BABEL: Bio-inspired Architecture for Brain Embodied Language – Berlin part

Institution:	Freie Universität Berlin, FB Philosophie und Geisteswissenschaften, Institut für deutsche und niederländische Philologie, Brain Language Laboratory
Coordinator:	Prof Dr Dr Friedemann Pulvermüller
Research team:	Prof Dr Dr Friedemann Pulvermüller, FUB Dr Max Garagnani, FUB Rosario Tomasello, MA, FUB Malte Schomers, MA, FUB
Collaborators:	Prof Angelo Cangelosi, Univ Plymouth Prof Steve Furber, Univ Manchester Dr Thomas Wennekers, Univ Plymouth
Duration:	01.04.2013 – 30.08.2016
Contact:	Prof Dr Dr Friedemann Pulvermüller
E-Mail:	friedemann.pulvermuller@fu-berlin.de

Abstract: Previous research in behavioural and cognitive neuroscience demonstrates a close link between the brain systems for language, action and perception. These parallel developments in behavioural and computational neuroscience, as well as in cognitive robotics and in neuromorphic engineering constitute a timely opportunity to synergistically integrate the interdisciplinary methods and approaches from these fields with the aim of furthering the scientific and technological progress in language processing in natural and artificial cognitive systems. The project proposes the interdisciplinary integration of new brain imaging experiments, of neuro-anatomical computational and neuromorphic studies, and of humanoid robotics experiments in order to characterise the brain mechanisms supporting language learning in an embodied and pragmatic (situated) context, and to design and test novel brain-inspired neural technologies for action and language learning experiments with interactive intelligent systems such as humanoid robots. This integrative approach is supported by the establishment of a highly interdisciplinary project team with an international track record in behavioural neuroscience of language (Pulvermüller), computational neuroscience (Wennekers, Garagnani), neuromorphic engineering (Furber) and cognitive and neuro-robotics (Cangelosi).

Background publications

Wennekers, T., Garagnani, M., & Pulvermüller, F. 2006. Language models based on Hebbian cell assemblies. Journal of Physiol, Paris, 100, 16-30.

Garagnani, M., Wennekers, T., & Pulvermüller, F. 2008. A neuroanatomically-grounded Hebbian learning model of attention-language interactions in the human brain. European Journal of Neuroscience, 27(2), 492-513.

Pulvermüller, F., & Fadiga, L. 2010. Active perception: Sensorimotor circuits as a cortical basis for language. Nature Reviews Neuroscience, 11(5), 351-360.

Kiefer, M., & Pulvermüller, F. 2012. Conceptual representations in mind and brain: Theoretical developments, current evidence and future directions. Cortex, 48(7), 805-825.

Key publications:

Pulvermüller, F. 2013. How neurons make meaning: Brain mechanisms for embodied and abstract-symbolic semantics. Trends in Cognitive Sciences, 17(9), 458-470. doi:10.1016/j.tics.2013.06.004

Garagnani, M., & Pulvermuller, F. 2013. Neuronal correlates of decisions to speak and act: Spontaneous emergence and dynamic topographies in a computational model of frontal and temporal areas. Brain and Language, 127(1), 75-85. doi:10.1016/j.bandl.2013.02.001

Pulvermüller, F., & Garagnani, M. 2014. From sensorimotor learning to memory cells in prefrontal and temporal association cortex: A neurocomputational study of disembodiment. Cortex, 57, 1-21.

Pulvermüller, F., Garagnani, M., & Wennekers, T. 2014. Thinking in circuits: Towards neurobiological explanation in cognitive neuroscience. Biological Cybernetics, 108(5), 573-593. doi:10.1007/s00422-014-0603-9

Garagnani, M., & Pulvermüller, F. 2016. Conceptual grounding of language in action and perception: A neurocomputational model of the emergence of category specificity and semantic hubs. European Journal of Neuroscience, in press.