



LLCd Symposium.
SPEAKERS AND PRESENTATIONS.

Name: Abhilasha Srivastava

Affiliation: Centre of Behavioural and Cognitive Sciences, University of Allahabad, Allahabad, India

Brief Bio: I am a doctoral student at Center of Behavioural and Cognitive Sciences (CBCS), University of Allahabad, India. I have completed my Masters in Psychology from Centre of Advanced Studies, Department of Psychology, University of Allahabad. My research interest includes studying the different aspects of language and especially how dynamic entities or events such as actions are depicted by linguistic entities and structures and also the neural correlates of such representations. I am currently working on a project titled "Neural Mechanisms for Language Comprehension in Hindi-English Bilinguals". We are looking to uncover the neuro-cognitive mechanisms that support bilingual language processing and the cortical sources that support language specific mechanisms. While I am seeking to understand questions regarding bilingual comprehension, visual word recognition and the organization and use of the bilingual lexicon, for my PhD thesis, I have narrowed down my study to specifically examine the "Online comprehension of verbs in Hindi-English Bilinguals". I use eye tracking and electrophysiology as the research methodology for conducting my research.

and

Name: Narayanan Srinivasan

Affiliation: Centre of Behavioural and Cognitive Sciences, University of Allahabad, Allahabad, India

Theme: Morphology, semantics and syntax

Title of Presentation: Neural Mechanisms of Semantic anomaly detection and word order in Hindi-English Bilinguals: An ERP Study

Abstract: The process where a speaker uses a non-canonical (SVO) over canonical word order (SOV) has been termed as scrambling. Unlike a strict word order language like English, the free word order language like Hindi allows scrambling of words. When the position of the word changes in a sentence, the position of their grammatical status also changes. Therefore, it is important to study underlying processing mechanisms arising out of such variations. Some studies on different languages have shown that canonical sentence structures are better processed than the non-canonical structures (Kim, Koizumi & Ikuta, 2009, Erdocia et al., 2009). In a previous behavioural study, we have shown that the canonical word order is not processed faster than the other word orders in Hindi (Mishra, Pandey & Srinivasan, 2011). Working memory plays a critical role in

processing sentences with different word orders. The results from the study indicate that processing speed depends on the distance between the subject and the verb, thus supporting a locality dependent working memory based model of sentence processing. We do not fully understand the neural mechanisms underlying scrambling especially in the context of semantic anomaly detection among Hindi-English bilinguals.

Several ERP studies have employed semantically anomalous sentences in studying sentence comprehension (Kutas & Hillyard, 1984). Researchers in studying child language (de Villiers & de Villiers, 1972), in agrammatic aphasics (Kolk & Weijts, 1996), and in the ERP paradigm (Kuperberg et al., 2006) have used judgment of a semantically anomalous sentence as a sensitive task to explore the capabilities of the language processor. However, very few studies have explored the effect of sentential structure (word order) in the context of semantic anomaly detection. Since most of the research available on sentence processing has concentrated on English, it is important to study a free word order language like Hindi from a processing point of view.

We also investigated the role of proficiency (especially in L2) and measured the effects of these variables on different ERP components (N400, ELAN). The participants were checked for their proficiency (a composite score of participant's reading and understanding, speaking and writing skills) both in L1 and L2. Perfectly syntactically grammatical sentences with three word orders SOV, OSV and SVO were used in the study. We made the sentences anomalous by making the subject impossible to be used with the verb, that is, violation of selectional restriction of the verb (Chomsky, 1965). The data was recorded using a 64 channel electrode neuroscan system. The words were presented in sequence at the centre of the screen for 300 ms with an interval of 500 ms between words. Participants made a semantic judgment regarding the meaningfulness (acceptability or appropriateness) of the sentence after the offset of the last word.

In the behavioural results, we found differences for different word orders even for non-anomalous sentences. The pattern of results suggests that the canonical word order does not necessarily have a processing advantage in terms of speed and accuracy over non-canonical orders. EEG waveforms for each condition for the critical verb were averaged to get the ERP's and the amplitudes of different components from different electrodes was subjected to a 2(group) X 2(anomaly) X 3(word order) repeated measures ANOVA. Our preliminary results show differences in ERP amplitudes based on differences in the word order as a function of proficiency. Clear differences in the N400 amplitudes were seen predominantly in the left (Left parietal electrodes). Highly proficient participants in both Hindi and English showed larger amplitude compared to the group that was high proficiency in Hindi and low proficiency in English. The multilingual context affects sentence processing in L1, i.e. the processing of sentences with different word orders in Hindi is affected by proficiency in English. Further studies would be needed to understand the role of proficiency in different languages in sentence comprehension.

References:

Chomsky, N. (1965). *Aspects of theory of syntax*. MA: MIT Press. de Villiers, P. A., & de Villiers, J. G. (1972). Early judgments of semantic and syntactic acceptability by children. *Journal of Psycholinguistic Research*, 1, 299-310.

Erdocia, K., Laka, I., Mestres-Misse, A., Rodriguez-Fornells, A. (2009). Syntactic complexity and ambiguity resolution in a free word order language: Behavioral and electrophysiological evidences from Basque. *Brain and Language*, 109, 1-17.

Kim, J., Koizumi, M., Ikuta, N. et al., (2009). Scrambling effects on the processing of Japanese sentences: An fMRI study. *Journal of Neurolinguistics*, 22, 151-166.

Kolk, H., & Weijts, M. (1996). Judgment of semantic anomaly in agrammatic patients. *Brain and Language*, 54, 86-135.

Kuperberg, G., Caplan, D., Sitnikova, T., Eddy, M., & Holcomb, P. (2006). Neural correlates of processing syntactic, semantic, and thematic relationship. *Language and Cognitive Processes*, 21, 489-530.

Kutas, M., & Hillyard, S. A. (1984). Brain potentials during reading reflect word expectancy and semantic anomalies. *Nature*, 307, 161-163.

Mishra, R., Pandey, A., & Srinivasan, N. (2011). Revisiting the scrambling complexity hypothesis in sentence processing: A self-paced reading study on anomaly detection and scrambling in Hindi. *Reading & Writing*, 24, 709-727