=0.000]. Whereas the Working Memory ,Prospective Memory and problem solving-reasoning tasks did not achieve any significant difference between the two groups. These findings are in synchrony with the previous studies where STM has been specifically found to be affected in individuals with high BMI. This could be due to brain related changes like structural brain changes, impaired cerebral metabolism, elevated leptin and inflammation in the areas of brain dedicated for the STM among the high BMI group (Pricket, Brennan & Stolwyk ,2015). The findings of the present study report the deleterious effect of high BMI on some of the cognitive communicative processes. With the advances in the health related concerns among the youth, it would be great interest to study if weight reduction can lead to reversible effects on affected cognitive communicative parameters.

107. "IS YOUR LESS SLEEP PUTTING YOUR COGNITIVE FLEXIBILITY TO SLEEP?" EFFECT OF PARTIAL SLEEP DEPRIVATION ON VERBAL FLUENCY MEASURES

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Abstract: Verbal fluency is a measure of executive functioning. It is a task in which the individual is instructed to name maximum number of words with target criteria, in a given minute. The task can be that of a category or a letter/phoneme. This task is used to assess range of cognitive functions such as response generation/self-generation, working memory, processing speed, semantic memory, and set shifting (Strauss, Sherman, & Spreen, 2006). Cognitive efficiency is known to deteriorate on extended hours of wakefulness. This cognitive functioning can be hampered by loss of sleep. Sleep Deprivation has been identified to be of several types such as total sleep deprivation; which can be further divided in to short term(<45 hours) and long term deprivation(>45 hours), and partial sleep deprivation(<6 hours). Even a single day of being partially sleep deprived has been evidenced to affect glucose levels in the body (Cedernaes et al., 2015). However, there are minimal evidences suggesting the

link between the partial sleep deprivation and the verbal fluency measures. This study aimed at evaluating the effect of partial sleep deprivation on verbal fluency measures. The objectives of the study were to compare the partially sleep deprived young adults to the young adults with optimum sleep on letter fluency with and without alternations and category fluency with and without alternations respectively. The study followed a multi group pre-test post-test study design. A total of 30 young adults participated in the study. The participants were grouped into two groups with 15 each on the basis of their sleep duration for one night. Those with more than 4 hours of sleep deprivation were part of the experimental group whereas those with at least 8 hours of sleep duration were part of the control group. The assessment pre and post sleep/sleep deprivation for both the groups was done using four verbal fluency measures i.e. letter fluency letter fluency with and without alternation and category fluency with and without the alternation (Bajaj et al, 2014) . Repeated measure ANOVA and Bonferroni post hoc analysis was applied to the data through SPSS version 16.0. The results obtained from the present study suggested that there was no statistically significant difference between the experimental and control group on the letter fluency task with and without alternating letter fluency (p>0.05). However, there seem to be a significant deteriorating effect of sleep deprivation on the verbal fluency performance for the category fluency task with alternation [F (1,28)= 17.425,p=0.000] and without alternation [F (1,28)= 20.216 ,p=0.000]. These findings are in synchrony with the previous studies that sleep deprivation has an effect on cognitive functioning (Brown et al., 2013).Partial sleep deprivation is also known to cause glucose or energy deficits and imbalance in adults which is required for adequate task performance (Shlisky et al., 2012). Studies have shown that semantic fluency production has greater cognitive taxing than letter fluency due to the associated semantic search (Hurks et al., 2006). Hence, partial sleep deprivation could have affected complex task like category fluency more than the letter fluency which is easy to generate. It seems important for the clinicians to enquire about the sleep duration patterns of the patients who are undergoing cognitive communicative assessment as sleep deprivation might be a confounding variable.