Chapter 7.2
Does a Functioning Mind Need a Functioning Body?: Some Perspectives from Postclassical Computation

Colin G. Johnson
University of Kent, UK

ABSTRACT

In recent years, the idea that somatic processes are intimately involved in actions traditionally considered to be purely mental has come to the fore. In particular, these arguments have revolved around the concept of somatic markers, i.e., bodily states that are generated by mind and then reperceived and acted upon. This chapter considers the somatic marker hypothesis and related ideas from the point of view of postclassical computation, i.e., the view that computing can be seen as a property of things-in-the-world rather than of an abstract class of mathematical machines. From this perspective, a number of ideas are discussed: the idea of somatic markers extending into the environment, an analogy with hardware interlocks in complex computer-driven systems, and connections with the idea of "just-do-it" computation.

INTRODUCTION

One of the main topics of this book is the computational requirements for the existence of a functioning mind. This could either be a "purely rational" mind, or it could be a mind with affective capacity. In this chapter, I would like to consider to what extent it is possible for such a mind to exist in isolation from some form of "body." In particular, this question will be considered from the point of view of postclassical computation, which attempts to ground computation not in mathematical theories of abstract machines but by an analysis of the computational capabilities of the real world.

We will take a nondualist perspective as an axiom. Therefore, there is a requirement for the mind to be realized in some fashion in the physical world. The aim here is to consider the relationship between those parts of the body that act as

a substrate for mind (in the sense that they could be replaced in a functionalist fashion by another substrate with no difference) and those parts of the body that influence mind yet that cannot/are not part of a substitutable substrate. The "cannot/are not" in the previous sentence can be interpreted usefully at a number of levels. A strong notion may be that there are no physically possible ways of realizing the same phenomenon. Some phenomena may admit a weaker notion in that it is "easier" in some sense (for example, faster, more energy efficient) for the mind to process this phenomenon using an alternative process rather than processing it on the neural substrate.

This chapter is structured as follows. The first section consists of a review that gives a context for the current work. This consists of an outline of notions of embodiment from the cognitive science and robotics literature and the core ideas of postclassical computation. The main sections of the chapter are concerned with in-the-world extensions to Damasio's theory of somatic markers (1994), connections between notions of the embodied mind and ideas of hardware interlocks in computing systems, and connections between the mind–body relationship and "just do it" computation. A final conclusion summarizes the arguments of the chapter.

BACKGROUND

This section reviews the two main ideas on which this chapter is based. In the first part, notions of embodiment from the robotics literature are discussed. The second part discusses the idea of postclassical computation, i.e., computation that is based on the properties of physical objects in the world rather than on specific abstract models of computing machines. The final part looks at ways in which these two areas can be linked.

Notions of Embodiment

In recent years, much has been written about the importance of embodiment in the study of robots and autonomous machines. A definition of embodiment is given by Quick et al. (1999): basically, the embodied object is able to perturb some states of the environment and vice versa. There are a number of ways in which such notions are important for cognitive science research (Quick et al., 1999; Wilson, 2002; Ziemke, 2001, 2003).

In order for cognition to occur in the world, it has to be realized in some worldly "stuff." This alone is sufficient reason for considering notions of embodiment to be important to the arguments in this chapter. However, there is a second reason that is yet more relevant: the stuff in which cognition is realized will influence the cognitive capacity of the system. The brain-substrate, on which neural-network models of mind reside, opens certain pathways for, and places certain constraints on, the kinds of computations that can be carried out. By delegating parts of cognition to the body, a different set of computational affordances (Gibson, 1977; Norman, 1988) is provided.

A third perspective is that some procedures make use of their being-in-the-world as part of their functioning. Brooks (1991) said that "the world is its own best model," and many artificial cognitive systems consist of a reactive model, taking information from the world in an implicit fashion and reacting to that information, rather than building up an internal model of the world.

Another aspect of embodiment is that the actions of an embodied cognitive system are potentially unlimited. An action carried out on the mental substrate is limited by the computational capacity of that substrate. However, once a computation is sent off-substrate into the world, this restriction is removed.