LLCd Symposium.
POSTER PRESENTATIONS.

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Brief Bio: Sharathchandra R is a Research Associate in the Cognitive Neuroscience Centre at the National Institute of Mental Health and Neuro Sciences (NIMHANS), Bangalore.He graduated with a Masters in Artificial Intelligence from the University of Edinburgh (within the Institute of Perception, Action and Behaviour) in 2008 with research interests pertaining to perception studies, embodied cognition, virtual reality and multimodal interaction.

Being a licensed amateur radio broadcaster (VU3HPA), he is a proponent of the free use of airwaves for relief work, education and transmission art, has been a development related radio journalist for PANOS UK (@Nepal), trainer for community radio NGOs (VOICES-UNDP) and speaker at the International HAM-Radio Convention (Port Blair, 2006). As an experimental media artist, he creates multimodal interactive art installations. His recent work 'Neon Fauna' (at the 'Sound and Lights' exhibition of Jaaga.in in collaboration with the Goethe Institute @Bangalore) explored 'generalized symmetry' between Nature and Artificial Reality.

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Title of Presentation: Language and brain organization among Kannada-English-Hindi Multilinguals using a visually presented antonym generation task: a conjunction analysis

Abstract:

Introduction: Multi-linguistic learning and brain organization in multi-linguals is a complex non-linear process. This is particularly so in India where multilingualism spans languages from different roots such as Anglo-Saxon, Indo-Aryan and Dravidian.

Aim: Our aim was to study brain organization of languages in persons with multilingualism as the norm.

Method:

Sample: Twenty Five right handed normal multi-linguals formed the sample. The age range was from 21 to 32 years with a mean of 25.5yrs and S.D. of 3 yrs. Education ranged from 12 to 22 years of schooling with a mean of 18 years and S.D. of 2 yrs. Kannada was their mother tongue (L1) which was acquired from infancy in the home environment and through formal instruction since joining school at 3 years. English (L2) was acquired through formal instruction in school as second language from the age of 7 years. Hindi (L3) was acquired through formal instruction at school from age of 9 years as third language. Proficiency in the languages was tested through self report, and objectively by picture comprehension and passage comprehension. As per the self report their proficiency in speech, oral and written comprehension was excellent in Kannada and English but moderate in Hindi. As per the objective language proficiency tests they were proficient in the speaking, writing, reading and comprehension of Kannada and English. Hindi proficiency was present in comprehension and speaking but less in reading. Hence they could be termed as balanced multilinguals.

Task: Language activation in the MRI was studied with a silent antonym generation to visually presented words in each of the 3 languages. In each language the words were concrete and abstract, nouns and verbs, with 2-4 syllables in common usage. The word length ranged from 2 letter (“up”) to 6 letters (“Mother”). To the extent possible, words denoting similar concepts were given in the 3 languages. However the words were chosen after giving a set of 100 words in each language to 20 speakers to whom it was their mother tongue and they were proficient in. From this pool, words which could easily lend themselves to the generation of an antonym were chosen. Thus in each language, a total of 40 words were divided into 4 sets containing 10 each. The order of languages was constant across the participants with Kannada being first, followed by English and the last was Hindi. The visual complexity of written Hindi and Kannada was higher than for English, as the former are alphasyllabaries with “Akshara” while English is alphabetic.

fMRI scanning : A rest-active paradigm was used. The active set consisted of words and the rest set comprised of symbol ‘####’. TR was 4 secs, TE .03 secs, 80 dynamics with FOV of 192mm, slice thickness 4mm, number of slices 36, voxel size 3*3*4mm and the

matrix 64*64. MRI scanning was conducted using a 3 Tesla Siemens Magnetom Skyra and fMRI data was mapped onto an EPI template.

fMRI Analysis : The fMRI data pre-processing (realignment, normalization and Gaussian smoothing) was done with SPM Version 8 and analyzed using a stringent Family Wise Error threshold of $p< 0.05$ and a voxel cluster size of 5. One sample t test was used in the 2nd level analysis.

Results: Conjunction analysis revealed that the silent generation of antonyms activated the left premotor area and left claustrum in all the 3 languages. Hindi and Kannada activated the left occipital, left caudate and left medial prefrontal cortex. Hindi and English activated left premotor and left dorsolateral prefrontal cortices. Kannada and English activated left putamen and left dorsolateral prefrontal cortex. Each of the languages also uniquely activated brain areas.

Conclusion: In this task of antonym generation, each of the 3 languages is mediated by the left hemisphere. Pathways of subvocal speech are common across the 3 languages. The Indo-Aryan and Dravidian languages of Hindi and Kannada respectively appear to require executive functioning for the task performance, which may be attributed to the complex “Akshara” based script.