

**The Third A. Guiora Annual Roundtable Conference in
the Cognitive Neuroscience of Language**

The earliest stages of language learning

**Sponsored by *Language Learning* and
the Max Planck Institute for Psycholinguistics
October 8-9, 2009**

**The Max Planck Institute for Psycholinguistics, Nijmegen
the Conference room (1.63)**



Thursday October 8, 2009

'First exposure to an unknown language'

- 08.45 Coffee
- 09.00 Wolfgang Klein, MPI for Psycholinguistics – Introduction
- 09.30 M. Gullberg, C. Dimroth, L. Roberts, & P. Indefrey, MPI for Psycholinguistics – The First Seven Minutes Of Contact With An Unknown Language
- 10.15 Coffee
- 10.45 D. J. Davidson, MPI for Human Cognitive and Brain Science – Short-term Grammatical Plasticity in Adult Language Learners
- 11.30 R. Rast, American U. Paris and U. Paris 8 – The Role Of Linguistic Input In The Early Stages Of Adult Language Learning
- 12.15 Discussion
- 12.45 Lunch
- 14.00 N. C. Ellis & N. Sagarra, U. Michigan, Pennsylvania State U. – Learned Attention Effects In L2 Acquisition Of Temporal Reference In Latin And Spanish: The First Hour And The Next Eight Semesters
- 14.45 J. McLaughlin, U. Washington – Brain Potentials Reveal Discrete Stages Of L2 Grammatical Learning
- 15.30 Coffee
- 16.00 M. Laine & R. Salmelin, Åbo Akademi U., Helsinki U. of Technology – Neurocognition Of New Word Learning In The Native Tongue: Lessons From The Ancient Farming Equipment Paradigm
- 16.45 Discussion
- 17.15 Drinks for all participants
- 18.30 Conference dinner for invited speakers Restaurant *Puur*

Friday October 9, 2009
'Artificial vs. natural language learning'

09.00 **Coffee**

09.30 S. Lindsay & G. Gaskell, York U. – A Complementary Systems Account Of Word Learning In L1 And L2

10.15 R. de Diego-Balaguer & D. Lopez-Barroso, Institució Catalana de Recerca i Estudis Avançats, U. de Barcelona – Cognitive And Neural Mechanisms Sustaining Rule Learning from Speech

11.00 Coffee

11.30 K.-M. Petersson, Donders Institute for Brain, Cognition and Behaviour, Centre for Cognitive Neuroimaging – Artificial Language Learning In Adults (And Children)

12.15 Discussion

12.45 Lunch

14.00 John Williams, Cambridge U. – Initial incidental acquisition of word order regularities: Is it just sequence learning?

14.45 Coffee

15.15 P. Robinson, Aoyama Gakuin U. – Learning Artificial Grammars And Natural Second Languages: Effects Of Chunk-Strength, Frequency, Similarity, And Individual Differences In Cognitive Abilities

16.00- Discussion and closing

16.30

Abstracts

The first seven minutes of contact with an unknown language

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Abstract: How do adults break into the continuous speech stream of an unknown language in the wild? Despite the work on the role of input in adult second language (L2) acquisition, and the advances of artificial and statistical language learning studies, surprisingly little is known about this crucial first step in adult L2 acquisition. Here we report on a series of behavioural and neuroimaging experiments that examine what information adults can extract from naturalistic but controlled audio-visual input in an unknown and typologically distant L2 after minimal exposure (7 vs. 14 minutes) and without help or training. We tested whether Dutch adults can recognise Mandarin Chinese words and extract lexical meaning after minimal exposure, and what role item frequency and gestural links between sound and meaning play for such initial input processing. In an exploratory neural connectivity study we identified brain regions whose connectivity was related to word recognition performance. We also investigated whether adults can generalise from encountered exemplars in the input to novel items after minimal exposure, and extract phonotactic information. While emphasising the complexity of the learning task, the results also suggest that the adult learning mechanism is more powerful than normally assumed when faced with small amounts of complex, continuous audio-visual language input.

Short-term Grammatical Plasticity in Adult Language Learners

D. J. Davidson

Max Planck Institute for Human Cognitive and Brain Sciences

Abstract : This paper provides an overview of some recent work on certain electrophysiological correlates of grammar learning in adults. Electrophysiology is potentially useful for learning-related sentence processing research not only because it has the temporal resolution to observe responses to individual words as they appear within a sentence or a phrase, but also behavioral classification occurring on the same trials as well. A classroom-based longitudinal approach is first described, well-known from earlier research, in which EEG is recorded periodically while students acquire knowledge from an external course. A short-term learning design is also described, in which learners classify phrases while EEG is recorded. The main observation of this work is that short-term changes in several event-related potential (ERP) components can be seen in adult learners using conventional EEG or MEG recordings, and that these short-term changes might be diagnostic of learning mechanisms. The results, while preliminary in many respects, suggest that a productive direction for future research might be to examine the dynamics of electrophysiological responses and behavior at multiple time scales during grammar learning.

The Role Of Linguistic Input In The Early Stages Of Adult Language Learning

Rebekah Rast

The American University of Paris and UMR 7023 (CNRS & Université Paris 8)

Abstract: In the field of second language (L2) acquisition, the dominant view of the starting point of L2 acquisition holds that the properties of the learner's first language (L1) grammar form the basis for the initial state of interlanguage development. It is assumed therefore that L2 input processing happens through the lens of the L1, and that the perception of a discrepancy between the configuration of the L1 grammar and the L2 input triggers a restructuring of the developing system. This paper takes a different approach to the analysis of the earliest stages of language learning. Based on results from an empirical study of the linguistic input addressed to learners in the first seconds, minutes and hours of exposure to a novel target language, as well as learners' analysis of this input, it is argued that learners use a combination of knowledge stores, including but not limited to their L1 knowledge, to process the novel target language input to which they are exposed.

Learned Attention Effects in L2 Acquisition of Temporal Reference in Latin and Spanish: The First Hour and the Next Eight Semesters

Nick C. Ellis¹ & Nuria Sagarra²

¹University of Michigan

²Pennsylvania State University

Abstract : This paper relates adults' difficulty acquiring foreign languages to the associative learning phenomena of cue salience, cue complexity, and the blocking of later experienced cues by earlier learned ones. It examines short- and long-term learned attention effects in adult acquisition of lexical (adverbs) and morphological cues (verbal inflections) for temporal reference in Latin (one hour of controlled laboratory learning) and Spanish (three- to eight- semesters of classroom learning). Our experiments indicate that early adult learning is characterized by a general tendency to focus upon lexical cues because of their physical salience in the input and their psychological salience resulting from their simplicity of form-function mapping and from learners' prior L1 knowledge. Later on, attention to verbal morphology is modulated by cue complexity and language experience: acquisition is better in cases of cues of lesser complexity, speakers of morphologically rich native languages, and longer periods of study. Finally, instructional practices that emphasize morphological cues by means of pre-exposure or typographical enhancement increase attention to inflections thus to block reliance upon adverbial cues.

Brain Potentials Reveal Discrete Stages Of L2 Grammatical Learning

Judith McLaughlin¹, Darren Tanner², Ilona Pitkänen¹, Cheryl Frenk-Mestre³,
Kayo Inoue¹, Geoffrey Valentine¹, and Lee Osterhout¹

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Laboratoire Parole et Langage Aix-Marseille Université

Abstract : In this paper we review several studies investigating the neural correlates of second language (L2) grammatical learning, in the context of novice adult learners progressing through their first year of L2 classroom instruction. The primary goal of these studies was to determine how and when learners incorporate L2 knowledge into their online language processing system. We show that at least some learners progress through discrete stages of grammatical learning during the first year of instruction. These stages are robust across languages, experimental tasks, and levels of language (lexical versus sentential), and indicate that there is an intermediate stage of learning between no L2 grammatical knowledge and grammaticalization. We also show how simple analytical methods can be applied to separate learners into meaningful subgroups even when the between-learner variation is continuous.

Neurocognition Of New Word Learning In The Native Tongue: Lessons From The Ancient Farming Equipment Paradigm

Matti Laine¹ & Riitta Salmelin²

¹Department of Psychology Åbo Akademi University

²Brain Research Unit, Low Temperature Laboratory, Helsinki University of Technology

Abstract: Here we review behavioral, neuroimaging and neuropharmacological studies using a word learning task coined as the Ancient Farming Equipment (AFE) paradigm. This task has been used to explore the neural correlates of explicit learning and maintenance of new names for novel objects in the native tongue. The main conclusions drawn from these studies are as follows: (1) retrieval of both the newly learned and familiar names is subserved by predominantly left hemispheric cortical regions; (2) within this network, retrieval of newly learned words can be accomplished in different ways depending on the exact form of training; (3) patient studies indicate that episodic memory mechanisms subserved by hippocampal structures are related to word acquisition rather than long-term maintenance of newly learned words; (4) explicit learning and maintenance of novel words can be facilitated by neuropharmacological manipulation that boosts the dopaminergic system; (5) neural events following completed training may predict long-term retention of newly learned words.

A complementary systems account of word learning in L1 and L2

Shane Lindsay & Gareth Gaskell

York University

Abstract: We review a body of behavioural and neuroimaging research relating to the acquisition and integration of novel words. An important outcome from this research is that different aspects of knowledge associated with learning a new word develop over different time scales. We suggest that the temporal dissociations found in word learning are due to the application of and interaction between complementary learning systems in the brain, with rapidly acquired episodic representations stored via the medial temporal lobes, and slower learning supported by neo-cortical systems. We discuss the implications of this model for understanding the earliest stages of learning a novel word and for learning words in a second language.

Cognitive and Neural Mechanisms Sustaining Rule Learning from Speech

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² Departament de Psicologia Bàsica, Facultat de Psicologia, Universitat de Barcelona

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Abstract_ Learners of a new language are faced with the task of extracting from speech the words as well as the rules structuring them. Learners are endowed with the capacity to extract statistical regularities from their environment. This capacity allows, applied to language, to extract words from speech in the absence of other cues. However, it has been proposed that natural languages have an intrinsic cue: the presence of pauses inducing prosodic information. This cue seems to trigger the application of different computational resources that allows the extraction of rules. This review summarises work indicating the different aspects of executive functions are critical in the early stages of acquisition of a language, when no semantic information is available. Different experiments recording event-related potentials while participants were learning an artificial language with non-adjacent embedded rules in the words (AXC: puliku, pusaku, pubeku) indicate a functional dissociation between the brain responses associated to word and rule learning. The result indicate that the presence of salient cues such as prosodic information help to control attention to bias perceptual information to ignore irrelevant information and attend to the relevant segments containing the rule shifting from word acquisition to rule extraction. Other aspects of executive function such as working memory and its rehearsal component have also a critical role in word segmentation and rule-extraction. Finally, data from brain-lesioned patients is reviewed pointing to the critical role of the basal ganglia as a coordinator structure between language, working memory and attention through its rich connections with the brain areas responsible of these functions.

Artificial Language Learning in Adults (and Children)

Karl-Magnus Petersson

Donders Institute for Brain, Cognition and Behaviour, Centre for Cognitive Neuroimaging

Abstract: Despite much progress it is still not well-understood how humans acquire language. One view suggests that we master language by means of a language-specific acquisition device. An alternative proposal is that children make use of domain-general learning mechanisms. We will review some recent work which suggests that there might be some truth to both perspectives and that the two might be integrated. We will also review some of our own more recent work on artificial syntax learning in adults (behavioral, fMRI, TMS).

Initial incidental acquisition of word order regularities: Is it just sequence

John N. Williams

Cambridge University

Abstract : There is a long tradition of implicit learning research looking at learning of artificial grammars (finite state grammars that generate meaningless letter strings). Are the associative learning processes evident in these studies at work in learning word order in natural language? To what extent do meaning and prior linguistic knowledge need to be taken into account in the natural language case? In the study reported here incidental learning of natural language word order is compared directly to a meaningless analogue (in which the same sequential regularities underlie meaningless syllable strings). The results of both experiments are compared to connectionist (simple recurrent network) simulations. The comparisons suggest that similar associative sequence learning mechanisms underlie learning of both the natural language and its meaningless analogue (with the result that there are certain limitations to what is learned). However, to achieve this alignment it is necessary that we take into account the linguistic categories and meaning structure that the participants are likely to impose on the natural language. It is concluded that the initial incidental learning of word order can be explained in terms of associative (sequence) learning, and that linguistic knowledge is engaged to the extent that it defines the categories over which statistics are computed.

Learning Artificial Grammars and Natural Second Languages: Effects of Chunk-Strength, Frequency, Similarity, and Individual Differences in Cognitive Abilities

Peter Robinson

Aoyama Gakuin University

Abstract : Many second language acquisition researchers invoke findings from studies of Artificial Grammar (AG) learning to variously support conclusions drawn from studies of implicit and incidental natural second language learning. But how comparable are AG and incidental natural language learning? I report on a study that directly compared, for the first time, AG learning and incidental second language learning of a previously unknown language, Samoan, by experienced Japanese second language learners of English. The effects of chunk-strength on learning both AGs and incidental learning of Samoan were compared for their effects on transfer task assessments of learning, as were the effects of frequency of occurrence of tokens of exemplars in the input, and the effects of similarity of tokens in the input during training. In addition, individual differences in Working Memory, Language Learning Aptitude, and Intelligence Quotient (IQ) were assessed to examine the extent to which cognitive abilities mediated implicit learning of AGs and incidental natural language learning.