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A Review of the Literature

Becker, Markus C.

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A review of the literature

Markus C. Becker
Department of Marketing
University of Southern Denmark
DK-5230 Odense M
Denmark
Tel. 0045-65503350
Fax 0045-66155129
mab@sam.sdu.dk

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Abstract

Twenty years have passed since Nelson and Winter (1982) proposed routines as the unit of analysis of an evolutionary theory of economic change. Since then, the concept of routines has been taken up widely in the economics and business literature. Many ambiguities and open questions still persist, however. The article presents a review of the literature on routines (mainly) since 1982, focussing on the questions 'What progress has been made in understanding what routines are', and 'what are their roles in organisations and in the economy?'

An Evolutionary Theory of Economic Change (Nelson and Winter 1982) was a milestone for the development of an evolutionary perspective on the economy. One of the many important contributions in the book was that Richard Nelson and Sidney Winter proposed routines as the equivalent of the gene in the social realm. Accordingly, routines would be the unit of analysis of an evolutionary perspective on the economy, the unit to be analysed in order to understand how the economy changed. Like the concept of the gene in biology, the concept of the routine would be the key for understanding how the economy changed. Twenty years have passed since Nelson and Winter have proposed routines as the unit of analysis in evolutionary economics. What has been achieved since? What do we know about the concept today? The present article presents a systematic and comprehensive review of the literature that has contributed to the conceptual development of the concept of routines, and of the empirical literature that has applied the concept of routines¹.

1. The concept of routines twenty years after Nelson and Winter (1982)

The most important fact to take note of is that in the last twenty years, the idea of routines as the most basic unit of analysis in evolutionary economic theory has been taken up by a growing number of authors. The reason is that indeed, as Nelson and Winter (1982) have suggested, the concept of routines seems to fulfil the prerequisites required of a unit of analysis in an evolutionary framework. In such a framework, the unit of analysis has to figure in the explanation of three questions: (i) how variation comes about, (ii) how selection takes place, and (iii) how what has been selected in one period is transmitted to the next period. Identifying a unit of analysis in the social realm that has these characteristics is a crucial prerequisite for being able to apply an evolutionary framework to economics. Routines appear to have gene-like stability (inheritance), the capacity to 'mutate' (variation), and to be the

object of choice and selection. Thus, routines seems to cover all aspects of evolution. The great promise that the concept of routines holds for evolutionary economics is that it might enable the application of an evolutionary explanation in economics. An evolutionary explanation is a promising candidate for explaining change in the social realm, such as for instance innovation, the diffusion of innovation, the transfer of ('best') practices, and organisational memory and organisational learning. Moreover, routines are also important because of the more immediate roles they have in organisations (for instance, in coping with pervasive forms of uncertainty, cf. Becker and Knudsen 2001).

Despite 20 years of research, many ambiguities and inconsistencies in the concept itself prevail still today. Explanations that rest on the concept are therefore not as clear as they could be. Our understanding of the concept of routines itself is still incomplete, and progress has been slow (Avery 1996). There has been 'little progress' in reaching agreement on what routines are' (Cohen *et al* 1996, p. 656; also Cohen and Bacdayan 1994, p. 556). A 'unified academic vision of the notion of routine does not exist' (Reynaud 1998, p. 468) and in 2001 still, the 'current understanding of routines remains imprecise' (Jones and Craven 2001, p. 269).

In what follows, I will present the understanding(s) of the concept of routines that authors using the concept (mainly) since 1982 have had², thus attempting to draw a picture of the consistencies and inconsistencies so they can be tackled. The presentation is structured in categories that have been generated from the literature overview. After establishing the importance of the concept of routines, I first present characteristics of routines: they are patterns, repetitive and persistent, collective, non-deliberative and self-actuating, of processual nature, context-dependent, embedded, and specific, and path dependent.

Subsequently, I give an overview over the roles routines are seen to have in organisations: to

co-ordinate and control, provide 'truce', economise on cognitive resources, reduce uncertainty, lead to inertia, provide stability and enable and constrain, act as triggers, and embody knowledge. In each category, I first present a summary of the conceptual, and then of the empirical research.

2. The concept of routines in the literature

2.1 Importance of routines

A recent empirical study has found that organisational routines are significant in explaining performance differences between firms (Knott and McKelvey 1999). This survey-based study contrasted franchises with company-owned establishments. The marginal value of access to a franchiser's organisational routines was isolated by comparing franchisees with independents (both with residual claims), and the marginal value of residual claims was isolated by comparing franchisees with company-owned establishments (both with access to the franchiser's routines) (Knott and McKelvey 1999, p. 369). The study found that

the productive value of professional managers in generating, selecting and enforcing superior organisational *routines* (or production functions) is of greater value than *residual claims* (or perfect incentive alignment) in defining firm efficiency (Knott and McKelvey 1999, p. 367-8)

and

that prescriptions for maximising efficiency through development of operational routines may offer more promise of economic success than prescriptions of incentive

alignment (Knott and McKelvey 1999, p. 380).

This finding lends empirical support to the idea that routines indeed play important roles in organisations, on top of and apart from the role they play in evolutionary explanations.

Results pointing into the same directions also come out of the Zollo, Reuer and Singh (2002 forthcoming) study, which find that ‘firms that have developed an alliance history with a partner and a corresponding set of routines have less need to turn to equity structures to align incentives, provide monitoring rights, and institute formal controls in the collaborative relationship’ (Zollo, Reuer and Singh 2002 forthcoming, p. 13).

2.2 Patterns

The history of the concept of routines reveals that the notion of 'patterns' has been central to the concept from early on (Becker 2002 forthcoming). In his first publication, Sidney Winter defined a routine as 'pattern of behaviour that is followed repeatedly, but is subject to change if conditions change' (Winter 1964, p. 263 n.). At about the same time, philosopher Arthur Koestler defined routines as 'flexible patterns offering a variety of alternative choices' (Koestler 1967, p. 44)³. The notion of routines as patterns also appears in Nelson and Winter (1982, p. 14, 15 and 113), Teece and Pisano (1994, p. 541 and 545), Sanchez, Heene and Thomas (1996, p. 7), Teece, Pisano and Shuen (1997, p. 518), Grant (1996, p. 115), Dyer and Singh (1998, p. 665), Heiner (1983, p. 334) and Cohen *et al* (1996).

What, however, do these patterns consist of? At this point, the ambiguities mentioned above come to the surface. In the literature, four different terms are used for denoting the content of the patterns: *action* (Egidi 1996; Cohen *et al* 1996; Jarzabkowski and Wilson 2002), *activity* (Winter 1990, p. 275-6; Dosi, Nelson and Winter 2000, p. 4; Jones and Craven 2000; Karim

and Mitchell 2000), *behaviour* (Nelson and Winter 1982, p. 14; Winter 1986; Gersick and Hackman 1990; Langlois and Everett 1994; Langlois and Robertson 1995; Montgomery 1995; Coombs and Metcalfe 1998; Amit and Belcourt 1999; Bessant, Caffyn and Gallagher 2000; Feldman 2000; Jones and Craven 2000; Feldman and Rafaeli 2002), and *interaction* (Dosi, Teece and Winter 1992, p. 191-2; Teece and Pisano 1994, p. 545).

Obviously, it is not clear precisely what the content of patterns is supposed to consist of. There are differences, and they are a major source of ambiguity surrounding the concept. The remainder of this section will attempt to provide some clarification.

The first difference is that whereas in economics and business theory, the terms 'action' and 'activity'⁴ can reasonably be interpreted as synonyms, the terms 'action' and 'behaviour' commonly differ in economics and business theory, where ' "behaviour" is used to indicate directly observable events' (Cohen *et al* 1996, p. 658; cf. also Gersick and Hackman 1990, p. 70)⁵. The second difference is constituted by the term 'interaction' which connotes a collective dimension. The difference between 'action' and 'interaction' emphasises the distinction between the individual and the collective level. As mentioned above, their collective nature historically distinguished routines from habits. In order to be historically consistent, routines should be understood as consisting of *interaction*. Overlooking that routines are patterns of *interaction* carries the danger of overlooking their collective nature, and conflating them with individual habits.

Thirdly, the difference between 'action' and 'behaviour' introduces a difference in observability. The term 'behaviour' is usually associated with observability. The fact that both terms are used in the literature flags an important, and so far unresolved question lingering behind the implicit⁶ assumption of observability: Do all routines have to be observable? Are

non-observable routines conceivable?

The three differences referred to above matter for reducing ambiguity surrounding the concept, and for our understanding of routines. From this very first look, we can state that recurrent activity patterns appear to exist on different levels: on the individual and the collective level, and the observable and the non-observable level, as illustrated by figure 1.

	individual	collective
not observable action	mental recurrent action patterns (mRAP) 'habits of thought'	[mental recurrent interaction patterns, mRIP ⁷] 'unobservable routines'
observable action ('behaviour')	recurrent action patterns (RAP) 'habits'	recurrent interaction patterns (RIP) 'routines'

Figure 1: A taxonomy of recurrent activity patterns

In the history of the concept, and in the literature reviewed here, the term 'routines' seems to refer most to recurrent *interaction* patterns, that is, *collective* recurrent activity patterns. As opposed to that, recurrent activity patterns on the *individual* level best fit the term 'habits' (cf. also Hodgson 1993c, p. xiv; Cohen and Bacdayan 1994, p. 555). It appears that both recurrent interaction patterns on the collective and the individual level can either be observable or unobservable.

Empirical studies support the idea that routines are patterned (Pentland and Rueter 1994; Zellmer-Bruhn 1999). As for the question of what patterns consist of, empirical studies support the idea that they are patterns of *interaction* (Cohen and Bacdayan 1994).

2.3 Repetitiveness/persistence

One key characteristic of routines is that they are repetitive (Winter 1990; Cohen *et al* 1996). Surely, without repetition, a routine is inconceivable. It is repetition without much change that renders routines stable (Coombs and Metcalfe 1998; Amit and Belcourt 1999). Stability, in turn, gives rise to predictability (Cyert and March 1963; Nelson and Winter 1982; Langlois and Everett 1994; Inkpen and Crossan 1995).

Empirical studies support the idea of being repetitive (Cohen and Bacdayan 1994; Pentland and Rueter 1994; Pentland *et al* 1996; Egidi and Narduzzo 1997; Knott and McKelvey 1999; Costello 2000; Karim and Mitchell 2000; Betsch *et al.* 2001).

2.4 The collective nature of routines

Routines are collective phenomena (Nelson and Winter 1982, p. 73; Grant 1991; Hodgson 1993c, p. 1998; Cohen and Bacdayan 1994; Murphy 1994; Lazaric 2000; cf. Stene 1940, p. 1129; Simon 1947, p. 100). Recently, Nelson and Winter have revisited this point in order to alleviate confusion: 'In our view, clarity would be served by reserving the term "skills" to the individual level and "routines" to the organisational level' (Dosi, Nelson and Winter 2000, p. 5).

Scrutinising the literature shows that the collective nature of routines has slipped attention in parts of the literature, mostly due to an unfortunate presentation in crucial passages of key works (Simon 1947; Nelson and Winter 1982). Empirical research has contributed an important caveat to this discussion: Conceptualising routines as analogous to individual habits

bears the danger of taking the analogy too far and 'subsequently missing the big picture' (Avery 1996, p. 114-5). Overlooking the collective nature of routines clearly was one important source of ambiguity. In order to be consistent with the collective nature of routines, the term 'routines' should therefore be understood as 'recurrent patterns of *interaction*'.

Recognising the collective nature of routines has important implications for understanding the concept of routines. It makes us aware that routines can be distributed (Simon 1992; Winter 1994; Scapens 1994; Marengo in Cohen *et al* 1996, p. 678; Coriat and Dosi 1998; Lazaric and Mangolte 1998; Zollo and Winter 2002). Distributedness means that knowledge held by different members of an organisation does not completely overlap, and that it is very difficult, if not impossible, to get the overview over the 'whole' knowledge in the organisation (cf. Winter 1994; Cohen *et al* 1996; Lazaric and Marengo 2000; Zollo and Winter 2002).

The distributed nature of routines gives rise to intransparency (Grant 1991) and complexity (Barney 1991). Acknowledging the collective nature of routines thus informs understanding complexity.

Empirical studies support the idea that routines are collective phenomena (Weick 1990; Cohen and Bacdayan 1994; Pentland and Rueter 1994; Jones and Cravens 2000; Edmondson, Bohmer and Pisano 2001). Weick's study has shown that routine can be disrupted when participants in a routine start 'acting in a manner that is more individual than collective' (Weick 1990, p. 579). This finding has profound implications for our understanding of the relationship between individual actors and the collective routine they participate in. In order for organisational co-ordination to not break down, a fine balance between individual habits and organisational routines needs to be kept. Empirical research also supports the idea that routines can be distributed (Pentland and Rueter 1994; Dubuisson 1998). Egidi has found that

'[o]rganisational procedures (routines) ... emerge as the outcome of a distributed process generated by "personal" production rules' (Egidi 1996, p. 303), i.e., that the collective element might arise out of the interplay of individual rules.

2.5 The non-deliberative and self-actuating nature of routines

Like habits, routines are self-actuating, being executed in a virtually automatic manner (James 1890; Camic 1986). Reflection or volition is absent or not necessary (James 1890; Reynaud 1998). Like habits, routines are characterised by individuals following them without deliberation, without devoting *conscious* or explicit attention (Ashforth and Fried 1988; Waller 1988; Langer 1989; Biddle 1990; Gersick and Hackman 1990; Cohen 1991; Louis and Sutton 1991; Kilduff 1992; Postrel and Rumelt 1992; Pentland and Rueter 1994; Nelson 1995; Dosi, Nelson and Winter 2000; Lazaric 2000; Knott 2001; cf. Stene 1940; Simon 1947). This is related to why routines are 'uneventful' and characterised by a smooth performance (Szulanski 1996; Dosi, Nelson and Winter 2000; cf. also Rumelt 1995). Because routines do not require attention, we are not usually aware of them as long as they run smoothly, and only become aware of them when they do not (Twomey 1998; 1999).

Routines have been found to have an automatic character in empirical studies, too (Cohen and Bacdayan 1994; Pentland and Rueter 1994; Betsch, Fiedler and Brinkmann 1998; Dubuisson 1998; Costello 2000). Experimental studies have shown that routines can influence choice independent of behavioural intentions (see Betsch, Haberstroh and Höhle 1999 for an overview of the psychology literature on routines).

2.6 The processual nature of routines

The processual nature of routines lies at the heart of the question that they are invoked to answer. For Winter, 'first among the focal concerns of economic evolutionary theory is understanding the nature and sources of productive competence' (Winter 1990, p. 271). Understanding that involves understanding how organisational performances come about (Winter 1990). As Penrose has pointed out, 'the services yielded by resources are a function of the way in which they are used' (Penrose 1959, p. 25). Process, therefore, matters for understanding performance and competences. Because firms typically are specialised in particular products and produce those using particular production methods, most processes will be repetitive – routines. Not acknowledging the processual nature of routines will make them a blunt tool for an analysis of economic evolution.

Several characteristics along which the processual nature of routines can be described have been identified in the literature: decay, leading to a need for 'maintenance' of routines (Hannan and Freeman 1989, p. 76; cf. Giddens 1984, p. 86); decay speed (Cohen 1991, p. 139; Grant 1991, p. 123); the speed of executing routines, of changing their contents, and of switching between them (Cohen 1991, p. 136); reaction speed (Cohen and Bacdayan 1994, p. 558); reaction time, time lags, and time delays (March 1994, p. 42); frequency of repetition and point of time of impact (Ginsberg and Baum 1994, p. 130); frequency and fashion of shifting from one routine or set of routines (Hannan and Freeman 1989, p. 76); age (duration) of an activity, speed of environmental change, quality of information with regard to the activity, amount of managerial and employee turnover, and volatility of the decision environment which all can act to intensify or dispel the influence of routines (Hirshleifer and Welch 1998).

In order to further deepen our understanding of the processual nature of routines, it is helpful to generate fruitful questions for making the processual aspects of routines accessible for

analysis, such as the following: 'Which classes of routine behaviour are capable of protracted coexistence with each other, without producing, out of their own dynamic logic, pressures for change? What classes are mutually incompatible or antagonistic, and in what time frame is the clash likely to become acute?' (Winter 1975, p. 109). In answering such questions, tensions arising from different speeds, that is, dynamic forces and tendencies (for example structural inertia, self-reinforcing effects) can be identified, greatly improving our understanding of the development, persistence and change of routines.

Empirical research has contributed many additional and rich insights regarding the processual nature of routines. Pentland and Rueter have added the insight that routines occupy 'the crucial nexus between structure and action, between the organisation as an object and organising as a process' (Pentland and Rueter 1994, p. 484), illustrating how the concept of routines offers a great opportunity for making processes accessible to analysis.

Empirical research has also identified further processual characteristics of routines: time of impact (cf. Narduzzo, Rocco and Warglien 1997), decay (Weick 1990; Cohen and Bacdayan 1994), necessary maintenance (Sherer, Rogovsky and Wright 1998; cf. Weick 1990), reaction time (Narduzzo, Rocco and Warglien 1997), delays (Narduzzo, Rocco and Warglien 1997), time needed for acquisition and what it depends on (e.g. complexity of the knowledge, Weick 1990), whether change takes place in leaps or incrementally (Weick 1990), number of repetitions and its implications for example for reliability (Weick 1990), and age dependence (Warglien 1995). These characteristics furnish us with dimensions for describing routines. Amongst those, the frequency of repetition (Narduzzo, Rocco and Warglien 1997) seems to be a particularly important one. In psychology, it is well known that the strength of association between a situation and an option often increases as a function of the relative frequency and intensity with which the act is followed by a reinforcement (Betsch, Fiedler

and Brinkmann 1998). Such frequencies are as low as 6 times (Betsch, Haberstroh, Glöckner and Fiedler 1998, p. 30), which lends support to the idea of the ubiquity of routines.

Interruptions have also been shown to play a role for routinisation: they increase the likelihood that teams engage in external acquisitions of routines (Zellmer-Bruhn 1999). Furthermore, experimental research in psychology also clearly supports the importance of time pressure and other constraints for the maintenance of routines. Several studies found that time pressure increases the likelihood of routine choices (as opposed to non-routine choices), even if the inadequacy of the routine was indicated before the choice (cf. Betsch, Fiedler and Brinkmann 1998; Betsch, Haberstroh, Glöckner and Fiedler 1998; Betsch, Haberstroh and Höhle 1999; Betsch, Brinkmann, Fiedler and Breining 1999). Under increased constraints such as time pressure, prior knowledge gains a stronger impact on choices and can also overrule new evidence in the decision process (Betsch, Brinkmann, Fiedler and Breining 1999). Empirical studies in the economics and business literature report consistent findings: Under time pressure, behaviour tends to be more routinised, as experimental subjects use only one strategy to co-ordinate their actions, even if it is inefficient (Garapin and Hollard 1999). In situations of extreme stress and pressure, team responses that were acquired more recently and practised less often can be expected to unravel sooner than those acquired earlier, which have become more habitual (Weick 1990). These findings indicate that increased time pressure (and other constraints such as stress) will not only induce falling back on routine responses – but will also lead to a preference of those routine responses which are oldest, i.e. rehearsed most often. A study on the effects of time pressure on the adoption of routines did not support the hypothesis that time pressure is negatively related to the adoption of routines from *external* sources (i.e., that time pressure leads to the entrenchment of the routines already in use) and concluded that the effect of time pressure in external search is unclear (Zellmer-Bruhn 1999). Because the experimental subjects in this study were groups, whereas

in the Betsch *et al* studies they were individuals, this result suggests that the relationship between time pressure and external information search might be different at the group and the individual level. It has been proposed that 'when time is scarce, teams will not devote scarce temporal resources to internal development of new work routines, but will instead go outside their boundaries and "grab" a satisfactory option' (Zellmer-Bruhn 1999, p. 88-9).

2.7 Context-dependence, embeddedness, and specificity

Many authors make the point that routines are embedded in an organisation and its structures, and are specific to the context (Teece and Pisano 1994; Inkpen and Crossan 1995; Cohen *et al* 1996; Dosi in Cohen *et al* 1996, p. 660; Madhok 1997; Teece, Pisano and Shuen 1997; Morosini, Shane and Singh 1998). They identify several reasons for the specificity and context-dependence of routines. First, it is the *process* of application or use of a resource that determines the services it will yield (Penrose 1959). Most of such processes are recurrent, i.e. they are routines. Application or use, however, will always take place in a specific context. Thus, successful application depends on the specificities of the context in which routines are applied. Second, context is important because of complementarities between routines and their context. Some routines need complementary elements in order to work. The notion of 'scaffolded' action illustrates that action relies on some kind of external support, in which external structures (e.g. artefacts) help to control, prompt, and co-ordinate individual actions (Clark 1997).⁸ Such an idea is consistent with the notion that general rules and procedures have to be incompletely specified when transferred across contexts, precisely *because* contexts are different. As a consequence, the application of general rules to specific contexts always involves incomplete specification and missing components, and thus the necessity of completing them (Reynaud 1998, p. 473). This will always require 'repair skills', such as interpretation and judgement skills, for example to know what routines to perform when

(Nelson and Winter 1982; Hill, Hwang and Kim 1990). Skills⁹ at the same time are a necessary supplement to more general forms of knowledge, because rules or general knowledge are applied in combination with other knowledge, the ability to apply that knowledge, and personal traits (Gordon and Howell 1959). A whole *ensemble* is required in order to put routines into application. Because routines are embedded and interlinked (Nelson 2000), they are also able to identify supporting complementary elements that are necessary for their implementation in a specific context. They are 'keyed' to certain 'elements' of the environment that act as trigger (Nelson and Winter 1973).

Several *kinds of specificity* have been identified in the literature: historical specificity (Barney 1991; Reynaud 1996; Hodgson 2001), local specificity (Simon 1976), and relation specificity (Dyer and Singh 1998). Historical specificity derives from the fact that whatever happens does so at a certain point of time, which is characterised by a certain constellation of environmental factors and interpretative mindsets (Reynaud 1996). Because such constellations will be complex, there is a low probability that routines can be replicated identically. Specificities also arise because routines are the outcome of local learning processes (Egidi 1992; Malerba and Orsenigo 1996; see also the 'principle of minimal dislocation', Foster 1981). Local specificity also arises because of cultural differences and limits to generalisation arising from those (cf. for example Simon 1976).

The most important *implication* of specificity is that routines are transferable to other contexts to a limited extent only. When removed from their original context, routines may be largely meaningless (Elam 1993), and their productivity may decline when transferred (Grant 1991). Problems with transferability arise because it may not be clear what is essential about the routines and what is peripheral (Lippman and Rumelt 1982; Nelson 1994); because the routine might be incompatible with the new context (Madhok 1997); or because some

elements of the routine might be impossible to copy due to problems in transferring tacit knowledge (Hill, Hwang and Kim 1990; Grant 1991; Langlois and Robertson 1995; Nonaka and Takeuchi 1995).

An important implication of the limited transferability of routines across different contexts is that no such thing as a universal best practice can possibly exist (Amit and Belcourt 1999).

There can only be *local* 'best' solutions. To the extent that firms provide somewhat homogenous environments, the possibility of knowledge- and routines-transfers increases inside the firm (cf. Hodgson 1988; Hill, Hwang and Kim 1990; Kogut and Zander 1992; Kogut and Zander 1993).

Empirical research supports the idea that routines are context-dependent, embedded and specific (Costello 1996; Dubuisson 1998; Karim and Mitchell 2000; Jarzabkowski and Wilson 2002), and have emphasised the importance of recognising the links between routines and 'higher-order' assumptions and values, and between cognitive aspects of organisation and organisational structures and processes (Johnson 2000). It is however also evident in the empirical research that the *nature* of the linkages between the cognitive and behavioural levels is still unclear (Narduzzo, Rocco and Warglien 1997). In specific cases, empirical studies have spelled out how routines build the structural context for processes such as the development and change of corporate strategy (Menuhin and McGee 2001).

Empirical research also supports the idea that routines are transferable to a different context only to a very limited degree (Karim and Mitchell 2000), for instance because the knowledge bound by routines is procedural knowledge (not declarative knowledge) (Cohen and Bacdayan 1994, p. 557).

Finally, empirical studies have supported the notion of historical specificity of routines (Cohen and Bacdayan 1994). Because general rules and routines always have to be incompletely specified, and always require interpretation, their application always involves a certain flexibility. Because of this, local specificities can develop, leading to local heterogeneity of practices (Narduzzo, Rocco and Warglien 1997).

2.8 Path dependence

It is well recognised in the literature that routines are path-dependent (David 1997) and shaped by history (Nelson and Winter 1982; Levitt and March 1988; North 1990; Barney 1991; Bourdieu 1992; Dosi, Teece and Winter 1992; March 1994; Nelson 1994; Malerba and Orsenigo 1996; Foss 1997; Madhok 1997; Oliver 1997; Teece, Pisano and Shuen 1997; Coriat and Dosi 1998; Amit and Belcourt 1999). Routines build on the past. How they will develop is a function of where they have started out from (Dosi, Teece and Winter 1992). Based on their *previous* state, routines adapt to experience incrementally in response to feedback about outcomes' (Levitt and March 1988; Cohen *et al* 1996).

Recognising the path-dependent nature of routines highlights the importance of feedback effects (Argyrous and Sethi 1996). It helps recognise that what has evolved is not necessarily analysable: '[t]he experiential lessons of history are captured by routines in a way that makes the lessons, but not the history, accessible to organisations and organisational members who have not themselves experienced the history' (Levitt and March 1988, p. 320). Without knowing the history, that is, the reasons why a certain path was taken, it is impossible to reconstruct the path and the (string of) problems to which the routine was the solution. Because this reconstruction is impossible, an analysis of the *development process* of the solutions is not possible without being an insider to the group. Even then, remembering the

process matters. For understanding routines, enculturation and memory of the historical process are required.

Empirical studies support the claim that routines are path dependent phenomena (Cohen and Bacdayan 1994; Costello 1996; Egidi and Narduzzo 1997). One implication of path dependent development identified in empirical studies is that local heterogeneity of routines persists despite pressures for organisation-wide homogeneity. Once a local heterogeneity of routines has been established, homogeneity of practices is very difficult to bring about because the established (and locally heterogeneous) practices 'tend to persist in spite of pressures for organisation-wide homogeneity ... and create an "organisational imprinting effect" that gives each zone a peculiar style and organisational flavour' (Narduzzo, Rocco and Warglien 1997, p. 7). This imprinting effect, in turn, will have a locally bounded effect and thus reinforce local specificity and make it persist. Another aspect of routines related to path-dependency is that actors take prior experience into account when making decisions (Betsch *et al.* 2001).

2.9 Co-ordination and control

Routines are important not just because they are the equivalent to the gene in the social realm. They are also important because they have a number of more immediate roles in organisations. Whereas I have so far identified *characteristics* of routines, I now turn to the *roles* that routines fulfil in organisations.

Routines *co-ordinate* (Nelson and Winter 1982; March and Olsen 1989; Gersick and Hackman 1990; Coriat 1995; Dosi, Nelson and Winter 2000). Routinisation means that tasks can be performed smoothly (Rumelt 1995). This becomes particularly clear when co-

ordinated action breaks down because of the interruption of important routines (Weick 1990). The co-ordinative power of routines derives from their capacity to support a high level of simultaneity and to permit highly varied sequences of interaction (Grant 1996); from giving regularity, unity, and systematicity to practices of a group (Bourdieu 1992); from making many simultaneous activities mutually consistent (March and Olsen 1989); and from providing each of the actors with knowledge of the behaviour of the others on which to base his own decisions (Simon 1947; cf. Stene 1940). Nelson and Winter (1982) identify several aspects in which routines influence co-ordination: they embody a truce, provide instructions in the form of programs, and contribute to order by establishing zones of indifference (Barnard 1938).

As co-ordinating devices, routines are more efficient than contracts, so that they could even substitute for contracts and make them increasingly unnecessary over time (Langlois and Robertson 1995). Co-ordination can, however, also turn into *control* (Winter 1986; Dosi and Malerba 1996; cf. Cyert and March 1963).

Empirical research has started to cast some light on the role of routines in co-ordination and control. One empirical study found that the co-ordination role of routines in firms is fulfilled by controlling the stimuli of individual decision making, so that a sequence of individual decisions can be integrated into a cohesive whole without conscious effort (Knott and McKelvey 1999). Other studies found that routines, to the extent that they are standardised, are controlling (Sherer, Rogovsky and Wright 1998), and that standards are influential for control (Segelod 1997). A possible reason is that 'routine behaviour is necessarily easier to monitor and measure than non-routine behaviour' (Langlois 1992, p. 104-5). The more standardised, the easier to compare. The easier to compare, the easier to control. Because of the collective nature of routines, co-ordination processes become crucial elements of the

architecture of systems of interdependent routines (Narduzzo, Rocco and Warglien 1997).

Recent empirical results show that routines are more efficient for co-ordination and control than residual claims (Knott and McKelvey 1999). This finding can hardly be overestimated in its importance. Principal-agent theory has propagated residual claims as the most efficient solution to the monitoring problem. Recent empirical research has, however, shown that routines are much more efficient and have a greater value than residual claims (or perfect incentive alignments) (Knott and McKelvey 1999).

2.10 Truce

According to Nelson and Winter (1982, p. 107), organisational performances have two different aspects: cognitive and 'motivational' or 'governance' aspects (cf. also Coriat and Dosi 1998). By emphasising the second aspect, Nelson and Winter, and Coriat and Dosi highlight the smooth functioning of most organisations, i.e. the fact that members are rarely surprised by each other's behaviour and that involuntary separations of members from the organisation do not occur (Nelson and Winter 1982, p. 108). What mechanisms are underlying this capacity? Nelson and Winter do not assume that organisations function smoothly because there are no divergent interests or intraorganisational conflicts arising from those (Nelson and Winter 1982, p. 108). Rather, this could be due to control. But although rule-enforcement mechanisms play a 'crucial but limited role in making routine operation possible' (Nelson and Winter 1982, p. 109), control systems usually leave a zone of discretion within which conformity cannot be forced but is a question of motivation. In order to provide conformity within this zone of discretion, a 'truce' between workers and management is in place, to the effect that 'the usual amount of work gets done, reprimands and compliments are delivered with the usual frequency, and no demands are presented for major modifications in the terms

of the relationship' (Nelson and Winter 1982, p. 110).

The two dimensions of routines – cognitive (problem-solving) and motivational (governance) – are inseparable (Mangolte 1997b; Coriat and Dosi 1998). Importantly, both have their own logic and their own evolutionary path (Mangolte 1997a; 1997b; 2000). The notion of 'truce' not only serves to make the account of organisational change more realistic. It also fulfils a very important – and overlooked – theoretical task. Without the notion of 'truce', one would have to explain how the different social relationships that permit the activation of the routine establish themselves in each period, and how those relationships are maintained over longer periods of time. If they transform themselves, one would have to explain how they lead to the formation and stabilisation of a particular body of cognitive knowledge (Mangolte 1997b).

Understanding a routine as comprising a 'truce' helps recognise and appreciate that political or motivational arrangements are underlying the working and stability of recurrent activity (Mangolte 1997b; Lazaric and Mangolte 1999).

Empirical studies have found that social relations and potential conflicts may disturb routines in operation. They thereby support the importance of the notion of 'truce' (Lazaric, Mangolte and Massué 2000; cf. Inam 1997). Power and organisational conflict can play important roles both for the stabilisation and the change of routines (Burns 2000). Lazaric and Denis (2001), for instance, identify the impact of the codification of knowledge on the two levels, the cognitive and the political.

2.11 Economising on cognitive resources

Routines economise on resources. Most importantly, they economise on cognitive resources.

Cognitive resources are scarce (Simon 1947; Simon 1955; March and Olsen 1976; March and Olsen 1989). Neither all alternatives nor all consequences of any one alternative can be known (March and Simon 1958). Nor can organisations attend to all of their goals simultaneously (Cyert and March 1963; March 1988). Routines economise on scarce information processing and decision-making capacity of agents (Simon 1947; Simon 1977; Gersick and Hackman 1990; Louis and Sutton 1991; Langlois and Everett 1994; Fransmann 1998; cf. also Hayek 1952; Penrose 1959; Egidi and Narduzzo 1997; Hodgson 1997). Economising on cognitive resources is an important role that routines fulfil. It is also an important aspect of habituation that has already been recognised very early on by Peirce, James and Dewey (cf. Waller 1988). But it has also been proposed that routines can lower governance costs: when processes are routinised, contracts are increasingly unnecessary (Langlois 1992; ; Langlois and Everett 1994; Langlois and Robertson 1995).

There are two mechanisms by which routines (and habits) economise on cognitive resources. First, as learned habits and routines become more automatic, mental resources free up (Penrose 1952; Postrel and Rumelt 1992), so that on the higher levels of awareness, mental deliberation and decision-making capacity becomes available for the more complex decisions (Hodgson 1997). Second, routines focus attention (Cyert and March 1963). They guide search and reduce the space of events that managers should scan in order to avoid bad surprises and take advantage of good ones (Shapira 1994; cf. Inbar 1979; Swaan and Lissowska 1996). This effect is achieved by ignoring what does not receive attention (Garud and Rappa 1994). Attention then can be given to what deviates from normal conditions (Finne 1991) - that is, precisely the recurring elements (of the routine itself) are *not* in the focus and do *not* receive attention. Such recurring elements are dealt with on a semi-conscious level. Through the two mechanisms specified above, routines help to economise upon limited cognitive resources in two ways: they focus attention on certain elements, thereby guiding search by experience, and

they free up cognitive resources to be devoted to exceptional cases by relegating recurrent problems to the realm of the semi- and sub-conscious.

There is clear empirical evidence that routines allow individuals to save on mental efforts and thus preserve scarce information-processing and decision-making capacity (Egidi 1996; Egidi and Ricottilli 1997; Ashmos, Duchon and McDaniel 1998; Zellmer-Bruhn 1999). Empirical research indicates that one way in which routines achieve this is by focusing the attention of actors, through a predisposition to respond to issues in certain ways (Weick 1990; Ashmos, Duchon and McDaniel 1998), by providing a first guess at a problem solution (Betsch, Haberstroh and Höhle 1999), or by economising on the time necessary for reaching a solution (Betsch, Fiedler and Brinkmann 1998).

2.12 Reducing uncertainty

Above, I have described how routines are seen as economising on cognitive resources. Freeing up mental resources by way of routines is also a crucial contribution to the ability of actors to cope with complexity and uncertainty¹⁰ (Weiss and Ilgen 1985; Gersick and Hackman 1990; Langlois and Everett 1994; Fransmann 1998). Because routines free up mental resources, it becomes possible to act even when there are problems of evaluating all alternatives in the time available and means-ends relationships cannot be specified (Scapens 1994) – that is, under conditions of complexity and uncertainty:

... greater uncertainty will cause rule-governed behaviour to exhibit increasingly predictable regularities, so that uncertainty becomes the basic source of predictable behaviour (Heiner 1983, p. 570).

What are the 'mechanisms' underlying the capacity of routines to deal with uncertainty? One mechanism is the freeing up of mental resources as previously described. The second mechanism by which routines enable actors to act under uncertainty consists in introducing predictability by fixing certain parameters (Hodgson 1988; cf. North 1990). Thereby, predictability is increased directly, thus decreasing uncertainty. This second mechanism can work on various levels: on the societal level, societal institutions like laws, norms and so forth establish a certain level of predictability for all members of the society. Within the firm, formal institutions like standard operating procedures, combined with informal institutions like those making up the 'truce' establish certain expectations for the members of the firm. In principle, the same is true for the level of divisions, units, groups, teams, and so on.

Empirical results support the idea that routines can indeed reduce uncertainty (Avery 1996, Egidi 1996, Inam 1997), even in its stronger forms (Becker and Knudsen 2001). An experimental study concluded that routines 'enable individuals to ... radically reduce the complexity of individual decisions' (Egidi 1996, p. 304). A case study found that 'the development of individual routines is accompanied by reduced uncertainty and increased confidence in the appropriateness of typical response patterns' (Avery 1996, p. 3). A survey-based study tested a set of hypotheses pertaining to the uncertainty-reducing effect of routines, explicitly taking into account pervasive forms of uncertainty (Becker and Knudsen 2001). In particular, routinisation was tested against increased information flow as a way for dealing with uncertainty. The most important outcome was that the results strongly support the hypothesis that increasing routinisation will decrease perceived uncertainty. The results strongly support the idea that routines can serve as a way for dealing with uncertainty, in particular where uncertainty is pervasive (Knightian uncertainty).

2.13 Inertia, stability, and constraining and enabling

Probably the most widely known role of routines is that they lead to inertia. Routines are said to persist even in the face of negative performance feedback (cf. for instance Heiner 1983; Kilduff 1992; Rumelt 1995; Hirshleifer and Welch 1998). As one cause for inertia, 'cognitive sunk costs' have been identified (Oliver 1997, p. 793; cf. Langlois and Robertson 1995). A less strong way of putting this point is to say that routines provide stability (Hodgson 1992; Langlois 1992; Nelson 1994). They tend to come into existence when certain ways of doing things consistently give results that are at least satisfactory, in the sense that they do not trigger conscious cognitive problem solving to find something better to be doing. Routines have the character of truce or implicit contracts, and may require renegotiation if they are to be changed (Nelson 1994). Technology seems to be one of the drivers of the stability of routines: organisations develop routines around the use of existing technologies (Orlikowski 2000; Edmondson, Bohmer and Pisano 2001). Another driver of stability are connections that organisational routines make between people (Feldman and Rafaeli 2002). The stability of routines plays an important role: it enables feedback mechanisms to assess the changes, to compare, and to make improvements (Tyre and Orlikowski 1996), or more generally, to learn (Langlois 1992; Postrel and Rumelt 1992; Shapira 1994).

A related, but slightly different role of routines is that they are constraining (Cyert and March 1963; Burgelman and Sayles 1986; March and Olsen 1989; Langlois and Robertson 1995; Nelson and Winter 1982; Pisano 1997; Leonard-Barton 1995; cf. also Wells 1986; Grant 1991; Oliver 1997; Segelod 1997; Delmestri 1998). In many articles, the focus is on the constraining characteristic of routines. Sometimes, the advice is that routines have to be 'broken' in order to enable change. This message is overly strong and one-sided. Rather, it is important to also take account of a 'twin'-role that routines are credited to have: routines are

seen as not just constraining, but also as enabling (Foss 1996; Hodgson 1997a; 1998), for example when introducing 'path-dependence and inflexibility on the cost side, while introducing specialisation advantages and coherence on the benefit side' (Foss 1997, p. 73). One particular instance of these 'twin'-roles is the simultaneous problem-solving (Egidi 1996) and co-ordinating/governance character of routines (Coriat and Dosi 1998). The enabling role of routines seems to be underestimated in much of the literature. However, it is crucial. Moreover, enabling is not even in contrast to constraining: think about supporting micro-processes that are necessary for a market transaction to take place. Many of them are routinised (paying, counting, weighing) in a quite 'constraining' way. But this is precisely what makes the transaction work. It seems important not to lose sight of the role of routines in enabling certain activities.

Empirical studies have also linked routines with inertia (Dubuisson 1998; Sherer, Rogovsky and Wright 1998). Routines have been seen to crystallise quickly and prevent further change, particularly at a local level (Narduzzo, Rocco and Warglien 1997). Empirical findings have also pointed out, however, that routines give stability to organisations and a direction to their recurring activities (Knott and McKelvey 1999). Furthermore, several case studies have come to the conclusion that routines are not completely inert but that they are capable of incorporating change (Costello 2000; Feldman 2000; Johnson 2000; Edmondson, Bohmer and Pisano 2001, Feldman and Rafaeli 2002). In fact, empirical studies by Martha Feldman have underlined that routines have a great potential for change due to an internal dynamic – participants responding to the outcomes of previous iterations of a routine (Feldman 2000). Organisational routines thus contribute to both stability and change, and indeed are an important part of organisational flexibility (Feldman and Rafaeli 2002).

In the same vein, empirical results more generally indicate support for both the constraining (Inam 1997; Ashmos, Duchon and McDaniel 1998) and enabling (see below) roles of routines. Empirical research on enabling has so far focused on how routines enable individuals to save on cognitive resources and mental effort (Egidi 1996; Egidi and Narduzzo 1997; Becker and Knudsen 2001). Whether the enabling or the constraining effects of routines are more pertinent in particular circumstances appears to depend – at least in part – on whether these circumstances are normal or exceptional. A study of crisis situations showed that while routines present 'boundaries and constraints under normal conditions, they also act as powerful tools during exceptional times, such as crisis situations, serving as catalysts to release the disciplined energy of institutions to perform effectively, resolve problems and re-establish order' (Inam 1997, p. 3-4). Another, historical, case study of a well-known crisis found that leaders could intervene to override the constraining effect of routines, a finding that questions the idea of routines as necessarily highly constraining (McKeown 2001).

Another interesting empirical finding in this context is that the constraining and enabling effects of routines can come in different degrees. For example, logical dependence among parts of routines or among various routines might provide additional structure, but fall short of constraining all performances to be identical. The authors of the respective study call this 'constrained variety: performances that are functionally similar but not necessarily the same' (Pentland and Rueter 1994, p. 504). They also propose the interesting metaphor of grammar for this relationship: 'Members enact specific performances from among a constrained, but potentially large set of possibilities that can be described by a grammar, giving rise to the regular patterns of action we label routines' (Pentland and Rueter 1994, p. 484). The grammar metaphor seems to be appropriate because 'a grammar does not specify a fixed outcome; it defines a set of possibilities from among which members accomplish specific sequences of

action. For this reason, grammatical models acknowledge both structure and agency' (Pentland and Rueter 1994, p. 485).

2.14 Triggers

Routines are triggered (Weiss and Ilgen 1985; Winter 1986; March and Olsen 1989; Gersick and Hackman 1990; Cohen 1991; McKern 1993). Triggering, however, works both ways: routines may be triggered and may also trigger other routines. Nelson holds that 'routines ... tend to come into existence when certain ways of doing things consistently give results that are at least satisfactory, in the sense of not triggering conscious cognitive problem solving to find something better to be doing' (Nelson 1994, p. 250). Aspiration levels, therefore, could well be amongst the most important triggers of routines.

Empirical research has much improved our understanding of the micro-processes of triggering. Most importantly, the development of a fixed response to defined stimuli eliminates search (Pentland and Rueter 1994), thereby simplifying choice and decision making. Triggers are the complement to fixed responses, calling them into action.

Empirical studies have also identified a number of factors that play a role in triggering: prior activation, the simultaneous activation of other factors, the strength of association between a situation and an option (the frequency), the intensity of reinforcement (Betsch, Fiedler and Brinkmann 1998) and the intensity of stress (associated with the triggering), which is positively correlated with the regression to *first* learned responses (Weick 1990). Furthermore, the type of feedback that acts as a trigger is important. Empirical results indicate that negative feedback acts as a more powerful trigger than positive feedback (Schneier 1995; Avery 1996). Interruption (either the non-occurrence of something expected or the occurrence of something

unexpected) can also act as a trigger. The importance of interruptions for triggering search has been supported empirically. Teams experiencing more interruptions will be more likely to either search for or adopt new routines from external sources (Zellmer-Bruhn 1999). The degree of autonomic activity that occurs following an interruption, in turn depends on two factors: first, the degree of organisation of the action or thought process that is interrupted (invariant, habituated actions with a high degree of expectancy among participants create a sharp increase in autonomic activity when interrupted); and second, the severity of interruption (high external demand to complete an action, coupled with repeated attempts to restart the action and repeated interruptions combine to facilitate arousal) (Weick 1990, p. 577). It moreover matters after how many repetitions a trigger is received. At least for the case of negative feedback, triggers are more likely to lead to a change in routines where failure was experienced after one execution of the decision-making process than after a series of continuous successes (Schneier 1995). Triggers are also a reason for the occasional suboptimality of routines: because triggers can be identical over different circumstances and environments, routines introduce the risk of highly inappropriate responses and a tendency to occasionally 'misfire' in inappropriate circumstances (Cohen and Bacdayan 1994).

2.15 Embodying knowledge

Routines embody knowledge. Nelson and Winter (1982) devote an entire section to this idea (5.1 'Routine as Organisational Memory'), where they propose 'that the routinisation of activity in an organisation constitutes the most important form of storage of the organisation's specific operational knowledge' (Nelson and Winter 1982, p. 99). Routines (and the supporting skill packages) are a key repository of knowledge in the firm (Winter 1995, p. 152) in the sense that they 'represent successful solutions to particular problems' (Dosi, Teece and Winter 1992, p. 191-2; Nelson and Winter 1982; Winter 1987a; Levitt and March 1988;

Miner 1990; Teece and Pisano 1994; Hodgson 1998; Feldman 2000; Zollo and Winter 2002). Once a successful solution to a problem has been figured out, and is likely to be accessible whenever the same problem is encountered again, a routine can be understood as a behavioural option that comes to mind as a solution when the decision maker is confronted with a certain decision problem – it makes up the repertoire of available responses (cf. Betsch, Fiedler and Brinkmann 1998). Maybe the most important characteristic of routine is that they are credited with being able to embody *tacit* knowledge (Winter 1987b; Winter 1994; Teece, Rumelt, Dosi and Winter 1994; Hodgson 1998; Lazaric 2000). Routines also play an important role in organisational learning, which takes place by encoding inferences from history into routines (Levitt and March 1988; cf. also Grant 1991; March, Sproull and Tamuz 1991; Grant 1996).

The concept of routines is helpful for understanding how the productive knowledge of firms (in particular tacit knowledge) is stored, applied, decays, and changes. Many open questions, however, still remain (Winter 1995). By way of example, what is the role of routines in the articulation of tacit knowledge? What is the role of routines in providing tacit knowledge components that are necessary complements to explicit knowledge components? What is the role of routines in protecting tacit knowledge? The concept of routines also provides a handle for analysing how distributed knowledge is integrated in action. While concepts like 'virtual teams' or 'virtual networks' do provide such handles, too, the concept of routines is more focused on the productive practices themselves, i.e. the *application* of knowledge. According to Penrose (1959), this is the decisive level.

Empirical research has supported the idea that routines contain knowledge (Costello 2000; Dowell and Swaminathan 2000), including tacit knowledge (Cohen and Bacdayan 1994; Szulanski and Winter 2002). Empirical research has also supported the notion that practical

knowledge of the type represented by routines is important (Pentland 1992). The term 'procedural knowledge' has been chosen to characterise such knowledge that is less subject to decay, less explicitly accessible, and less easy to transfer to novel circumstances than declarative knowledge (Cohen and Bacdayan 1994). Changes in the 'state' of knowledge, for example the creation and articulation of knowledge, have an impact on the routines in use. Changes in the knowledge 'state' are not neutral, do change routines and can put them and the 'truce' surrounding them in question (Lazaric, Mangolte and Massué 2000; Lazaric and Denis 2001). Interesting findings have also been generated with regard to the distributedness of knowledge and the role of routines in dealing with it. Distributedness of knowledge means that actors have only a partial overlap of knowledge. Routines have been proposed as one way to deal with this situation, allowing to recreate missing knowledge due to the recombination of components of routines (Egidi 1996). Routines thus serve as 'quarry', that is, they are used as a check list of activities' or 'a system of manipulable elements', they are a 'structuring resource' for manipulating the list of activities and restructuring their position in time (Narduzzo, Rocco and Warglien 1997, p. 19). Routines accordingly also are used as heuristics: instead of being executed in a precise way, they are followed as a guideline, with a rather high portion of variation injected. This new aspect is consistent with other empirical findings, which indicate that routines serve as the 'first guess' in many choice situations. They allow for spontaneous reactions, even under constraint situations in which reflective decision making is no longer possible (Betsch, Fiedler and Brinkmann 1998, p. 875-6).

3. Conclusions: Routines and the concept of routines as they are conceived today

In the modern literature, the concept of routines is built around the notion of patterns. While these patterns are formed by sequences of activities over time, there is considerable ambiguity regarding what precisely is the meaning of 'activity'¹¹. The analysis of the literature presented

here supports a definition of routines as 'recurrent interaction patterns'. It emphasises the collective nature of routines, as opposed to the individual nature of habits.

Routines are central to economic and business phenomena because of the roles they have in organisations. The literature indicates that routines have the following roles in organisations:

(i) Routines are co-ordinating and controlling. Co-ordination is provided by enabling the simultaneity of action and thus giving rise to regularity, consistency and predictability; at the same time, co-ordination can easily turn into control. (ii) Routines also represent a 'truce', in the sense that they build on a micro-political stability that allows the routines to function free of interference. Although clearly stated by Nelson and Winter (1982), this aspect of routines has often been overlooked but has very important consequences for evolutionary theory: without a 'functioning truce', an explanation of why there are no disturbing interferences in the environment of the routine, and thus of the stability of routines, is lacking. (iii) Routines are a key mechanism in economising upon bounded cognitive resources. They do so by freeing up cognitive resources on the higher levels of awareness through relegating repetitive decisions to be dealt with by semi-conscious mechanisms. Also, they focus attention not on the repetitive, but exceptional events, thereby guiding search through experience. In this way, routines provide a crucial contribution to the ability of actors to cope with uncertainty. (iv) Routines help coping with uncertainty. Two mechanisms are underlying this possibility: the freeing up of mental resources by relegating some activities to the semi-conscious as described above; and establishing a certain predictability of other participants through setting constraints. (v) Routines can lead to inertia, primarily driven by (cognitive) sunk costs. However, 'inertia' does not mean that there necessarily are no possibilities at all for variations. (vi) Routines do not necessarily have to lead to inertia, but can also provide stability. This function is sometimes overlooked in favour of its pathological condition, inertia. The providing of stability plays an important role for learning: it enables comparison. Routines

therefore have a role not only in providing stability, but also in implementing change. More generally, it is important to recognise that routines do not just have constraining, but also enabling roles. (vii) Routines are interlinked with other routines, and both trigger off other routines and are triggered by them. Aspiration levels could be an important form of trigger. (viii) Routines embody knowledge, including tacit knowledge. They embody knowledge in action. Thus, the repertoire they 'embody' is sensitive to certain degrees to interruptions in the exercise of the routine, or subject to decay.

Building on the definition advocated above, recurrent interaction patterns, the literature ascribes the following characteristics to routines: (i) They are repetitive; by virtue of their recurrence they are persistent, leading to predictability. (ii) They are patterns of *interaction* and thus collective in nature; distributedness is an important aspect pertaining to their collective nature. It is the *interplay* of a collective that constitutes a whole out of the distributed parts of routines. Organisational routines are constitutive of collective action; they integrate distributed elements in action. (iii) They are self-actuating and do not require conscious deliberation. Because of this characteristic, when dealt with by routines, these problems are removed from conscious influence, freeing up cognitive resources for deliberative action. (iv) Routines are processual phenomena. (v) Routines are context-dependent, specific and transferable only to a limited extent. The reasons why context-dependence of routines matters is that the successful application of routines always depends on the specificities of the context, and that there are complementarities between routines and their context. Specificity can be alleviated, but not completely 'neutralised', by standardisation. Routines are transferable to different contexts only to a limited extent. This means that they can only represent local 'best' solutions, never global 'best' solutions. (vi) Routines are shaped by history and are path-dependent. The path-dependence of routines makes clear that routines involve mutually dependent forces that have positive or negative

feedbacks between them and which have no pre-defined endpoint to which they naturally converge. Changes will most likely be incremental and build on the previous state. Thus, being an insider to the history of a routine makes a difference for understanding its contemporary form.

From the many research questions that have arisen from the literature review, some of the more important ones are the following. What determines stability and persistence? What are the parameters determining the adaptability of recurrent interaction patterns? What is the role of routines in protecting and storing knowledge, in particular tacit knowledge? Under which circumstances do interruptions in the exercise of a routine matter for the decay of the knowledge it embodies?

Adding to the conceptual literature, empirical research has consolidated and enriched our understanding of the roles of routines in organisations. Among the new distinctions introduced by empirical research were that the 'enabling/constraining-balance' depends on whether circumstances are normal or exceptional, that there are different strategies to reduce uncertainty in different situations, and that negative and positive feedback has different implications for triggering. Overlooked issues uncovered in the empirical literature included that the frequency of repetition is a particularly important variable, and that interruptions and time pressure are further important dimensions of the concept of routines. Moreover, an implication of path dependence is that local heterogeneity of routines persists despite pressure for organisation-wide homogeneity, and that routines can also be used as heuristics.

In many cases, empirical research has added detail to our understanding, for example that routines are interrupted when participants act in a manner that is more individual than collective; by identifying triggering factors; and by seeing routines as the 'nexus between

structure and action, between the organisation as an object and organising as a process' (Pentland and Rueter 1994, p. 484). A research question raised was the role of collective nature of routines for the transfer of knowledge. An underlying cause that has been identified (as a hypothesis) was that limited transferability has to do with the fact that the knowledge bound by routines is procedural knowledge. Empirical support has been lent amongst others to the importance of routines, showing that they are significant in explaining performance differences between firms, and to many other characteristics of routines.

The objective of this article was to draw together the dispersed conceptual contributions on routines and the studies applying the concept of routines in the twenty years since Nelson and Winter (1982), in particular with regard to the question 'What do we know about the concept of routines today?' Maybe the most important result of this exercise is that a considerable and substantial body of literature exists on the topic of routines – the concept of routines has thus been taken up and is being developed further. As other commentators have remarked, the concept of routines is still clouded by some degree of ambiguity. As described above, the problem arises because of different terminology, but also because some important points have not yet received sufficient attention. We have made an argument regarding the distinction of individual and collective recurrent action patterns in the paper. Another issue is the clear distinction of behavioural (interaction) and cognitive ('rules') aspects of routines. Even despite this terminological ambiguity, however, a 'core' understanding of what a routine is, what dimensions it has, and what its roles in organisations are, is clearly perceivable. Regarding many points there is much overlap in the individual, and sometimes much dispersed, contributions. The conclusion is therefore, first, to introduce a finer distinction between the different types of recurrent activity patterns (figure one can be seen as a starting point). After all, it is important to remind oneself that the term 'routines' is used to describe many different 'things' that have to do with repetition: for instance, recurrent action, rules that lead to

recurrent action, effects of recurrent action such as problems in motivation, and so on. Clearly, all of these are important for economics and business. It must also be clear, however, that these are different 'things', and that not one individual concept can capture all of them. If there could be one concept that could capture them all, it would have to be so wide that it necessarily would lack sharpness. The direction for further research on routines should therefore be to describe (i) which different 'entities' there are that have been lumped together in the term 'routines', and (ii) how they are related to each other. For instance, cognitive rules are linked to recurrent interaction patterns by influencing behaviour in a stable way such that always the same patterns of recurrent interaction are actualised. The second conclusion has to do with the original motivation for proposing the concept of routines: the development of an evolutionary explanation of economic change. Such an explanation works by identifying the mechanisms of variation, selection, and retention. Routines are supposed to be the unit of analysis. Therefore, we have to be able to explain how the variation of routines comes about, how routines are selected for, and how routines are retained over time. When considering the starting point for Nelson and Winter's (1982) proposal of routines, it is astonishing how little progress on this path has been made. No substantial efforts have yet begun for understanding the exact nature of the involvement of routines in processes of variation, selection and retention, with the exception of Winter's, Szulanski's and Zollo's recent work on the replication of routines (retention) (Szulanski 1996, 1999; Szulanski and Winter 1999, 2002; Winter and Szulanski 2001a, 2001b; Zollo and Winter 2002). While many studies allude to routines and variation, the area of the selection of routines is virtually untouched. Having consolidated the understanding of the concept of routines, the road ahead clearly leads in the direction of fitting routines into explaining variation, selection and retention in the social realm. Much work remains to be done here. Yet, it is also one of the core points of Nelson and Winter's (1982) research program, and one that has not yet been realised. Pursuing this path has the potential to put a cornerstone of an evolutionary theory of economic change in place.

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¹ The literature review does not cover the many studies that mention 'routines' in passing. A huge number of such studies exist which allude to routines but, however, do not contribute to the understanding of the *concept* of routines. The literature included here is – to the best of the author's knowledge – comprehensive with regard to studies that either are concerned with making a contribution to understanding the concept of routines or to how to apply it. Exceptions most certainly will exist, but I do not believe they will alter the picture drawn here substantially.

² The present article refers mainly to the 20 years since the publication of Nelson and Winter (1982). For a history of the concept of routines see Becker (2002, forthcoming).

³ Note the emphasis on variation in these two early definitions of routines. This aspect subsequently disappeared when attention largely focused on the inertia of routines. Accordingly, today '[t]he variation and openness of routines are often missed' (Costello 2000, 14).

⁴ From here on, I use the term 'activity' as a general one comprising 'action', 'behaviour', and 'interaction'.

⁵ Such an understanding is also supported by management dictionaries (Cleveland 1998) and by standard dictionaries like the American Heritage Dictionary which defines behaviour as an 'aspect of being observed by others' and 'involving essentially external relationships' (Morris 1976, 120). In the present paper, I use the term 'action' to comprise behaviour, that is, observable and unobservable activity.

⁶ Bessant, Caffyn and Gallagher (2001) are one of the few studies that are explicit on the observability of routines.

⁷ It remains doubtful whether this combination of attributes makes sense. This is what the square brackets are supposed to indicate.

⁸ This also questions the 'separability assumption' made in information processing theories – that there is a separation between the system that does information processing and the information that is processed (Lazarcic and Mangolte 1998).

⁹ In the 1993 edition of 'Organizations' (originally published in 1958), March and Simon have acknowledged that they would have given more importance to supporting skills in 1993 than at the time of the original publication (March and Simon 1958/1993, 5 and 17).

¹⁰ Another issue I do not have space to consider here is the different types of uncertainty and the impact of routinisation as a strategy to deal with uncertainty under these different circumstances. The reader interested in these questions is referred to Becker and Knudsen (2001).

¹¹ 'Activity' here is used in a broad sense, including action, behaviour and interaction.