UK COMPUTING RESEARCH COMMITTEE

A Response to Thematic Group 5: Intelligent and Cognitive Systems

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[This response is by Yorick Wilks, Professor of Artificial Intelligence at the University of Sheffield (UK), on behalf of UKCRC, the UK Computing Research Committee, an Expert Panel of the British Computer Society, the Institution of Electrical Engineers and the Council of Professors and Heads of Computing. It was formed in November 2000 as a policy committee for computing research in the UK. Its members are leading computing researchers from UK academia and industry. Committee members have had sight of this response and have made comments on it, but its content should be considered only as the views of its author.]

The research program proposed in the document is a holistic one, in the sense of aiming for a full-scale implemented and integrated model of intelligence, in a single embodied entity, rather than a set of implementations of different faculties or functionalities. Its emphasis is specifically sensorimotor and neurophysiological, as opposed to representational in the sense of traditional artificial intelligence, and its key notions are morphological computation (in the sense of computing the development of tissues and organs directly), artificial life, growable materials, behavioural neuroscience, embodied, situated response to environments, self-assembling materials and , crucially, the emergence of properties such as purpose from the interaction with an environment.

Although it is probably a healthy research impulse at intervals to advance research in this way and renounce work on fragmented problems, that approach relies on the component technologies being in a state where that is possible, and it is far from obvious that is the case here. The authors themselves write “growth in artificial systems is not well understood” (p.6). Again, there is the serious problem, which they barely mention, of how a holistic, autonomous individual implementation could possibly be evaluated.

The document is deeply confused about the role of cognition and explicit representation: it seems to say that its focus is agents that are intelligent/cognitive in some way `like’ humans, and at the same time says such agents cannot have built-in purpose, but must somehow develop purposive behaviour emergently. This is a very odd position to take as the basis for a research program. The document proposes to drive intelligent systems upwards from sensorimotor `hard’ technology without initially installing a significant cognitive capability but also without allowing for the extremely long term evolutionary process in which purposive behaviour would be gradually emergent.

Another major objection to the report’s main thrust, against research on cognitive structures directly, is that people can perceive, think about and reason about things they are totally incapable of doing or producing using their own bodies, e.g. flying to the moon. Species such as our own have also evolved the ability to represent actions in a manner that is neutral between different ways of producing or perceiving them. If planning is tightly tied to the action itself, this possibility cannot exist. This is also an obvious limitation on the authors’ research program.. In sum, there appears to be no recognition of the role for complex agent systems, of communication and the cognitive capabilities, especially symbolic ones, required to support it.

The authors of report have taken an extreme position that cognitive modelling, as the notion has been understood for the last forty years, has no role in the future of research in cognitive systems; and this position is simply assumed not defended. It may be that this is done on the (unspoken) assumption that research within the traditional approach (reasoning, knowledge representation, language etc.) will continue in other IST research units. This assumption, if made, is a political one that should be made explicit and defended in this research proposal.