What can post-classical computation do for post-cognitivist psychology?

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Traditionally, computational modelling in cognitive science has focused on a *computational functionalist* stance towards mind. Firstly, that we can understand aspects of mind by considering the activity within the mind regardless of the substrate in which that activity is realised (functionalist). Secondly, that a computer is a sufficient medium for the realisation of the activity that is realised in neurally-substrated minds (what we might call *computationalism*).

There has been much analysis and criticism of the functionalist side of this stance. However the computationalist side of the stance has received less attention. In this paper I would like to embark on such an analysis.

The computationalist stance must needs be grounded in some model of what computation is. In work to date this has been a *classical* stance on computation, which delineates the scope of what we call computation by giving an abstract mathematical model of a computer (e.g. a Turing machine) and takes as an axiom the notion that all computers are physical realisations of that abstract mathematical machine.

In recent years a new approach to the foundations of computing has been devised, known as *post-classical*, *non-classical* or *reality-based* computing (Stepney et al., 2005a; Stepney et al., 2005b). This has its origins in the ideas of Feynman on simulating the world (Feynman, 1982), who suggested that when we find a phenomenon in the world that is difficult/impossible to simulate on a computer, this implies that we could build a new kind of computer based on that phenomenon. Thus in this stance we ground computing by assessing the computational capabilities of physical systems in the world, rather than basing computing on a mathematical model of computation.

My intention in this paper is to explore the consequences for the study of mind of this stance on computation. If we take computation in this reality-based sense, what does the computational functionalist stance on mind tell us? What implications does this have for the relationship between neurally-realised mind and body states (e.g. in the heart or gut) that are not traditionally regarded as providing a substrate for aspects of mind (Johnson, 2005)? Can this inform the debate on the role of the body in affect (Damasio, 1994)? How can we use these ideas in building theoretical models and computational simulations of mind?

References

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