

Michael Arbib

Brief Curriculum Vitae

Born in England in 1940, Michael Arbib grew up in Australia (with a B.Sc. (Hons.) in Pure Mathematics from Sydney University), and received his Ph.D. in Mathematics from MIT in 1963. After five years at Stanford, he founded the Ph.D. program and the Department of Computer and Information Science at the University of Massachusetts at Amherst in 1970. He joined the University of Southern California (USC) in 1986 and was the Fletcher Jones Professor of Computer Science, as well as University Professor and a Professor of Biological Sciences, Biomedical Engineering, Electrical Engineering, Neuroscience and Psychology when he retired from USC in 2016.

He is currently an Adjunct Professor of Psychology at the University of California and a contributing faculty member in architecture at the NewSchool of Architecture and Design, both in San Diego.

The thrust of his work is expressed in the title of his first book, *Brains, Machines and Mathematics* (McGraw-Hill, 1964). The brain is not a computer in the current technological sense, but he has based his career on the argument that we can learn much about machines from studying brains, and vice versa. He has thus always worked for an interdisciplinary environment in which computer scientists and engineers can talk to neuroscientists and cognitive scientists. At the University of Massachusetts, he helped found the Center for Systems Neuroscience, the Cognitive Science Program (where his contribution focused on the linkage of linguistics and computational neuroscience), and the Laboratory for Perceptual Robotics, for each of which he served as Director. At USC, he was founder and first Director of the Center for Neural Engineering and the USC Brain Project, an interdisciplinary project in neuroinformatics. His research has long included a focus on mechanisms underlying the coordination of perception and action. This is tackled at two levels: via schema theory, which is applicable both in top-down analyses of brain function and human cognition as well as in studies of machine vision and robotics; and through the detailed analysis of neural networks, working closely with the experimental findings of neuroscientists. His group prepared the first computational model of mirror neurons and conducted some of the key initial imaging studies of the human mirror system. He continues to develop insights into the monkey brain and use them to chart the evolution of the human language-ready brain.

In addition to his research in artificial intelligence, brain theory and cognitive science, Arbib was actively involved in theory of computation and system theory. His concern for the social implications of computer science was given textbook expression in *Computers and the Cybernetic Society*. In 1983 he and Mary Hesse delivered the Gifford Lectures in Natural Theology at the University of Edinburgh, since published as *The Construction of Reality*, extending schema theory to provide a coherent epistemology

for both individual and social knowledge. Arbib was also a founding member of the board of the Institute for Advanced Study in the Humanities at the University of Massachusetts and the Institute for Advanced Studies at the University of Western Australia.

He has served as Vice-President of the Academy of Neuroscience for Architecture (ANFA) and is currently Coordinator of the ANFA Advisory Council. His interest in the neuroscience of the experience and design of architecture is complemented by work in neuromorphic architecture in the sense of supplying buildings with an “interaction infrastructure” informed by research on computational models for cognitive and social neuroscience. Papers on this topic include

Arbib M.A. 2012. Brains, machines and buildings: towards a neuromorphic architecture. *Intelligent Buildings International* 4: 4(3), 147-68, DOI:10.1080/17508975.2012.702863

Arbib, M.A. (2015). Towards a Neuroscience of the Design Process. In S. Robinson & J. Pallasmaa (Eds.), *Mind in Architecture: Neuroscience, Embodiment and the Future of Design* (pp. 75-98). Cambridge, MA: The MIT Press.

His 2018 lectures at UCSD on these topics are now available on YouTube.

2012 saw the publication of Arbib’s 40th book, *How the Brain Got Language: The Mirror System Hypothesis* (Oxford University Press) followed by the 2013 edited volume from the MIT press, *Language, Music and the Brain: A Mysterious Relationship* (based on a Strüngmann Forum he organized in Frankfurt in May 2011) as well as *From Neuron to Cognition via Computational Neuroscience* (a textbook he edited, with James Bonaiuto developing a complementary website) in 2016. *Interaction Studies* is publishing a special issue in 2018 edited by Arbib and based on an international workshop he organized. On “How the Brain Got Language: Towards a New Road Map.”

Papers and Chapters: 2016-2018

1. Arbib, M. A. (2016). Towards a Computational Comparative Neuroprimatology: Framing the Language-Ready Brain. *Physics of Life Reviews*, 16, 1-54.
2. Arbib, M. A. (2016). Primates, Computation, and the Path to Language. Reply to Comments on “Towards a Computational Comparative Neuroprimatology: Framing the Language-Ready Brain”. *Physics of Life Reviews*, 16, 105-122.
3. Arbib, M. A. (2016). From Neuron to Cognition: An Opening Perspective. In M. A. Arbib & J. J. Bonaiuto (Eds.), *From Neuron to Cognition via Computational Neuroscience*. Cambridge, MA: The MIT Press.
4. Arbib, M. A. (2016). Evolving the Language-Ready Brain. In M. A. Arbib & J. J. Bonaiuto (Eds.), *From Neuron to Cognition via Computational Neuroscience* (pp. 719-757). Cambridge, MA: The MIT Press.

5. Arbib, M. A. (2016). How Language Evolution Reshaped Human Consciousness. In R. Poznanski (Ed.), *Biophysics of Consciousness: A Foundational Approach* (pp. 87-128). Singapore: World Scientific.
6. Arbib, M. A. (2016). Mirror systems and more in evolving the language-ready brain. *Journal of Chinese Linguistics Monograph on New Horizons in Evolutionary Linguistics*, 27, 1-15.
7. Arbib, M. A. (2016). When Brains Design/Experience Buildings: Architectural Patterns for a Good Life. In J. W. Vasbinder & B. Z. Gulyás (Eds.), *Cultural Patterns and Neurocognitive Circuits* (pp. 111-140). Singapore: World Scientific Publishers.
8. Arbib, M. A. (2016). Your Soul is a Distributed Property of the Brains of Yourself and Others. Reti, Saperi, *Linguaggi: The Italian Journal of Cognitive Sciences*(1), 5-30, doi: 10.12832/83914.
9. Arbib, M. A. (2017). Dorsal and ventral streams in the evolution of the language-ready brain: Linking language to the world. *Journal of Neurolinguistics*, 43, Part B, 228-253. Arbib, M. A. (2017). States of Linear Systems, Automata, and Marriage : A Tribute to Rudolf Kalman [Historical Perspectives]. *IEEE Control Systems*, 37(2), 170-170.
10. Arbib, M. A. (2017). Toward the Language-Ready Brain: Biological Evolution and Primate Comparisons. *Psychonomic Bulletin & Review*, 24(1), 142-150.
11. Gasser, B., & Arbib, M. (2017). When one brain needs to learn from another: the case of observational facilitation of list learning in macaques. *Adaptive Behavior*, 25(3), 147-161. doi:doi:10.1177/1059712317715866
12. Gasser, B., & Arbib, M. A. (2017). A neuro-computational model of sequence learning in macaques: the Simultaneous Chaining Paradigm. *Adaptive Behavior*, 25(4), 195-213.
13. Arbib, M. A. (2018). Computational Challenges of evolving the language-ready brain: 1. From Manual Action to Protosign. *Interaction Studies*, 19(1-2).
14. Arbib, M. A. (2018). Computational Challenges of evolving the language-ready brain: 2. Building towards neurolinguistics. *Interaction Studies*, 19(1-2).
15. Arbib, M. A. (2018). In support of the role of pantomime in language evolution. *Journal of Language Evolution*, 3(1), 41-44. doi:10.1093/jole/lzx023
16. Arbib, M., Aboitiz, F., Burkart, J., Corballis, M., Coudé, G., Hecht, E., . . . Wilson, B. (2018). The Comparative Neuroprimatology 2017 (CNP-2017) Road Map for Research on How the Brain Got Language. *Interaction Studies*.