Tokyo Evolutionary Linguistics Forum

March 19, 2012 – Komaba Campus, The University of Tokyo

10.00 – 10.10	Welcome Remarks *Luke McCrohon*
10.10 – 10.40	Intracerebral Electrical Neuroimaging: a New Paradigm to Study Avian Syntactic Abilities? *Gabriel Beckers (Max-Planck Institute for Ornithology)*
10.40 – 11.10	Parrots and Bellbirds: Avian Models for Language Evolution *Irene Pepperberg (Harvard University)*
	Break
11.30 – 12.00	Relaxed Selection in the Evolution of Complex Songs in Bengalese Finches *Kazuo Okanoya (University of Tokyo)*
12.00 – 12.30	Tripartite Evolution in Birdsong and Spoken Language *Johan Bolhuis (Utrecht University)*
12.30 – 14.00	Lunch Break
14.00 – 14.30	Understanding Communicative Signs by Children and Chimpanzees *Jordan Zlatev (Lund University)*
14.30 – 15.00	Representation and Reference: Comparative and Developmental Studies of Gesture *Erica Cartmill (University of Chicago)*
15.00 – 15.30	Abstraction and Cultural Variation in the "Wild": Why is it Important for the Study of Language Evolution? *Rafael Núñez (University of California, San Diego)*
	Break
15.50 – 16.20	The Evolution of Meaningful Combinatorial Communication *Thom Scott-Phillips (University of Edinburgh)*
16.20 – 16.50	What do Evolutionary Biologists Have to Offer Linguists *Russell Gray (University of Auckland)*
16.50 – 17.20	Reconstructing the Evolution of Language in Time and Space *Sean Lee (University of Tokyo)*
	Break
17.40 – 18.10	Models of Anatomy Evolution *Bart de Boer (University of Amsterdam)*
18.10 – 18.40	Language/Communication Theory in the Era of Massive Data Flow *Takashi Ikegami (University of Tokyo)*
18.40 – 18.50	Closing Remarks *Kazuo Okanoya*
19.00 – Late	Presenters' Dinner

Intracerebral Electrical Neuroimaging: a New Paradigm to Study Avian Syntactic Abilities? – *Gabriel Beckers*

Despite the wide interest in the syntactic abilities of birds and other non-human animals, progress on this topic remains slow. I will discuss some problems in existing approaches, which test for responses to stimuli at the level of behavior (either conditioned or natural), and argue that neuroimaging of responses at the level of neuronal electrical activity should help to circumvent these problems. Furthermore, such an approach provides more direct insight into the mechanisms underlying syntax processing, and enables us to address the question whether or not shared syntactic capabilities between humans and non-human animals are caused by shared mechanisms. I will briefly discuss an experiment identifying a promising spatio-temporal neural response pattern in secondary auditory cortex of zebra finches (*Taeniopygia guttata*) that is reminiscent of the mismatch negativity (MMN) response in human EEG, and that could be exploited for syntax experiments. This response pattern can be elicited with stimulus paradigms that are realistic with respect to natural vocalization behavior of this species, adding further weight to its suitability as a neural response measure for discrimination of syntactic patterns.

Parrots and Bellbirds: Avian Models for Language Evolution – *Irene Pepperberg*

Most language evolution research focuses on primates, positing a transitional hominid with the beginnings of learned vocal communication. Interest in primate models of language evolution increased after apes, humans' closest genetic relatives, learned some nonvocal elements of human communication systems. However, avian species phylogenetically distant from primates, notably Grey parrots (Psittacus erithacus), not only acquire human-like communication skills comparable to those of great apes (Pepperberg, 1999), but also engage in vocal learning, and studies have demonstrated striking parallels between both ontogeny and neurological underpinnings of vocal communication in birds and humans (e.g., Jarvis et al. 2005). Recently, an avian species, once thought incapable of vocal learning, has shown elements of such acquisition (Kroodsma, 2005; Saranathan et al. 2007), suggesting it might be a living avian model for the transitional link between our nonvocal-learning and vocal-learning hominid ancestors. This paper explores data supporting use of parrot and bellbird models for language evolution.

Relaxed Selection in the Evolution of Complex Songs in Bengalese Finches – *Kazuo Okanoya*

Bengalese finches (BFs) are a species of songbirds with complex song sequence. Note-to-note transition in their songs is best described by the 2nd-order Markovian model in a finite-state song syntax. BFs were domesticated form of wild white-rumped munias (WRMs) and these two strains have been isolated for more than 250 years. Unlike BF songs, song sequence in WRMs is simple and fixed. We aimed to find factors related with the strain differences in songs.

First, we cross-fostered eggs of BFs and WRMs to see the extent in which song complexity was genetically determined. BF chicks learned WRM songs but WRMs had difficulty in learning BF songs. However, copy accuracy was higher in WRMs than in BFs, indicating that the ability to make a precise copy of tutor song maybe degenerated in BFs but BFs gained a capacity to learn non-specific songs. Next, we made a field work to find ecological correlates of song complexity. We located 3 colonies of WRMs in Taiwan. WRM has a sympatric related species, spotted munias, in Taiwan. Among the 3 colonies, mixed colony ratios of WRMs with the spotted munias are correlated with song simplicity, suggesting that mixed colony requires higher degree of song simplicity to presumably avoid cross breeding. These results suggest relaxed selection account for a part of reasons why songs became complex in BFs.

Tripartite Evolution in Birdsong and Spoken Language – *Johan Bolhuis*

Darwin's suggestion that apes are cognitively closer to humans than to fishes (or birds) has led to an focus on non-human primates as model systems for human cognition, including language. However, recent studies on the cognitive capabilities of birds suggest that evolutionary convergence may be the rule rather than the exception, e.g. in the case of metatool use or vocal imitation. Behaviorally, in both birdsong and human speech there is a sensitive period for vocal learning early in development as well as a transitional phase at the start of vocal production, which is called 'babbling' in human infants and 'subsong' in songbirds. Considering the evidence on birdsong and human spoken language, an evolutionary scenario emerges where three factors are important. First, there is increasing evidence for neural homology, where similar brain regions are involved in auditory learning and vocal production, not only in songbirds and humans, but also in other mammals. Second, there is evolutionary convergence with regard to the mechanisms of auditory-vocal learning, which proceeds in essentially the same way in songbirds and human infants, but not in non-human primates. Third, as yet there is no evidence to suggest that non-human animals possess the combinatorial complexity of human language syntax. It may be that the neural mechanisms that evolved from a common ancestor, combined with the auditory-vocal learning ability that evolved in both humans and songbirds, enabled the emergence of language uniquely in the human lineage.

Understanding Communicative Signs by Children and Chimpanzees – *Jordan Zlatev*

Tomasello et al. (1997) showed that 30-month old children utilized pointing gestures toward one of three boxes that contained a hidden reward, and arbitrary "markers" placed on top of the relevant box, as well as a "replica", held up in the air, as a means of directing their attention and reaching action towards the box in question, and obtaining the reward. In contrast, chimpanzees could be trained to respond to one of the types of cues (pointing, markers, replcias), but did not generalize to the others. These results have been considered to demonstrate that children, but not apes, understand communicative and cooperative

intentions. Zlatev (2008) interpreted these results as supporting the theory that children combine their understanding of signs and communicative intent through bodily mimesis: the representational use of the body (cf. Donald 1991, 2001). To investigate these issues we conducted an adapted version of the original experiment, with the following modifications: (1) one of two "communicators" in the experiment with chimpanzees was a "surrogate mother" a keeper in the zoo who had taken care of the chimpanzees since an early age; (2) we included a fourth type of sign pictures; (3) three age-groups of children performed the task: 18, 24 and 30 month-olds; (4) measures for the children's language skills using the standard MacArthur Inventory Questionnaires for Swedish (Eriksson and Björklund, 2005) were collected. The results showed that comprehension of communicative intentions is dependent on sign type, and seems to be sensitive to degree of familiarity with the communicator, at least in the case of chimpanzees.

Representation and Reference: Comparative and Developmental Studies of Gesture – *Erica Cartmill*

Comparative and developmental perspectives provide different types of insight on the evolution of human communication. We must consider not only what structures were present before the origin of human language, but also how the preferences and environments of juvenile learners shape what is passed on to the next generation. I will discuss the gestural communication of human children and great apes and how they relate to mental representation and linguistic reference. I hope to demonstrate the utility of combining comparative and developmental approaches in the study of language evolution.

Abstraction and Cultural Variation in the "Wild": Why is it Important for the Study of Language Evolution? – *Rafael Núñez*

The study of variability in evolution is essential, and so is the study of meaning, abstraction and symbolism in the investigation of the origins of language. In this talk I will briefly present two of our field studies (with the Aymara of the Andes, and the Yupno of Papua New Guinea) that show striking varieties of conceptualization of time – a fundamental and ubiquitous concept in human cultures. In doing so, I will point to the importance of studying spontaneous speech-gesture co-production in the "wild", and I will discuss some implications for the study of language evolution.

The Evolution of Meaningful Combinatorial Communication – *Thom Scott-Phillips*

Human language is richly combinatorial, but otherwise meaningful combinatorial communication is rare in nature – and where it does exist, it is in very simple forms. In this talk, I will use both theory and data to argue that the origins of widespread combinatorial communication, such as we see in languages, depends upon advanced mind-reading abilities, and therefore must have followed rather than preceded the origins of sophisticated social cognition.

What do Evolutionary Biologists Have to Offer Linguists – *Russell Gray*

From the outside linguistics and evolutionary biology may seem like very different disciplines, and yet numerous scholars have observed "curious parallels" between the processes of biological evolution and linguistic change. These parallels mean that evolutionary biologists and historical linguists seek answers to similar questions and face similar problems. As a result, the theory and methodology of the two disciplines have often evolved in remarkably similar ways despite some recent controversies and frequent mutual misunderstandings. In this talk I will argue that computational phylogenetic methods have much to offer historical linguistics The offerings include:

1. new methods for dating language divergences,
2. new methods for inferring geographic origins,
3. new methods for constructing language networks and quantifying patterns of borrowing,
4. new methods for testing hypotheses about functional dependencies in language and thus claims about language universals.

I will emphasize that these methods should be seen as a supplement to, rather than a replacement of, traditional linguistic scholarship.

Reconstructing the Evolution of Language in Time and Space – *Sean Lee*

Patterns of linguistic variation among individuals carry the signature of a group's demographic past. In this talk, I will (1) demonstrate how I applied biological methods to extract evolutionary signals from the linguistic variation in the Japanese islands, and (2) explain what the results revealed about the origins of two distinctive ethnolinguistic groups coresiding in this unique chain of islands, namely the Japanese and the Ainu. I will also discuss how applying Darwinian methods to quantify linguistic change in time & space can be a complementary strategy for understanding the nature of human language.

Models of Anatomy Evolution – *Bart de Boer*

This talk aims to present an overview of recent work on modeling the evolution of the anatomy for speech, including work presented at the Kyoto EVOLANG conference. The focus will be on computational models, but it will also pay attention to pen-and-paper models, as long as the models describe a link between anatomy observable in the fossil record and speech.

It will also briefly address the issue about what the epistemological status of such models can be and how pursuing such models can make a useful contribution to the study of language evolution.

Language/Communication Theory in the Era of Massive Data Flow – *Takashi Ikegami*

In the face of massive complexity and data flow due to digital technologies, theories of language/communication change inevitably. Ten years ago, a simple theory and narrative were much more convincing than now days. Now, nobody seems to expect any theory to deal with the massive complexity of language/communication. My background is Artificial life and its messages from 20 years of research are "autonomy", "enaction", "sustainability", "open-ended evolution" and so on (see, e.g. [1][4]). My current mission is to ground these concepts in a real world context, in particular, how we can develop the concepts in the era of massive data flow ([2]). In this talk, from my recent studies on the real world artificial life systems, I would like to discuss new ideas and approaches for studying communication (e.g. [2,3,5]).

[1] Hanczyc, M. and Ikegami, T., Chemical Basis for Minimal Cognition, Artificial Life Vol. 16, No. 3, (2010) Pages 233-243.

[2] Ikegami, T. A Design for Living Technology: Experiments with the Mind Time Machine, Artificial Life (in press).

[3] Oka, M and Ikegami, T., Characterization of Autonomy in the Web via Transfer Entropy (submitted to ALIFE 13).

[4] Froese,T., Ikegami, T. and Virgo, N., The Behavior-Based Hypercycle: From Parasitic Reaction to Symbiotic Behavior (submitted to ALIFE13)