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Editorial

Interactive Tools and Media in the Neural and Cognitive Sciences

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Brains are believed to belong to the most complex structures in the universe. They consist of densely packed and intricately interconnected networks of neurons, each of which has already highly complex computational properties. With their neuronal machinery animals and humans are able to deal successfully with extraordinary behavioural and cognitive tasks - at least if judged by the performance of man-made artificial systems. It may thus be not surprising that understanding the functioning of brains is an extremely challenging endeavour - both for researches as well as for students. Interactive media and tools, like models and simulations, databases and visualizations or virtual laboratories proved to be not only indispensable in research but also in education to help understanding brain function. Accordingly, a wide range of such media and tools are now available and it is getting increasingly difficult to see an overall picture.

Written by researchers, tool developers and experienced academic teachers, this special issue of Brains, Minds & Media covers a broad range of interactive research media and tools with a strong emphasis on their use in neural and cognitive sciences education. The focus lies not only on the tools themselves, but also on the question of how research tools can significantly enhance learning and teaching and how a curricular integration can be achieved.

The special issue is divided into four parts. The first part is dedicated to simulation tools designed for neural and cognitive modeling and simulation. The contributions cover model simulations of neural networks at a wide range of spatial and temporal scales and, accordingly, at different levels of abstraction: On the one hand, tools for simulating biophysical mechanisms of action potentials and synaptic transmission within small neural circuits are introduced. On the other hand, tools are presented for modelling large-scale neural networks, for understanding large topological maps and for simulating embodied agents and cognition. Part two introduces virtual neuroscientific methods as learning tools, exemplified by a virtual electrophysiology laboratory and by interactive high-resolution digital brain atlases and virtual microscopy. Part three discusses the use of model repositories for teaching and learning. The last part focuses on curricular development, covering three highly relevant aspects: ready-to-use educational simulations, integration of models of mind and brain in general curriculum development, and learning environments for curricular integration of different existing interactive learning resources.

This collection presents the first general comparison of this sort thus far and gives a comprehensive overview of existing tools and their usage[1] as well as the underlying educational ideas. The special issue of Brains, Minds & Media will thus provide a state-of-the-art orientation guide not only for teaching researchers but also for interested teachers and students.

[1] see also Bower JM and Beeman D (Eds.) (2005). Special Issue on Realistic Neural Modeling – WAM-BAMM '05 Tutorials. Brains, Minds and Media, Vol. 1, bmm237.