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**Routines and Problem-Solving in the Evolutionary Theory of the Firm:
Cognitive and Epistemological Foundations**

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The evolutionary theory of the firm can be distinguished from mainstream theories, such as transactions cost or agency theory, by its central focus on knowledge. The firm, in the evolutionary approach, is conceived first and foremost as an entity whose function is to store, accumulate and generate knowledge. The notions of routine and search are central to these functions. Routines are the organisational analogy of human skills, since they develop through learning and they embody knowledge. They constitute a form of 'organisational memory', since they preserve for the organisation the lessons of the past. Search, which itself can be routinised to some extent, allows the firm to generate new knowledge and to solve problems.

Given the central role of the concepts of routine and search in the evolutionary account, it is important to examine their cognitive foundations. This paper argues that the conception of human reasoning developed in the evolutionary account can be traced to Newell and Simon's (1958, 1961) early work on the computer simulation of human problem-solving. More generally it bears the imprint of their conception of human cognition in terms of physical symbol systems. This legacy can be seen most clearly in the view that computer simulation provides an adequate tool for developing a realistic characterisation of organisational knowledge and decision-making. Underlying this epistemological stance is the view that organisations, much as human minds and computers, are complex information processing systems. Correspondingly, it is argued, much can be learned about how organisations use and develop knowledge by studying the characteristics of computer programmes.

This tendency to anthropomorphise organisations while simultaneously using the computer as a model for human cognition is not something which emerged *de novo* in the 1980s and

1990s, through a creative integration of concepts from mainstream cognitive psychology into the theory of the firm. Rather, it arrived by a more circuitous path, having its roots in the behavioural theory of the firm associated notably with March and Simon (1958) and Cyert and March (1963), from which Nelson and Winter (1982) borrowed heavily in developing their evolutionary account. It is thus to this legacy that I turn Section 2 of this paper, using the discussion as a vehicle for presenting the basic concepts of the evolutionary theory of the firm.

Nelson and Winter (1982), while identifying the basic elements for the construction of an evolutionary account of organisational behaviour, do not operationalise them. There is no sustained analysis of the mechanisms that assure coordination within the firm. As the authors observe, this can be explained by the fact that their primary aim was to model industry behaviour and not firm behaviour. Correspondingly, much of the ingenuity in their formal modelling exercises has to do with specifying the mechanisms linking together the behaviour of collections of heterogeneous firms rather than the mechanisms linking together heterogeneous agents within the firm. In order to put flesh on the bones, I turn in Section 3 to what I consider to be one of the major achievements of recent computational modelling exercises: the use of genetic algorithms in the framework of object orientation in programming to analyse the importance of internal coordination mechanisms for the way heterogeneous agents adapt their behaviours to external changes in the environment.

In Section 4 of the paper I turn to a key debate in the literature on routines, namely the question of whether research should focus on routines understood as *rule-based representations* or on routines understood as *behaviours*. By analogy with the genotypical/phenotypical distinction in biology, this can be seen as asking whether routines may be identified with an underlying code formed of rule-based mental models which find their phenotypical expression in particular behaviours which are subject to natural selection. I argue that more is at stake here than whether it is possible to extend the biological analogy in the evolutionary theory of the firm to incorporate a two-stage neo-Darwinian selection argument based on the distinction between genotypes as ‘replicators’ and phenotypes as ‘interactors’. Rather, the fundamental issue at stake here is whether, in keeping with Newell and Simon’s physical symbol hypothesis, symbolic structures and operations on these structures (e.g. reproduction, modification, destruction) can provide a psychologically accurate characterisation of knowledge and its development in organisational settings.