Genomes for self-constructing, self-modifying information-processing architectures

Draft Abstract for talk at SGAI-2010 Workshop on Bio-inspired and Bio-Plausible Cognitive Robotics

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Work with J.M.Chappell

Last updated: 17 Nov 2010
Installed: 17 Nov 2010

Abstract:

Between the earliest proto-organisms and modern complex animals, evolution has produced hugely varied physical forms, physical behaviours, life-cycles, and modes of reproduction.
All use information of various kinds (along with matter and energy). Information contents control internal and external processes: including changes through learning and development of individuals, and in genome development by evolution. Information contents are also involved in social and cultural changes.

I conjecture that animal intelligence involves far more diversity in forms of information-processing than we have dreamed of so far, and that major sources of that diversity lie in various layers of complexity in the physical, biological, and social environments in which evolution and individual development occur.
Contrary to assumptions of many researchers interested in embodiment, some of the more abstract features of the environment (e.g. rigidity and diversity of 3-D terrain structures) can have a common influence on evolution of information-processing in animals with very different neural mechanisms, sensory and motor systems and morphology, though implementations of common functionality can differ enormously.
The ontologies currently used for observation and theory-construction by most neuroscientists, psychologists, biologists, and AI/Robotics researchers cannot accommodate all of those features, seriously restricting the explanatory power of theories using current ontologies.

I shall address some ways of overcoming those limitations, in part by illustrating environmental features that have received little attention, and in part by decomposing some of the functions of a genome.

The talk will build on ideas in

Jackie Chappell and Aaron Sloman,
Natural and artificial meta-configured altricial
information-processing systems, in
Int. J. of Unconventional Computing. vol 3, No 3, 2007 pp. 211--239,
http://www.cs.bham.ac.uk/research/projects/cosy/papers/#tr0609

and

Aaron Sloman,
What's information, for an organism or intelligent machine?
How can a machine or organism mean?,
In *Information and Computation,* Eds. G. Dodig-Crnkovic and M. Burgin,
World Scientific, 2010,
http://www.cs.bham.ac.uk/research/projects/cogaff/09.html#905

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