

# ON THE CONCEPT OF ROUTINES IN THE CONTEMPORARY EVOLUTIONARY APPROACH TO ECONOMICS

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## 1. Introduction

Even though the connections between economics and evolutionary biology have been present since the early times of the latter discipline (see, e.g., Hodgson, 1993), in the last 25 years we have been witnessing the development of a modern evolutionary approach to economics, whose theoretical and empirical contributions in domains such as innovation studies, theory of the firm, and industry dynamics, among others, are far from insignificant.

One of the most influential works within this strand of research was Richard Nelson and Sidney Winter's *An Evolutionary Theory of Economic Change* (1982). In this book Nelson and Winter (henceforth N&W) put forward a number of models in which economic growth and industry dynamics are presented as the result of evolutionary processes. However, a significant part of their effort is targeted to overcome the view of firm's capabilities and behaviour which pervades the mainstream economic thought, and which they see as highly unrealistic and inadequate. N&W sustain that «modelling at an industry- or an economy-wide level ought to be guided and constrained by a plausible theory of firm capabilities and behaviour that is consistent with the microcosmic evidence.» (p.52) Accordingly, they dedicate three chapters of the book to the development of a theory of firm's capabilities and behaviour; the specific modelling efforts presented in the latter chapters of the book are regarded as summarizing the main implications of their view of the micro level.

In fact, the theory of firm's capabilities and behaviour N&W put forward in their 1982 book as been rather influential, both in economics and in organizational sciences

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(probably more influential than the evolutionary models of growth and industry dynamics themselves).

My goal in the present text is to critically assess N&W's proposed theory of capabilities and behaviour, and more specifically the concept of 'routines', which appears as a central concept in their theory.

The term 'routine' is now often found in contributions to the study of organizations and organizational change. Still, the exact meaning of the term – and, consequently, its empirical counterpart – is not always clear. In some sense, this should not be surprising since, in spite of its centrality, N&W themselves assumedly use the term in a highly flexible way: «it may refer to a repetitive pattern of activity in the entire organization, to an individual skill, or, as an adjective, to a smooth uneventful effectiveness of such an organizational or individual performance.» (p.97)<sup>1</sup>

Conceptual flexibility should not be seen as a problem in itself, as long as it does not obscure the fundamental axis of an argument. This is something that can only be assessed by analysing the use of a concept in its context. In what follows, I'll start by putting the term 'routine' into the context of the evolutionary theory of economic change as proposed by Nelson and Winter – namely, to understand its relevance within the general evolutionary approach. In section 3, I discuss the problems which were left unsolved in N&W's book and which motivated further discussion among the community of evolutionary economists. Finally, I conclude with a reference to the future challenges faced by the evolutionary theory of organizational capabilities.

## **2. The role of the concept of routine in N&W's evolutionary framework**

According to Nelson (1995), the evolutionary mode of explanation is characterized by its focus on a variable, or set of variables, that go through processes of change over time. The main theoretical concern is to understand the dynamic process underlying the

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<sup>1</sup> In Dosi, Nelson & Winter (2000) the authors retract from this too wide definition, proposing to stick to a sharp distinction between organization routines and individual skills; this was not always the case in Nelson and Winter (1982), where, as can be seen in the quotation above, skills are sometimes considered as types of routines.

observed changes. The theory suggests that the variable or system at hand is subjected to variation or disturbance (which is somehow stochastic), and that there are mechanisms that systematically filter (that is, select) the diversity thus generated. The predictive power of this sort of theories largely rests on the specification of the selective forces. Furthermore, it is assumed that strong inertial tendencies preserve what survives the selection process. At the same time, there are forces that keep on introducing variety into the system, on which selective forces will act.

In sum, evolutionary approaches present three constitutive elements (Dosi & Nelson, 1994; Hodgson, 1993): (i) variation among the elements of a population (e.g., an industry), (ii) heredity (or continuity), that is, mechanisms through which individual traits are transmitted through generations, and (iii) selection, leading to the greater descent or lesser mortality of individuals most adapted to a certain context.

As N&W note in numerous passages of their book, the general idea that market competition is analogous to biological competition and that business firms pass a survival test imposed by market forces has a long tradition in economics. What they propose to offer is a systematic development of these ideas, based on the connection of evolutionary thinking to the work of behaviouralists (such as Simon, Cyert, and March) on the understanding of human behaviour in organizational contexts.

Following the behaviourist tradition, N&W sustain that human beings are boundedly rational – they have limited computational capacities to deal with all the information they can access, and live in a complex and changing world which is inherently uncertain.<sup>2</sup>

Moreover, N&W view organizations as a locus of conflict among individuals and groups in what concerns the definition of goals and the implementation of tasks. In this vein, N&W go back to a problem which pervades social theory since the Scottish Enlightenment, that is: how is it possible that a decentralized social system, composed

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<sup>2</sup> They reject therefore a rational (in the sense of optimising) model of decision making in which agents are seen as maximizing the expected value of an objective function (utility, profit) given the available (or obtainable, at some cost) information about the relevant variables (including the outcomes of their actions in all possible future states of the world, and the probability of occurrence of these different states).

of numerous individuals with more or less divergent goals, operates in an orderly way, thereby assuring the well-being of its members? This was, of course, a founding problem in Adam Smith's work and it was the basis of a great deal of brain effort put into 20<sup>th</sup> century economics (namely, in the domain of General Equilibrium Theory). Within the neoclassical tradition in economics the problem of coordination among individual agents is solved through the market system (the adjustment of prices in response to the supply and demand conditions - which are supposed to be known, either with certainty or with a probability distribution).

However, when radical uncertainty is assumed (as is the case in the evolutionary approach), the market system may no longer assure coordination. Furthermore, if agents are boundedly rational, individual cognitive limitations in dealing with information can prevent the achievement of ordered interactions. Still, coordination in human collectives (namely in firms) is a fact of the world and in the evolutionary approach it is explained on the basis of routinized behaviours.

N&W suggest that coordination is achieved in firms when individual members, knowing their jobs, correctly interpret and respond to the stream of incoming messages (both verbal and non-verbal, resulting from both deliberate and non-deliberate acts of communication) they receive from other members and from the environment. These messages are generated by the performance of routine tasks and in turn are interpreted as calling for particular performances by their recipients, which generate other performances, messages, interpretations and so on. What is relevant for the present goals is that, while part of the individual abilities involved in this informational process are not organizational specific (corresponding instead to skills such as speaking and understanding a common language, which are acquired outside the organizational contexts), other abilities are developed within each specific organization.

In this sense, productive knowledge is partially collective and organizational specific. As N&W put it: «(e)ven if 'knowing' is something that only humans can do, the knowledge stored in human memories is meaningful and effective only in some organizational context, and for knowledge exercised in an organizational role that context is an organizational context.» (p.105) This organizational context is given by physical elements, such as the equipment and the working environment in general, but

more importantly by the information possessed by the different members of the organization, and the specific communication system that results from the experiences shared by those members in their past organizational performance.

The coordination thus achieved among individual members is highly efficient since while each member must know her or his job, there is no need for a centralized account of the coordination process. In fact, N&W argue, an exhaustive symbolic account of the organization's methods cannot exist, since the knowledge involved remains to a large extent tacit<sup>3</sup>. Therefore, the routinization of activity in an organization constitutes the most important form of storage of the organization's specific operational knowledge (p.106). In sum, routinization reflects the achievement of coordination and the establishment of an organizational memory that sustains such coordination.

Up to this point, only the cognitive dimensions of coordination have been mentioned. But in N&W's view, routinization also has a role to play in aligning the motivation of organizational members with the requirements of organizational functioning. In what concerns motivational issues, N&W converge with the 'contractualist' approaches<sup>4</sup> in assuming that rule-enforcement mechanisms leave individual behaviours with substantial areas of behavioural discretion. In their view, even if rule-enforcement is complemented with other motivational mechanisms, both manifest and latent conflict persists in organizations.

Routines, N&W argue, work as a truce between organizational members with diverging interests. In spite of persistent conflicts of interests, given the uncertainty about the potentially disruptive effects of dealing with the disagreements in a routine-breaking fashion, members are usually willing to continue to perform to their usual standard, and manifest conflict follows largely predictable paths that are consistent with the ongoing performance. In N&W's view, this is a fundamental reason for the prevalence of

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<sup>3</sup> This is, in fact, another source of efficiency of routines – they substitute calculative decision with automatic consent, thereby saving on computational efforts by agents, who can thus focus their attention on the more fundamental problems arising from the ongoing productive activities (see Grandori, 2001).

<sup>4</sup> The contribution of Williamson's ideas are explicitly acknowledged.

routines in organizations: the «fear of breaking the truce is, in general, a powerful force tending to hold organizations of relatively inflexible routine.» (p.112).<sup>5</sup>

This is also one reason why prevailing routines in organizations tend to be less than optimal. Namely, even if a contemplated action is otherwise sensible both for the organization and for the member taking it, it may have to be rejected if it is likely to be interpreted as provocative (Nelson and Winter, 1982, p.111).

This background offers the essential ingredients that allow us to understand the centrality of the concept of routines in N&W's work. Routines play the role that genes play in evolutionary theory: they are persistent features of organism (firm) and determine its possible behaviour (actual behaviour also depends on the environment); they are heritable in the sense that tomorrow's organisms generated from today's have many of the same characteristics (e.g., a new production facility of a firm); and they are selectable in the sense that organisms with certain routines do better than others, and, if so, their relative importance in the population (industry) is augmented overtime. (Nelson and Winter, 1982, p.14)<sup>6</sup> These are in fact the basic ideas that underline the models of growth and industry evolution developed by N&W in latter chapters of their celebrated book.

### **3. Some problems with N&W's use of the concept of 'routine'**

Notwithstanding the illuminating and path-breaking character of many of the arguments put forward by Nelson and Winter (1982), their use of the concept of routine gave rise to many discussions, which to some extent result from the way the term was dealt with by N&W themselves. In what follows I will try to discuss what seem to me the most relevant issues.

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<sup>5</sup> Inflexibility of routines can also derive from the fact that in functioning complex systems with many highly differentiated and tightly interdependent parts, changes in one part (even when looking as obvious improvements when viewed from a particular role) can easily have adverse effects elsewhere in the system; since a comprehensive understanding of the system cannot be obtained, organizations will tend to resist 'mutations'.

<sup>6</sup> Furthermore, one can say that, given this framework, two fundamental conclusions derived from evolutionary biology concerning living organisms are also applicable to socio-economic entities (including technologies and institutions); namely, they are both (i) sub-optimal and (ii) not deliberate (at least not entirely, in the social realm).

### 3.1. The use of the biological analogy

To begin with, N&W are not totally clear about the extent to which they are willing to push forward the analogy with biological evolution. Some times N&W referred to routines as behavioural patterns of firms. In other passages (see last paragraph of section 2) N&W seem to suggest a distinction between actual behaviour and routines, the latter being understood as rules that determine possible behaviour of firms (the actual behaviour depending also on the environment), in what closely resembles the biological distinction between genotype and phenotype.

This is somewhat problematic. The difficulties raised by the direct transposition of the biological evolution to the socio-economic realm are widely recognized – and, actually, they are explicitly mentioned by N&W. Such difficulties derive from the inexistence of a real analogy with biological heredity, as well as from the fact that socio-economic systems are characterized by deliberation, purposefulness and choice in human action – elements that offer possibilities of variation and transmission which are inexistent in the biological domain.<sup>7</sup>

This problem, however, does not necessarily represent an overwhelming obstacle to the use of an (arguably weak) evolutionary analogy in the understanding of economic dynamics. All that is needed for the use of the explanatory triad ‘variation-selection-retention’ is that organizations are characterized by some traits which remain constant over a period long enough for a selective feedback from the environment to operate. Routines can be considered as corresponding to these persistent traits, and this would assure the internal consistency of the proposed theory. One problem that remains is the one of assessing empirically the relevance of those evolutionary mechanisms in explaining economic change in each concrete situation. I’ll come back to this issue later.

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<sup>7</sup> This is the reason why it is often stated that socio-economic evolution is more ‘Lamarckian’ than ‘Darwinian’.

### 3.2. The role of efforts for organizational change

Another problem then arises, which can be stated as follows: why should one expect firms' behaviours to be determined by routines, when deliberate innovative activities, and design of strategies and structures to produce and control behaviour, are often attempted by the organizations?

N&W promptly recognized that there is a great deal of business behaviour that is not routine behaviour – and this includes the recognition of deliberation and purposefulness elements in firm's actions. But these elements are treated in their models as stochastic, while most of regular and predictable behavioural patterns of firms are subsumed under the heading 'routine'. One could be led to infer from this that the centrality of routines in N&W's framework is essentially a matter of formalistic convenience, a consequence of the difficulty to model the more purposeful elements of firm's behaviour. If this were the case, it would constitute a serious shortcoming of the evolutionary approach, for its empirical relevance would risk being rather weak.

In fact, In N&W's view, this does not seem to be the case, as can be understood from the following quotation: «the behaviour of the firms can be explained by the routines they employ. (...) Modelling the firm means modelling the routines and how they change over time.» (Nelson and Winter, 1982, p.128) That is, N&W argue that routines are in fact the main determinants of firms' behaviour (and, ultimately, of their success<sup>8</sup>). How can this be made compatible with the above reference to the deliberate innovative activities and design of strategy and structure by organizations? Three arguments put forward by N&W (and other evolutionary economists later on) can be related to this problem, and help to solve the puzzle.

First, one should recall the role of routines as truce, mention in section 2 above. The members of an organization, including its managers, are constrained in their choices by the fear of breaking the truce by changing an established practice. This means that firms do not have a broad menu of alternatives to choose from – the scope of their choices is

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<sup>8</sup> We have here implicit a theoretical debate which is central to the strategic management literature, opposing those authors who sustain that competitive advantage of firms derives from strategic investments and market positioning, to others who see it as resting on firms' idiosyncratic and difficult to imitate resources. (Teece, Pisano and Shuen, 2000)



somehow narrowed by the members expectations, which are intrinsically related to the prevailing routines. As Dosi, Nelson and Winter (2000, p.11) put it, «(t)entative choices that are actually incompatible or substantially subversive of the overall performance get rooted out in the course of learning (...). Choices compatible with the overall performance are allowed to stabilize and become habitual, without either the choices or the habits necessarily being recognize as such along the way.»

Second, N&W's notion of routines includes not only the operational level, but also the investment decisions, and the higher-order procedures which operate to modify the operating characteristics of firms. The latter include what is generally called 'innovation'; and this is very important in N&W's framework, since technical innovation is a central topic in their book and innovations are seen as changes in routines. In N&W's view, although uncertainty of the results is a fundamental characteristic of innovative activities, the nature of the activities themselves may be highly routinized. The routinized arrangements for producing innovations and solutions to problems are considered under the notion of 'heuristic'. A heuristic is any principle or device that contributes to the reduction in the average search of a solution (p.132).<sup>9</sup> Heuristics vary in the scope of application. They include high-level decisions of a business firm, such as strategy and principles guiding the selection of organizational structure. In sum, innovative activities and all the patterning of organizational activity that the observance of heuristics produces are assimilated to the concept of routine. (Nelson and Winter, 1982, p.133).

Third, and finally, N&W are careful to note that the analysis they put forward does not necessarily apply to every kind of organization. The organizations they have in mind are large and complex organizations, with high division of labour and related problems of coordination, and which provide goods or services that are similar over extended periods (Nelson and Winter, 1982, pp.96-97). It is in such organizational contexts that routines play a crucial role as 'repositories of organizational knowledge' and as truce among members.

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<sup>9</sup> Newel, Shaw and Simon are the main references here.

In sum, N&W seem to suggest that the firms they have in mind, due to their complexity and consequent need for decentralized coordination, may be expected to behave in the future according to the routines they have employed in the past; and the behaviour they refer to includes the operational level, the investment decisions and the heuristics followed in innovation and problem-solving activities<sup>10</sup>. Even if the results and impacts of problem-solving efforts by firms (including innovative activities and the design of strategies and structures) are difficult to predict (and are therefore regarded as stochastic), they can be seen as following quasi-routine patterns (and, consequently, are modelled as such).

### **3.3. Empirical assessment of routines**

It results from the former discussion that it may be reasonable to expect some organizations' behaviour to follow routine patterns, namely due to the constraints imposed by the requirements of coordination among bounded rational individuals.

In fact, it is not difficult to find examples of somewhat recurrent patterns of behaviour in several organizations. The gist of the Fordist model of production was very much the automatic reproduction of interactions among individuals, and between individuals and machines; and many of its ingredients are still to be found in manufacturing firms around the world. More generally, the administrative and other back-office procedures in most organizations visibly follow more or less stable patterns.

This is not to say that one should expect to widely observe instances of strictly repetitive patterns of action in organizational activities. In a comment included in Cohen et al. (1996), Egidi notes that purely routinized collective behaviours are rather difficult to realize. Routinized collective behaviours require coordination rules prescribing

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<sup>10</sup> In Cohen et al. (1996), Winter suggested the following typology of routines (based on the different ways a routine may relate to the cognitive functioning of the individuals involved in its performance): (i) routines (narrow sense) - highly automatic behaviours involving high levels of unconscious information processing; (ii) rules of thumb - quantitative, relatively simple decision rules that are consciously invoked and require low levels of information processing; (iii) heuristics and strategies - concepts and dispositions that provide orientation and a common structure for a range of similar problem-solving efforts; (iv) paradigms, cognitive frameworks - fundamental mental models that affect perception, problem solving and other cognitive functions.

actions which are compatible with the actions performed by the partners, taking into account the reaction to other's actions, including errors and conflicts. This means that interactions among actors require a huge set of rules (increasing exponentially with the number of participants) governing those interactions. But there are limits to the complexity of the set of rules that can be activated by boundedly rational actors. Beyond this threshold, reasoning cannot be substituted for by purely automatic behaviour. More than isolated individual action, collective coordination is expected to involve some degree of deliberation and learning.

This will be more so in contexts of rapid change in technologies, regulations and competitive conditions. As Zollo and Winter (2002) suggest, in such contexts operating routines are not expected to be persistent; on the contrary, systematic efforts by the firms are needed to track environmental change. It was noted in sub-section 3.2 above that evolutionary economics deals with this apparent paradox by pointing to the notion of 'heuristics' as pattern methods guiding problem-solving. Zollo and Winter have developed these ideas by suggesting the existence of two different sets of organizational activities: *operating routines*, geared towards the operational functioning of the firm; and *dynamic capabilities*, dedicated to the modification of operating routines. They suggest that for a firm to show persistent superiority and viability in the market its dynamic capabilities have to be structured and stable.<sup>11</sup> That is, dynamic capabilities – just like heuristics in Nelson and Winter (1982) – are seen here as second-order routines.

Thus presented, the notion of dynamic capabilities is enough to preserve the evolutionary perspective that “firms are not frictionless reflections of their momentary environments, but rather highly inertial action repertoires, responding to (...) today's environment largely in terms of lessons learned from actions in days gone by.” (Cohen et al., 1996)

But this does not make it any easier – actually, it makes it harder to deal with - the problem of empirically assessing the presence and relevance of routine behaviour in organizational contexts. As pointed out by Cohen and Bacdayan (1994), the

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<sup>11</sup> These ideas converge with Grandori's (2001, Ch.7) suggestion that flexible organizational cultures focus on values and principles instead of routines.

understanding of routines is hampered by three basic characteristics: (i) they are multi-actor, and thus harder to grasp than single-actor phenomena; (ii) they have an emergent quality, largely evolving from experiential learning rather than from explicit decision making (which make it difficult to understand the functions of particular acts); and (iii) the underlying knowledge of the parts of routines held by individual actors is often partially inarticulate (individuals may not be able to explain what they do and why).

If, additionally, the concept of routines is taken as wide enough to include highly automatic behaviours, rules of thumb, heuristics and strategies, and even paradigms or cognitive frameworks (see footnote 10), then its empirical identification may become an overwhelming challenge. One thing is to observe recurring action patterns in actual collective behaviour (which is something rather difficult to realize – as mentioned before); another thing is to infer from varying actual organizational behaviour the presence of stable heuristics or cognitive frameworks – the dimensions that give continuity and idiosyncrasy to firms in contexts of significant environmental change.

By making these remarks I am not suggesting the impossibility to establish an empirical counterpart to the evolutionary claims on firms' behaviour. In fact, the papers by Cohen and Bacdayan (1994) and Pentland and Reuter (1994) correspond to examples of empirical exercises (the first based on a laboratory study, the second on a real world situation) that show the presence of routine behaviour, even in the absence of strict recurrent action patterns. Still, it might be often overwhelmingly difficult to show the relevance of idiosyncratic 'organizational capabilities' for the relative success of firms in competitive contexts. The chapters included in the collective book edited by Dosi, Nelson and Winter (2000) are important both as examples of the possibility of approaching the role of routines in an empirical manner, and as evidence of the difficulty (and corresponding scarcity) of such exercises.

#### **4. Conclusions**

The need to justify the applicability of the evolutionary sort of explanation to the realm of economic change led N&W to develop a rather insightful and influential account of organizational behaviour (drawing largely on the works of Simon, Cyert and March, as

well as on other authors such as M. Polanyi and Williamson, to form a coherent theoretical whole).

At the centre of that account lays the concept of routines. In N&W's book the term 'routine' was used in a somewhat loose fashion, giving rise to subsequent discussions about issues such as the applicability of the analogy with the biological evolution to economic change, the scope of the notion of routines, the role of tacit vs. explicit components, the role of deliberation vs. automatic behaviour, the empirical correspondence of the theoretical constructs, among others.

I argued above that most of the developments within the evolutionary approach since N&W's book have helped to clarify many of those issues and therefore gave more internal consistency to the evolutionary perspective on organizational behaviour. At a general level, the point that understanding how organizations develop, maintain, and advance their capabilities is fundamental to understand how society works and how it changes (a crucial point in the evolutionary endeavour) is now widely accepted – even if largely ignored by mainstream economic models, to which N&W directed their main criticisms more than 20 years ago. At a more specific level, the idea of firms having ways of doing things that show strong elements of continuity and which are distinctive, seems to be supported by much empirical evidence (Dosi, Nelson and Winter, 2000).

However, it was also noted that it might be rather troublesome to identify persistent cognitive elements underlying the actual behaviours of firms. As a consequence, the statement that the competitive advantage of certain firms in given industries derives from persistent and idiosyncratic features of those organizations<sup>12</sup> will often remain as little more than an *ad hoc* assumption (independently of its possible adequacy in explaining real world phenomena).

This poses some methodological problems to evolutionary economics, which should not be ignored if this approach is to keep its declared commitment to realism. Namely, two (related) basic assumptions demand some kind of previous empirical scrutiny, when the evolutionary mode of explanation is to be applied: (i) the notion that the behaviour of firms can be explained by the routines they employ (as noted before, this may apply to

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<sup>12</sup> A point that evolutionary economics shares with different strands of the so-called 'resources-based theories of the firm'

some organizations, but not necessarily to all of them), and (ii) the idea that organizational traits remain stable over a period long enough for significant selective feedback from the environment to operate, and the 'fitness' of those traits will determine the relative success of each firm. It might be the case that momentary strategic moves show up to be at least as important as organizational routines for the long run market success of firms. If that is the case, it might be rather inappropriate to insist on models that abstract from those strategic dimensions of behaviour (as tends to be the case with evolutionary models of industry dynamics).

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