

Hierarchical Analysis on Cognitive Systems

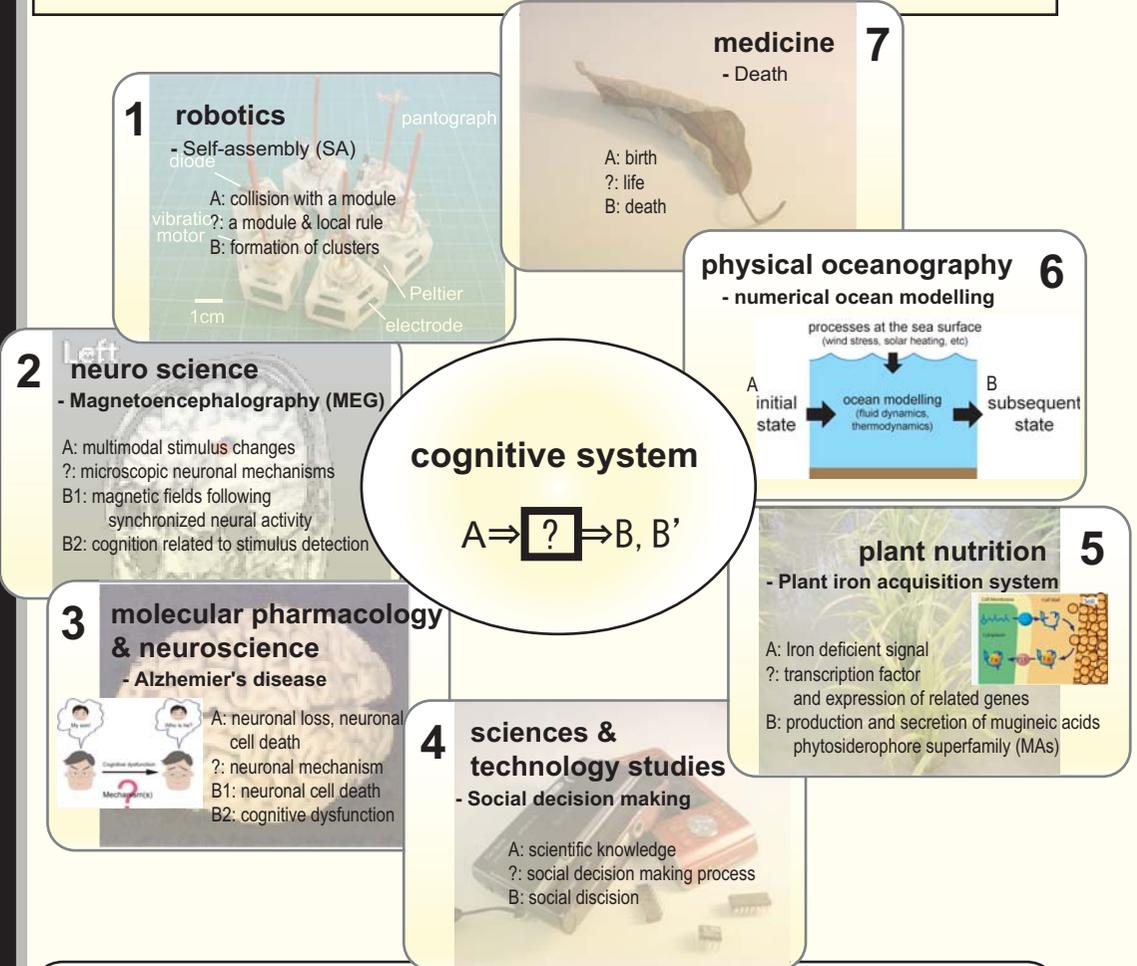
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- 1 Self-assembly system can be viewed as a cognitive system which doesn't necessarily require an explicit sensing mechanism. It just obeys local environmental rules but capable of autonomous configuration of global structures.
- 2 MEG enables to see correlations among external stimuli, dynamics of neural populations and cognitive states in the human brains. The example shown is a typical model of such correlations in response to multimodal environmental changes. From the magnetic fields evoked by the changes, it was revealed that sensory system detects multimodal stimulus changes in the supratemporal area after approximately 100 ms and much before cognitive detection.
- 3 Alzheimer's disease (AD) is a most common form of dementia characterized by loss of neurons and synapses, resulted in progressive cognitive dysfunction. However, the cell death mechanisms or cognition systems in human are not clearly defined. The difficulty in developing a remedy for AD is distinction of a cognitive system between human and animals which are useful for developing drugs. To solve this problem, further investigation of cognitive system in animals and established cognitive impairment model(s) are required.
- 4 In sociology, behaviors of mass people are studied in the flame work of cognitive science. Their decisions are thought as a reflection of the input, but the processes are considered as complex systems.
- 5 Graminaceous plants produce and release metal chelator called mugineic acid family phytosiderophores (MAs) from their roots. MAs bind to and solubilize ferrous iron (Fe(II)) insoluble in the rhizosphere. Under iron deficient condition, the genes involved in MAs biosynthesis were induced and the secretion amounts of MAs were increased. It remain unknown how plants recognize iron deficient signal.
- 6 Numerical ocean modelling, which is a central methodology of physical oceanography, can be recognized as a kind of cognitive systems. Using an ocean state at a moment for the initial condition and boundary conditions at the sea surface, the model outputs the subsequent state based on fluid dynamics and thermodynamics. However, all of the phenomena in the ocean cannot be represented due to numerical resources, and their effects are taken into account through empirical parameterizations (e.g. turbulent motions smaller than the model grid interval). Searching appropriate parameterizations is equivalent to trying to elucidate a cognitive system.
- 7 Cognitive system in a broad sense can be also seen in an ontogenetic time span. We (living systems) begin as a mother cell having a limitation in the period being alive. We are perpetually asked the meaning of existence.

Abstract

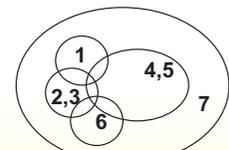
This paper compares some cognitive systems in various academic contexts. The authors consist of 7 researchers from different fields (science & technology studies, robotics, neuroscience, plant nutrition, physical oceanography, molecular pharmacology & neuroscience, and medicine), and discuss fundamental issues on cognitive science aiming at provoking a novel approach to unveil the mystery of intelligence.



Discussions & the proposed approach

-Time scales need to be taken into account: "happening here and now (1,2,3,5,6)", "ontogenetic speed (2,7)", or "phylogenetic speed (4,6)"

Surprisingly, the models described above which are based on material basis of physical phenomena, and the other models treating higher phenomena have similar frame of capturing their objectives. The conventional cognitive framework shows a room to understand the intelligence, probably because it leaves a possibility of that robots or ocean has consciousness in their intricate web of dynamics.



References

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