Kyoto Conference on Evolinguistics
Abstracts

Nov. 11 (Sat)

13:30-14:00

Evolinguistics: What is it, who does it, and how will it evolve?

Koji Fujita (Kyoto U.)

In this introductory talk, I will first overview our research project *Evolinguistics*, describing its aims and method and illustrating how we organize ourselves to attain our goal in an unprecedented, truly integrative and interdisciplinary manner. In the remainder of the talk, I will focus on the issue of hierarchy (or hierarchical compositional syntax) of human language, one of the two main common grounds for our project. I will review and rethink my previous hypothesis on the evolution of Merge, to bridge the gap between generative grammar and cognitive linguistics, occasionally referring to other speakers' lectures.

14:00-14:35

Principled explanations in comparative biomusicology

Rie Asano (Institute of Musicology, U. of Cologne)

Recent theoretical and empirical findings in comparative research on syntax of music and language indicate that both cognitive systems share some neurocognitive computations, but differ in their representations. However, it is still unclear how domain-general computations operate upon domain-specific representations. The goal of the current talk is to specify this computational problem from a theoretical, neuroscientific, as well as evolutionary perspective, and to clarify similarities and differences between music and language by providing principled explanations in terms of 1) syntax as a set of combinatorial principles and 2) neural structures and mechanisms as implementational principles. Original contributions of the current talk to music-language comparative research are twofold. First, through an extensive review of theoretical considerations as well as behavioral, neuroscientific, and neuropsychological studies, I show that the very similarity of music and language syntax lies in the process of temporal integration, i.e. the projection of domain-specific hierarchical structures onto temporal linearly ordered structures. Second, I discuss how the neurocognitive systems music and language are implemented on the basis of domain-general neural structures and mechanisms by focusing especially on the cortico-basal ganglia-thalamocortical circuits in morphosyntactic and phrasal syntactic processing in language as well as beat-based rhythmic sequence processing in music. Based on those results, I propose an action-oriented comparative framework and suggest for future research that the way how domain-general neurocognitive computations for temporal integration operate on domain-specific representations should be investigated in terms of domain-general motor planning flexibly adapting to domain-specific goals. The results of the talk provide important implications for Comparative Biomusicology, investigating the biological foundations of music in comparison with other cognitive systems in light of mechanisms, ontogeny, phylogeny, and adaptive function.

14:50-15:25

Brain mechanisms for MERGE

Michiru Makuuchi (National Rehabilitation Center for Persons with Disabilities)

Humans operate language as an information processing system on the basis of computational competence of the brain. The 'brain and language' relation is evident from clinical examination of patients who have organic insults to the brain. In the end of the 19th century, two areas are identified as language centres in the brain: Broca's area in the left inferior frontal gyrus and Wernicke's area in the left posterior superior temporal gyrus. Broca's area has a major role in speech production, but also makes a significant contribution to comprehension of complex sentences. Advent of modern neuroimaging techniques such as PET and fMRI in the 1990s has allowed us to observe brain activation of living men noninvasively with a resolution of several mm during the processing of language. As expected, researchers have found activation in Broca's area for hierarchical structure building of sentences. Some researchers, however, localised the effect in the anterior temporal lobe, claiming Broca's area participates to the sentence processing as a mere phonological working memory buffer during the processing. Zaccarella and coworkers recently review neuroimaging studies that compared sentences vs. word lists, and settled the disagreement: mixture of content and function words in lists caused unforeseeable activation in Broca's area while content-only and function-only lists did not. Furthermore, they demonstrated essential involvement of Broca's area in the fundamental operation of linguistic structure building, namely MERGE, by their own fMRI study. Thus, the current evidence suggests that Broca's area MERGEs words to build hierarchical structures.

15:25-16:00

Evolution of physical weakness by social selection through choice of collaborative partners

Yasuo Ihara (U. of Tokyo)

The interdependence hypothesis proposed by Tomasello and others is an evolutionary account for human cooperation and communication. They argue that human collaborative foraging first occurred in Stag-Hunt-type situations. In Stag Hunt, two players decide whether they hunt for Hare or Stag. Hare is less valuable and can be caught by oneself, while Stag is more valuable and requires collaboration. Stag is also a risky option because if you go for Stag and your partner does not, you get nothing. It is claimed that since early hominins lived in a relatively harsh environment, where "Hare" was insufficient for survival, strong selection favoring collaboration was at work. A possible obstacle to this hypothesis is dominance asymmetry. Considering dominance asymmetry, it is rational (or adaptive) for the dominant individual to monopolize the resource obtained collaboratively, in which case it becomes rational for the subordinate not to collaborate. How could this situation be saved? I hypothesize that preference for less dominant partners played a key role and this resulted in social selection for physical weakness. I explore this possibility using computer simulations, taking the reduction of canine teeth in humans as a possible example.

16:15-17:05

Brain growth trajectory and language-readiness: Linking hypotheses and new data

Cedric Boeckx (ICREA/U. of Barcelona)

In this first talk I revisit the claim I first formulated at Evolang9, Kyoto according to which the events underlying the globularization of the human brain/skull can shed light on how our brain became language-ready. I show how earlier explorations of this hypothesis may not have been the optimal way of articulating my central claim, and how recent data, from paleogenomics to cognitive neuroscience offer better ways to test, and eventually strengthen the original hypothesis.

Nov. 12 (Sun)

09:30-10:05

A biolinguistic approach to multicompetence

Shiro Ojima (Yokohama National U.)

Competence, the target of inquiry in Chomskyan theoretical linguistics, is the linguistic knowledge represented in the mind of an idealized native speaker. The implicit assumption here is that this idealized native speaker is monolingual. In the current world, however, there are more bilinguals and multilinguals than pure monolinguals, and multilingualism is becoming the default rather than the exception. Humans' language-learning capacity is potentially multilingual, as evidenced by the fact that healthy human children can become bilingual almost effortlessly given enough input in two languages. To fully understand humans' linguistic ability, the scope of our inquiry should be expanded to include multicompetence, that is, the knowledge of two or more languages represented in one mind. This also applies to rapidly increasing biolinguistic studies addressing language evolution or the evolutionary origin of humans' biological capacity to acquire language. My talk will outline a new research program which combines multicompetence and biolinguistics to address the evolution of multicompetence. In particular, I will ask whether the abilities needed to become multilingual are specific to human language or not. My tentative conclusion based on animal research and neuroscience is that none of those abilities is specific to human language. This in turn leads us to the view that the critical event that made humans linguistic (such as the appearance of Merge) during human evolution made them multilingual simultaneously, with the other abilities having been in place beforehand.

10:05-10:40

A cognitive linguistics view of language acquisition and its implications for language evolution

Kazumi Taniguchi (Kyoto U.)

This presentation aims to offer fundamental theoretical views of cognitive linguistics and to illustrate how it approaches the issue of language acquisition and evolution. Special attention will be paid to the "usage-based model" which presumes that grammar emerges from language use as a result of extracting common patterns among linguistic usages (i.e. constructional schemas). It is shown that the development of cognitive abilities concerning abstraction and recognition of commonalities is key to children's acquisition of word meanings as well as grammatical constructions. It will also be noted that the usage-based acquisition of a language is supported by communicative factors characteristically observable in child-adult interactions. The usage-based account of acquisition suggests the natural paths of development of language and the significant effect of individuals' acquisition process on historical language evolution.

10:55-11:30

Ostensive-inferential communication and language development

Harumi Kobayashi (Tokyo Denki U.)

Inferential mechanism is important in human communication. People do not code everything they want to say on language. They rather choose to rely on others' inferential ability to discern the

intended meaning that is not always shown explicit by utterances. In the ostensive-inferential communication, the speaker conveys information showing one's communicative intention explicit, suggesting "I convey some variable information to YOU right now." Ostensive-inferential communication is proposed to be human-specific. It makes interpretation of provided information possible and promotes sharing intentionality. Children develop the ability for ostensive communication at an early age. In this talk, I trace the development of ostensive communication and examine how it may contribute to language development. In particular, I focus on disambiguation mechanism of pointing gesture.

13:10-13:45

Constructive approaches to evolution of social learning and niche construction

Reiji Suzuki (Nagoya U.)

We discuss two studies on constructive approaches to evolution of social learning and niche construction focusing on emergence of novel traits, which may be relevant to understanding the coevolution of language and language-related abilities. First, we introduce a simple agent-based evolutionary model of social learning and individual learning of multiple phenotypes in a rugged fitness landscape. We show that interactions between different roles of these learning processes allowed the population to acquire complex and adaptive trait sets by crossing valleys in the fitness landscape. Second, we introduce an evolutionary model of defensive strategies of artificial prey creatures in which they need to avoid predation by constructing physical structures composed of multiple objects in a 2D physically simulated environment. We show that there was a large diversity in emerging adaptive structures, and ecological inheritance of these structures from a parent creature affected the proportion of types of evolved adaptive structures.

13:45-14:20

Adaptability of recursive combination: Evolutionary simulation and some speculations

Takashi Hashimoto (JAIST)

By adopting the hypothesis that the precursor of recursive combination of lexical items is the recursive combination of objects, we studied the evolution of recursive combination for understanding its adaptability using a computational model. We identified two adaptabilities of recursive combination: the diversification of production methods and the diversification of products. It was also shown that the recursive object combination became effective in an environment where resource competition among individuals was severe and the variety of possible products was sufficiently large. Since recursive combination involves the combination of components with each other, it encourages the reuse of components to produce various other products. The diversification of production methods may further enhance the chances of creating a novel product via mutation of various production methods. Therefore, in a sense, we can consider recursive combination to be included in the capability for innovation. On the other hand, products or artistic works that generate novel structures, styles, modes, etc. make us feel more innovative than producing various instances by reusing components. A possible process for such innovative works is the abstraction of a structure from existing instances, its manipulation to create a new structure, and the application of the new structure to realize a new instance. We can find such a

process in innovative technologies and creative arts, such as jet engine and whole tone scale. As exemplified by the structural priming in the use of language, we often recognize structures from experience and utilize the structures for producing various instances in varied domains of knowledge, which is not limited to just language. However, the manipulation of structures does not seem to be omnipresent; therefore, innovation/creation is not usual. In this talk, as for a future form of communication, we hope to discuss how recursive combination is related to the manipulation of structures.

15:05-15:55

Self-domestication and its contribution to modern human cognition

Cedric Boeckx (ICREA/U. of Barcelona)

In this talk I examine the claim that self-domestication was an important factor in the evolution of our species and its special cognitive mode. After briefly summarizing some of my group's recent results on this issue, I turn my attention to some unresolved issues pertaining to the nature of (self-)domestication, and focus on ways to experimentally test some of the predictions that our work has generated.

15:55-16:30

Behavioral and neural mechanisms for stimulus chunking in birds and humans

Kazuo Okanoya (U. of Tokyo)

Bengalese finches are a domesticated strain of wild white-rumped munias, which are endemic to South-East Asia. White-rumped munias were imported some 250 years ago to Japan and ever since domesticated as Bengalese finches. During the process, brownish plumage changed to whiteish in Bengalese finches and their parental behavior strengthened. In addition, songs became phonologically and sequentially complex. Notably, compared to linear, fixed sequence of munia songs, Bengalese finch songs are sequentially complex, comprising with several syllable chunks sung in a finite-state syntax. We consider these changes in part occurred by domestication that reduces stress level and favors for relaxed selection and sexual selection. We then examined sequential capacity in Bengalese finches. We showed that they learn songs from multiple tutors and splice and chunk multiple song elements to create novel songs. This should require an ability for statistical segmentation and we are able to show neural substrate that enables this cognitive manipulation. We also examined human on-line statistical segmentation in humans and showed basic brain architecture for statistical segmentation may be the same in birds and humans, and this is enhanced in both species by the process of domestication.