Language & the Brain: Evolution, its use and social interaction

Course Code: 16850 (Freie Universität Berlin & Humboldt Universität zu Berlin)

The aim of this seminar is to provide a comprehensive insight into the evolution of language, encompassing both biological and cultural changes. We will explore thought-provoking questions based on language evolution theories, such as the distinctions between human and animal communication and the reasons behind humans' ability to acquire a vast vocabulary compared to our closest ancestors. Through an exploration of neurocognitive experimental research and incorporating insights from artificial neurocomputational modeling, we will investigate the underlying mechanisms in the human mind and brain that govern language processing, usage, and evolution. Additionally, we will place particular emphasis on linguistic pragmatics, a sub-discipline that examines language as a tool of communication in social contexts, drawing upon foundational concepts from analytical philosophy and linguistic pragmatic models. Throughout these discussions, we will explore factors such as social interaction, turn-taking, and the establishment of common ground. Furthermore, there will be planned visits to the electroencephalography (EEG) laboratory to provide hands-on experience with neurocognitive experiments, as well as a visit to the aphasia therapy center of the Brain Language Unit at the Freie Universität Berlin.

Please note that the seminar will be conducted in English.

Readings (course preparation):

Tomasello M. 2004. Origins of human communication, MIT press.

Schomers MR, Garagnani M, Pulvermüller F. 2017. Neurocomputational Consequences of Evolutionary Connectivity Changes in Perisylvian Language Cortex. J Neurosci. 37:3045–3055.

Pickering, M. J., & Garrod, S. (2004). Toward a mechanistic psychology of dialogue. Behav Brain Sci, 27(2), 169-190; discussion 190-226.

Tomasello, R. (2023). Linguistic signs in action: The neuropragmatics of speech acts. Brain & Language 236:105203.

Pulvermüller, F., Tomasello, R., Henningsen-Schomers, M.R., Wenneker, T. (2021) Biological constraints on neural network models of cognitive function. Nat Rev Neurosci 22, 488–5

Dr Rosario Tomasello, PhD
Winter Term 2023/24
Wednesday 16:15-17:45; Start: 18.10.2023
Venue: KL 32/123 (Freie Universität Berlin)

General information

Each participant is expected to present one of the below-mentioned papers. The presentation should be **no longer than 15 mins and should be followed by 2-3 follow-up questions that will serve as a basis for discussion.** Student presentation sessions are an important component of this course, covering thematic areas essential for seminar comprehension. Therefore, it is crucial to thoroughly prepare your presentation in advance and discuss its content with the seminar lecturer. To facilitate this, please attend the seminar lecturer's office hours.

Electronic Files: Seminar materials will be available electronically on the [Brain Language Laboratory website](). To ensure this, please send your PowerPoint presentations created for the seminar to the organizing team members (j.knechtges@fu-berlin.de and tomasello.r@fu-berlin.de) at least 3 days before your presentation date, allowing sufficient time for posting.

Please name your files systematically according to the following pattern:

LangEvo_XX_[NAMED AUTHORS]_[TOPIC/CONTENT]

LangEvo _1a_Hinz_RillingSlides

All course materials are available on:

https://www.geisteswissenschaften.fu-berlin.de/v/brainlang/teaching/WS2324/WS23_16850_Tomasello/index.html

select 'materials'.

password: Brainy2023

As students from different universities (FU, HU) and very different MAs are part of this course, the criteria for success vary according to the relevant rules (see your own study regulation - "Studienordnung"). For some study courses, it is necessary also to write an essay. If you are interested in writing an essay, please contact per email the lecturer.

For any questions, please contact: Dr Rosario Tomasello, JK 31/224 at Freie Universität Berlin, Office hours Thurs. 11-12h; please register in advance by email at tomasello.r@fu-berlin.de, or Johanna Knechtges, j.knechtges@fu-berlin.de.

Seminar Syllabus

Please note, references marked with an asterisk (*) are required readings prior to the session.

18.10. Introduction, background, program, learning objectives and student presentation assignment

I. LANGUAGE EVOLUTION; Culture and biological evolutionary changes

25.10. How do human and non-human communication may differ in their key characteristics? – Offline Session

Short podcast: How did language evolve? - Phylogenesis vs. ontogenesis – Evolutionary changes

*Tomasello, Michael. (2009) *Constructing a language*. Harvard university press, (Chapter 2.2.-2.2.2 and 2.3.-2.3.1)

Exercise: Exploring Human Communication Advantages and Neurobiological Differences

Use the document provided to engage in discussions and consider examples highlighting situations where human communication surpasses that of other species (i.e., apes). Also, think about which neurobiological differences may exist between this species and potentially contribute to the development of human language.

01.11 Lecture: Human vs. Animal Communication

*Tomasello (2004), The origins of human communication, chapter 2

Tomasello M, Herrmann E. 2010. Ape and human cognition: What's the difference? Curr Dir Psychol Sci. 19:3–8.

08.11. From Ontogeny to Phylogeny: The Origin of Language and the Gesture First Hypothesis

1a. Gesture first hypothesis: *Corballis, M. C. (2009). Language as gesture. *Human Movement Science*, *28*(5), 556-565.

1b. The mirror neuron system: Fogassi, L., & Ferrari, P. F. (2004). Mirror neurons, gestures and language evolution. Interaction Studies, 5(3), 345-363.

1c. Gestural communication in apes: Bullinger, A. F., Zimmermann, F., Kaminski, J., & Tomasello, M. (2011). Different social motives in the gestural communication of chimpanzees and human children. Developmental Science, 14(1), 58-68.

15.11. Sound symbolisms, Human vs Apes

Lecturer presentation: Introduction to Sound Symbolism.

2a. Sound symbolism in great apes? *Margiotoudi, K., Allritz, M., Bohn, M., & Pulvermüller, F. (2019). Sound symbolic congruency detection in humans but not in great apes. Scientific Reports, 9(1), 12705.

2b. Sound symbolism in a human-raised ape?: Margiotoudi, K., Bohn, M., Schwob, N., Taglialatela, J., Pulvermüller, F., Epping, A., ... & Allritz, M. (2022). Bo-NO-bouba-kiki: picture-word mapping but no spontaneous sound symbolic speech-shape mapping in a language trained bonobo. Proceedings of the Royal Society B, 289(1968), 20211717.

22.11. Brain Evolutionary Changes – Comparative Studies

3a. Arcuate fasciculus and its evolution: *Rilling, J. K. (2014). Comparative primate neuroimaging: insights into human brain evolution. *Trends in cognitive sciences*, *18*(1), 46-55.

3b. Multimodal hub regions and their evolution: Ardesch, D. J., Scholtens, L. H., Li, L., Preuss, T. M., Rilling, J. K., & van den Heuvel, M. P. (2019). Evolutionary expansion of connectivity between multimodal association areas in the human brain compared with chimpanzees. Proceedings of the National Academy of Sciences, 116(14), 7101-7106.

3c. Connectivity and their development: Catani M, Bambini V. 2014. A model for Social Communication And Language Evolution and Development (SCALED). Curr Opin Neurobiol. 28:165–171

Additional readings: Schoenemann, P. T. (2009). Evolution of brain and language. *Language Learning*, *59*, 162-186.

29.11. Brain-Constrained Neural Network for Language Processing

Lecture: Introduction to Brain Constraints Neural Networks
*Pulvermüller, F., Tomasello, R., Henningsen-Schomers, M.R., Wenneker, T. (2021) Biological constraints on neural network models of cognitive function. Nat Rev Neurosci 22, 488–502

06.12. Brain Evolutionary Changes - Human vs Apes Neural Models

4a. The emergence of verbal memory and the role of the arcuate fasciculus: Schomers, M. R., Garagnani, M., & Pulvermüller, F. (2017). Neurocomputational consequences of evolutionary connectivity changes in perisylvian language cortex. *Journal of Neuroscience*, *37*(11), 3045-3055.

External Talk: Maxime Carriere, Verbal Working Memory depends on Network Architecture: Generalization across Brain-Constrained Network Models

13.12. Fast Mapping as a Factor for Large Vocabulary?

Lecturer Introduction: Language development & Vocabulary spurt

5a. Building memory networks in fast mapping, Coutanche, M. N., & Thompson-Schill, S. L. (2014). Fast mapping rapidly integrates information into existing memory networks. Journal of Experimental Psychology: General, 143(6), 2296–2303.

5b. Biological explanation of fast mapping, Constant, M., Pulvermüller, F., & Tomasello, R. (2023). Brain-constrained neural modeling explains fast mapping of words to meaning. Cerebral Cortex, 33(11), 6872-6890.

II. LANGUAGE USE & SOCIAL INTERACTIONS

20.12. Pragmatics and Current research at the Brain Language Laboratory

Lecturer Introduction: What is Linguistic Pragmatics and the project "Brain Signatures of Communication" part of the DFG priority "XPrag.de"

*Bach, K. (2006). Speech acts and pragmatics. The Blackwell guide to the philosophy of language, 147-167.

10.01. Experimental Pragmatics at the Brain Language Laboratory at Freie Universität Berlin

Lecturer Introduction: Short introduction to EEG method and Lab visit
This session is designed to give you an opportunity to see an experimental pragmatics experiment up close. Supervised by lab members, you will be introduced to a study of linguistic action processing in which subjects perform various speech acts while their brain waves are measured. A focus will be on the practice of the EEG method, which will then also be discussed from a theoretical perspective in the following session.

17.01. Neural Correlates of Speech Act Understanding: The case of Naming and Request

Lecturer Introduction: Description of linguistic actions
*Tomasello, R. (2023). Linguistic signs in action: The neuropragmatics of speech acts. Brain & Language 236:105203. Chapter 1&2

6a: How quickly do we distinguish between speech acts?, Egorova, N., Shtyrov, Y., & Pulvermüller, F. (2013). Early and parallel processing of pragmatic and semantic information in speech acts: neurophysiological evidence. Front Hum Neurosci,7(86), 1-13.

6b: Multimodal processing: Gesture-speech interaction, Tomasello, R., Kim, C., Dreyer, F.R., Grisoni, L.,Pulvermüller, F., (2019). Neurophysiological evidence for rapid processing of verbal and gestural information in understanding communicative actions. Sci. Rep. 9.

24.01 Shared Intentionality & Common Ground

Lecturer Introduction: What is common ground? *Clark, E.V. (2015). Common Ground. In The Handbook of Language Emergence (eds B.MacWhinney and W. O'Grady)

7a: Shared intentionality hypothesis, Tomasello, M., & Moll, H. (2010). The gap is social: Human shared intentionality and culture. Mind the gap: Tracing the origins of human universals, 331-349.

7b: Joint attention in apes? Wolf W, Tomasello M. (2020) Human children, but not great apes, become socially closer by sharing an experience in common ground. J Exp Child Psychol. Nov;199:104930.

31.01 Turn-Taking

Lecturer Introduction: Turn-taking and the implication for language
*Levinson, S. C. (2016). Turn-taking in Human Communication--Origins and Implications for Language Processing. *Trends Cogn Sci, 20*(1), 6-14.

8a. Turn-taking universal or culture specific?, Stivers, T., Enfield, N. J., Brown, P., Englert, C., Hayashi, M., Heinemann, T., et al. & Levinson, S. C. (2009). Universals and cultural variation in turn-taking in conversation. *Proc Natl Acad Sci U S A, 106*(26), 10587-10592.

8b: Turn taking, Human vs Animal communication: Pika, S., Wilkinson, R., Kendrick, K. H., & Vernes, S. C. (2018). Taking turns: bridging the gap between human and animal communication. Proceedings of the Royal Society B, 285(1880), 20180598.

07.02 Language Games - Intensive Language Action Therapy

Lecturer Introduction: Aphasia and Therapy, *Pulvermüller, F., Mohr, B., & Taub, E. (2016). Constraint-induced aphasia therapy: A neuroscience centered translational method. In G. Hickok & S. L. Small (Eds.), Neurobiology of language (pp. 1025- 1034). Amsterdam: Elsevier.

Johanna Knechtges: Theoretical and practical session on Intensive Language Action Therapy (ILAT)

17.02 Seminar Closure

Seminar summary, Seminar critique
Discussion of term paper topics