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Synantocytes and the space structure of the brain

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Bernhard Mitterauer Joined: 07 Jun 2005 Posts: 22	Posted: Fri Aug 06, 2010 9:53 am Post subject: Synantocytes and the space structure of the brain quote edit Synantocytes may generate and determine the space structure of the brain Bernhard J. Mitterauer How does the brain represent space? Is this representation entirely the result of learning from experience? In his Critique of Pure Reason, Immanuel Kant argued that there must be certain "a priori conditions" of cognition, which cannot be derived from experience but must instead be given prior to it. Recently, two groups have conducted experiments on rat pups and interpreted their results in a Kantian view of space (Langston et al, 2010; Willis et al, 2010). In both studies, the researchers placed electrodes in the hippocampal formation of freely moving 14-day-old rat pups, and recorded the activity ("firing" of electrical impulses) of individual neurons at 16 days after birth and up to 2 weeks afterwards. They were thus able to sample three classes of cells with distinctly different spatial coding characteristics. One cell type that discharges when the animal's head points in a particular direction is called direction cells. Another cell type fires when the rat moves through a particular location within the yet unexplored environment, termed place cells. Regarding to a third cell type, called grid cells, that fire in repeated discrete locations as the animal moves around its environment, the two studies disagree what the function of these cells concerns. Here we do not deal with an "a priori" space representation within the brain, but with innate neuronal cells that are specialized to compute variables necessary for space recognition. These cells may be comparable to special purpose processors (Baars, 2002). Moreover, we may not live in a general physical space but we may permanently generate subjective space structures dependent on our intentions and their feasibility in the environment. Therefore, the brain must be capable of generating subjective spaces based on a complex relational structure. I hypothesize that synantocytes may do this job. Synantocytes (NG2-glia) extend processes throughout all layers of the cerebral cortex and probably express heterogenous receptors. Similar to astrocytes, each cell may consist of distinct microdomains for information processing. These cells contact neurons, astrocytes, oligodendrocytes, axons at the node of Ranvier, and myelin (Butt et al, 2005; Fields, 2009). Most importantly, synantocytes do not form networks comparable to the astrocytic syncytium. Why not? According to the great physicist Smolin (1997), space is an aspect of temporal relations and events do not happen within a superposed space or

environment. Since synantocytes are able to register the information flux of all relevant cell systems of the brain, they may generate a relational structure via their processes embodying a specific subjective space. From a brainphilosophical point of view, each subjective space generated by a synantocyte represents a subjective reality. Since synantocytes comprise 10 percent of all cell types of the brain (Butt et al, 2005), our brain may be composed of very many realities that may determine our subjective view of the subjects and objects in the environment.

In addition, the capability of synantocytes to regenerate damaged cells and to maintain the equilibrium of the extracellular space indicates that synantocytes generate and control distinct microdomains of space generation within the brain. For the realization of an inner space structure in the environment, the brain is equipped with neurons specialized in perceiving and monitoring the geometrical variables necessary for space recognition. This procedure is based on movement.

The experiments shortly discussed represent a typical case of an overinterpretation, especially by not referring to glia. At least from the perspective of a gliophilosophy - as Robertson calls my approach – interpretations of experimental results on the behavioral level should also consider criteria of subjectivity such as intentionality and individuality, for which the glial system essentially may be responsible (Mitterauer, 2007). Thus, "pure" neuroscientists or neurophilosophers are endangered to misapply philosophical conceptions to the brain.

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