

Empirical research on routines
The state of the art and its integration into the routines debate

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Abstract

One of the major contributions of the Nelson and Winter (1982) book was to introduce the concept of routines as units of analysis of economic behaviour. Many authors have picked up on the concept of routines and have attempted to use it in the analysis of various types of economic activity. However, in spite of this, many ambiguities and inconsistencies in the concept itself still prevail. This situation is aggravated by the fact that at the same time, contributions on the concept of routines have been quite rare and their impact has been quite limited. Overall, little progress has been made regarding our understanding of the concept of routines (Avery 1996). In short, 'a unified academic vision of the notion of routine does not exist' (Reynaud 1998, 468).

Why are conceptual problems pertaining to routines so persistent? Our conjecture is that at least one of the reasons has to do with empirical research on routines largely missing in the discussion of routines. Empirical research is necessary and important because questions like for instance 'What roles do routines have in organisations?' are empirical questions that cannot be answered on an *a priori* basis. Understanding these questions, however, is important for understanding the concept of routines, and for applying it in a productive fashion. If empirical research is not integrated into the debate, our understanding of the concept of routines will suffer, as will the analytical and explanatory power of the concept and therefore of the analyses carried out employing it.

There are two reasons because of which empirical could be missing in the debate. First, there could be a lack of empirical studies on routines. Second, there could be problems with the integration of empirical results into the literature on routines. Both conjectures are probed in the paper. As to the first paper, it reports the result of a review of the empirical literature on routines, identifying thirty-three studies. They include survey-based, case-based, and experimental studies, as well as published and unpublished work. In order to probe the second conjecture, a citation analysis of the empirical studies was conducted using the ISI Social Sciences Citation Index in order to assess the integration of the theoretical and empirical literatures on routines. The clear finding is that there are only very few citations of empirical work on routines. The empirical and theoretical literatures on routines are not yet integrated very closely. Although there are some, empirical studies of routines, they appear to have been largely ignored. The paper presents a first step in integrating empirical research in the body of literature on routines.

1 Introduction

Although the current discussion of routines dates back at least to Nelson and Winter (1982), there has been 'very little advance' (Cohen and Bacdayan 1994, 556) in the way of further conceptual development of the theory of routines. There has been 'little progress so far in reaching agreement on what routines are – and therefore on how or why social scientists should study them' (Cohen *et al* 1996, 656). Even today, 'a unified academic vision of the notion of routine does not exist' (Reynaud 1998, 468).

A literature review shows that there is a 'conspicuous lack of empirical research on routines' (Schneier 1995, 8; cf. also Miner 1994; Cohen *et al* 1996; Zellmer-Bruhn 1999). Only a small number of pieces of empirical research¹ on routines have been conducted so far. This dearth of empirical research on routines might well be one reason for the absence of any significant advance in the development of the concept of routines.

Empirical research is necessary because the question 'What roles do routines have in organisations?' is an empirical question. Apart from this reason, empirical research could also be helpful for advancing the debate because it can make a number of possible contributions that are unique to empirical research: (i) empirical evidence opposing the validity of a hypothesis, (ii) empirical support for a hypothesis, (iii) pointing out new aspects not covered by way of abstract reasoning, (iv) an indication of the relevance of aspects in empirical situations which can serve as selection criteria guiding where to pursue further research, (v) methodological and other indications for further empirical research, and (vi) enriching our understanding through illuminating more details.

For these reasons, this thesis also draws on empirical research, casting some light on the role of routines in organisations through empirical studies of routines in organisations. In this chapter, I report the findings of the empirical literature. Although it concentrates on routines in organisations, conclusions for the concept of routines can also be drawn.

¹ For criteria see next section.

2 Empirical literature on routines

What counts as an empirical contribution on routines? The criteria applied here are that firstly, empirical data have to be used, that is, the research in question has to be based on observation or experiments, not on theory. Secondly, the studies either have to have a theoretical interest in developing the *concept* of routines, use routines as an analytical perspective in the analysis of a phenomenon, or investigate one subaspect of routines. Figure 2 reports all empirical studies fulfilling these criteria of which I am aware.

paper	interest in routines	research focus	empirical method
Weick 1990	routines as analytical perspective	airplane accident	case study
Inam 1997	routines as analytical perspective	institutional response to disaster (earthquake)	case studies
Sherer, Rogovsky and Wright 1998	routines as analytical perspective	drivers of employment relations	survey
Inam 1999	routines as analytical perspective	institutional response to disaster (earthquake)	case studies
Pentland <i>et al</i> 1996	subaspect	measuring routineness in the content and process of tasks	case study
Avery 1996	subaspect	influence of feedback on development and persistence of group routines	experiments
Segelod 1997	subaspect	role of written routines in investment manuals	case study
Ashmos, Duchon and McDaniel 1998	subaspect	role of organisational predisposition for participation in strategic decision making	survey

Betsch, Fiedler and Brinkmann ² 1998	subaspect	effects of novelty in task presentation and time pressure on routine maintenance and deviation	experiments
Betsch, Haberstroh, Glöckner, Fiedler 1998	subaspect	routine strength and adaptation in recurrent acquisition and disposal decisions	experiments
Winter and Szulanski 1998	subaspect	replication of routines	case studies
Betsch, Brinkmann, Fiedler and Breining 1999	subaspect	adaptive use of decision strategies and role behavioural routines	experiments
Betsch, Glöckner, Haberstroh 1999	subaspect	routines maintenance and deviation in repeated decision making	experiments
Knott and McKelvey 1999	subaspect	explaining efficiency differences between firms	survey
Szulanski 1999	subaspect	replication of routines	case study
Zellmer-Bruhn 1999	subaspect	effects of time pressure and interruptions on team external acquisitions of work routines	case studies
Denis and Lazaric 1999	subaspect	how and why routines change	case studies
Lazaric, Mangolte and Massué 2000	subaspect	influence of knowledge creation and articulation on routines	case studies
Becker and Knudsen 2000	subaspect	role of routines in reducing uncertainty	survey

² The studies by Betsch *et al* are psychological studies. Their definition of a routine is slightly different from those used by economists and management researchers: 'a behavioural option that comes to mind as a *solution* when the decision maker is confronted with a certain decision problem' (Betsch, Haberstroh, Glöckner and Fiedler 1998, 4). Although this definition is different from those that build on the notion of pattern, it is not necessarily inconsistent with the definitions that do so.

Pentland 1992	conceptual	how collective, knowledgeable performances are accomplished	case study
Cohen and Bacdayan 1994	conceptual	storage of components of organisational routines in distributed procedural memories	experiments as auxiliary approach to field observation
Pentland and Rueter 1994	conceptual	explain high degree of regularity of apparently nonroutine work	case study
Schneier 1995	conceptual	development and modification of managerial decision-making routines	experiments
Egidi 1996	conceptual	memorising of repeated sequences of decisions deriving from interactions with others	experiments
Pereira and Patelli 1996	conceptual	emergence of routines in co-operative games	experiments
Egidi and Narduzzo 1997	conceptual	path-dependent behaviours in co-operative contexts	experiments
Costello 1996	conceptual	whether the concept of routines is useful for empirical work and for understanding the evolutionary change of firms	case study
Narduzzo, Rocco and Warglien 1997	conceptual	whether the concept provides a suitable framework for describing and interpreting the emergence of organisational capabilities	case study
Egidi and Ricottilli 1997	conceptual	co-ordination under division of labour	experiments
Becker 1998	conceptual	what are routines?	case study

		what functions do they have?	
Dubuisson 1998	conceptual	overview over concept from the point of view of a sociologist	case study
Garapin and Hollard 1999	conceptual	routines and incentives in group tasks	experiments
Costello 2000	conceptual	analyse the constitutive processes involved in the creation and reproduction of routines in firms; enrich the conceptual framework	multiple case studies

Figure 2: Overview of empirical research on routines

Empirical research on routines is still very young. Empirical work with a conceptual interest has only been published since 1992 (the widely-quoted Cohen and Bacdayan and Pentland and Rueter papers also seem to have been circulated since approximately 1992). Work on particular subaspects of routines can only be found in published form beginning in 1996. Taking into account the fact that the concept of routines has received wide-spread attention at least since Nelson and Winter's work (1982), empirical research on routines seems to have received attention only for about a decade, and then only of a very scant sort³.

In methodological terms, the conceptual studies employ three methods: qualitative case studies, often following an ethnographic or grounded theory approach including observations, laboratory experiments, and surveys. Roughly speaking, half of the empirical contributions are based on qualitative case studies, 3/8 on laboratory experiments⁴, and 1/8 on surveys.

A citation impact analysis⁵ of the empirical studies shows that the theoretical and empirical contributions are as yet not closely integrated:

³ The reasons for this might of course have something to do with empirical research being particularly difficult in the case of a concept that has yet to achieve a clear, agreed meaning in the literature.

⁴ Experimental work has been initiated by Cohen and Bacdayan (1994) and has been replicated and developed further mainly in the 'Computable and Experimental Economics Laboratory' at the University of Trento, Italy.

⁵ ISI Social Sciences Citation Index

paper	published	citations	of which, citations by other works on routines (excluding author's own works)
Weick 1990	yes	24	0
Pentland 1992	yes	23	0
Cohen and Bacdayan 1994	yes	24	4
Pentland and Rueter 1994	yes	17	2
Schneier 1995	no	0	0
Egidi 1996	no	0	0
Pentland <i>et al</i> 1996	no	0	0
Avery 1996	no	0	0
Pereira and Patelli 1996	no	0	0
Costello 1996	yes	0	0
Egidi and Narduzzo 1997	yes	2	1
Egidi and Ricottilli 1997	no	0	0
Inam 1997	no	0	0
Segelod 1997	yes	1	0

Narduzzo, Rocco and Warglien 1997	no	0	0
Dubuisson 1998	yes	1	0
Winter and Szulanski 1998	no	0	0
Betsch, Fiedler and Brinkmann 1998	yes	(1) ⁶	0
Betsch, Haberstroh, Glöckner and Fiedler 1998	no	(0)	0
Sherer, Rogovsky and Wright 1998	yes	0	0
Ashmos, Duchon and McDaniel 1998	yes	1	0
Becker 1998	no	0	0
Betsch, Brinkmann, Fiedler and Breining 1999	yes	(0)	0
Betsch, Glöckner, Haberstroh 1999	no	(0)	0
Inam 1999	yes	1	0
Zellmer-Bruhn 1999	no	0	0
Denis and Lazaric 1999	no	0	0
Knott and McKelvey 1999	yes	0	0

⁶ Note that the ISI Social Sciences Citation Index includes psychological works like those of Betsch *et al.* However, it might not cover the whole breadth of psychological research which extends into medicine and other fields. Therefore, the citation impact of the Betsch *et al.* papers might be higher than indicated in the table. However, it can reasonably be assumed that excluding citations from the literature excluded by the ISI SSCI database does not exclude key inputs in the debate I am concerned with in this thesis. The imprecision in the citation analysis should be minor.

Szulanski 1999	yes	0	0
Garapin and Hollard 1999	yes	0	0
Lazaric, Mangolte and Massué 2000	no	0	0
Becker and Knudsen 2000	no	0	0
Costello 2000	yes	0	0

Figure 3: Overview of citation impact of empirical research on routines

Two conclusions arise from this overview: first, only a handful of theoretical⁷ papers cite empirical studies on routines! There is extremely little integration of theoretical and empirical research. There is no *a priori* reason why a closer integration of the two should be impossible. Empirical research appears to have been ignored almost entirely. As a consequence, the (large) body of theoretical work and the (small) body of empirical work on routines have yet to be integrated. To do so is one of the contributions of this thesis. Second, there is little integration even within the empirical literature on routines. The authors of empirical studies do not refer – with only three exceptions – to each other's results.

3 Empirical findings

Despite being overlooked, empirical research has some important contributions to make. As a first step in integration, I will pull together the empirical findings pertaining to the research objective. For doing so, I use the characteristics and roles of routines derived from the previous analysis.

⁷ This statement excludes Egidi and Narduzzo, who belong to the 'empirical camp' themselves (although they make theoretical contributions, too), and Grant, who *applies* routines as an analytical perspective in his theoretical work without working on the concept of routines itself.

3.1 Importance of the concept

With regard to the 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 franchisor'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 franchisor's routines) (Knott and McKelvey 1999, 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, 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, 380).

This finding lends empirical support to the idea that routines play important roles in organisations and that they are a useful and powerful concept (note that the Knott and McKelvey paper is concerned with predictive rather than explanatory power). Multiple case studies in the high-tech sector, too, conclude that the concept of routines 'is valuable in understanding change in organisations' (Costello 2000, 1).

3.2 Patterns

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 indicate that they are patterns of *interaction*⁸ (Cohen and Bacdayan 1994), thus supporting the conclusions of chapter III.

3.3 Repetitiveness/persistence

Empirical studies do also work with the notion of the repetitiveness of routines, as does the theoretical literature (cf. for example Cohen and Bacdayan 1994, 554; Pentland and Rueter 1994, 484; Pentland *et al* 1996, 6; Egidi and Narduzzo 1997, 680; Knott and McKelvey 1999, 368; Costello 2000, 1). None of the studies indicate any inconsistency of the empirical data with this idea.

3.4 The collective nature of routines

A number of empirical studies support the idea that routines are collective phenomena (Weick 1990; Cohen and Bacdayan 1994; Pentland and Rueter 1994).

Weick in particular has contributed interesting details to our understanding of the collective nature of routines. Routines seem to be disrupted when participants in a routine start 'acting in a manner that is more individual than collective' (Weick 1990, 579). This finding has profound implications for our understanding of the collective nature of routines and especially the relationship between individual actors and the routine. 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 finds 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, 303). The implication is that because actors do not possess all the knowledge needed to play the best strategy, they generally

⁸ Questions regarding the observability/non-observability of routines obviously cannot be addressed by empirical research working by observation.

explore only a limited part of the space of the potential rules. For this reason, they learn and memorise a simple, bounded set of 'personal' meta-rules (Egidi 1996).

The following research directions into the collective dimension of routines arise from empirical contributions: First, it might be helpful to further differentiate various aspects of routines. For example, it has been suggested that they themselves are social in nature, while their execution is mostly an individual task (Narduzzo, Rocco and Warglien 1997, 17). Third, the cohesive powers of routines might play a role in their collective nature. As Weick finds, routines can fall apart when actors act in a manner that is more individual than collective (Weick 1990, 579). Finally, the collective nature of routines has important ramifications for the transfer of knowledge. To be included in a community of practice was found to be a criterion for the acquisition of expertise:

Expertise is not only a matter of cumulated personal experience, but also a matter of membership to a community of practice within which experience is shared ... we have observed the case of an isolated technician, working in a physically remote area with low levels of integration within the community of colleagues, displaying more simplistic diagnostic activities despite having a long personal experience (Narduzzo, Rocco and Warglien 1997, 12).

Empirical research also contributes an important caveat to the collective nature of routines. Conceptualising routines as analogous to individual habits bears the danger of taking the analogy too far and 'subsequently missing the big picture' (Avery 1996, 114-5).

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

In empirical studies, routines have been found to have an automatic character (Cohen and Bacdayan 1994; Pentland and Rueter 1994; Betsch, Fiedler and Brinkmann 1998; Dubuisson 1998). In the psychological literature on routines, the most well-known finding from experimental studies is that routines can influence choice independent from behavioural intentions (see Betsch, Haberstroh and Höhle 1999 for a literature overview). A case study has characterised a routine as 'taken-for-granted way of working which is usually unchallenged' (Costello 2000, 1).

3.6 The processual nature of routines

Empirical research on routines contributes additional insights into the processual nature of routines.

Above, I have mentioned that as patterns of interaction, routines are processual phenomena. From their empirical studies, 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, 484). In this way, the concept of routines offers a great opportunity of 'cracking open' processes and making them accessible to analysis.

From a game theoretic perspective, 'dynamic' routines are interpreted as players responding not only to the static configuration of the game but also to the previous move by the other player (Pereira and Patelli 1996). We can use this for better understanding the meaning of 'procedural memory' (Cohen and Bacdayan 1994) and of the processual nature of routines.

Empirical research has identified a number of 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), the 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), the number of repetitions and its implications for example for reliability (Weick 1990), and age dependence (Warglien 1995). All of these dimensions are helpful in two ways: they enable us to ask questions about these characteristics (for example, 'How does it matter whether change takes place in leaps or incrementally?'), and they furnish us with candidates for dimensions of the concept of routines.

Frequency of repetition (Narduzzo, Rocco and Warglien 1997) seems to be a particularly important dimension of the concept of routines. 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 to which the act is followed by a reinforcement (Betsch, Fiedler and Brinkmann 1998; cf. Betsch, Haberstroh, Glöckner and Fiedler 1998). Betsch *et al* also report specific frequencies at

which routinisation effects have set in. They are surprisingly low and the idea of the ubiquity of routines:

Previous research indicates that submitting participants to repeat a certain choice about 15 times should suffice to induce routine effects. In another ... study, participants repeated the routine for 6 times only and showed routine effects in their choices directly afterwards (Betsch, Haberstroh, Glöckner and Fiedler 1998, 30).

Interruptions, too, have been shown to play a role for routinisation: they increase the likelihood that teams engage in external acquisitions of routines (Zellmer-Bruhn 1999).

Further, experimental research in psychology clearly supports the importance of time pressure and other constraints for the maintenance of routines. In a number of studies, it was found that time pressure increases the likelihood of routine choices (vs. non-routine choices). This holds true even if the inadequacy of the routine had been 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 like for example 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 coordinate 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). This strongly indicates that increased time pressure (and other constraints like for example stress) will not only lead to the actors increasingly falling back on routine responses – it will also lead to a preference of those routine responses which are oldest, i.e. rehearsed most often. Another 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 it 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. An explanation that has been suggested is 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, 88-9).

3.7 Context-dependence, embeddedness and specificity

Routines have empirically been found to be 'intimately connected to the social, cultural, and economic milieu in which the firm exists' (Costello 1996, 596-7), that is, to be context-dependent (Dubuisson 1998). It is evident in the empirical research, though, that the nature of those linkages with other levels is still unclear (Narduzzo, Rocco and Warglien 1997).

Cohen and Bacdayan's (1994, 557) findings support the idea that routines are transferable to a different context only to a very limited degree. This has to do with the knowledge-binding character of routines and particularly the fact that the knowledge bound by routines is procedural knowledge (as opposed to declarative knowledge):

The properties of organisational routines arise from the way individuals store and enact their parts in those routines. As individuals become skilled in their portions of a routine the actions become stored as procedural memories and can later be triggered as substantial chunks of behaviour. ... Procedural knowledge is less subject to decay, less explicitly accessible, and less easy to transfer to novel circumstances [than declarative memory] (Cohen and Bacdayan 1994, 557).

Empirical studies have also provided support for the notion of historical specificity of routines (Cohen and Bacdayan 1994) and that specificity generally is an important notion: 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).

3.8 Path dependence

Empirical studies support the claim that routines are path dependent phenomena (Cohen and Bacdayan 1994; Costello 1996; Egidi and Narduzzo 1997). This is because over time they can become 'contaminated' with extraneous, historically-specific and arbitrary components (Cohen and Bacdayan 1994).

One implication of path dependent development is that local heterogeneity of routines persists despite pressures for organisation-wide homogeneity. Once this 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, 7). This imprinting effect, in turn, will have a locally bounded effect and thus reinforce local specificity and make it persist.

3.9 Enabling and constraining

Empirical results indicate that routines are constraining, as is past performance (Inam 1997; Ashmos, Duchon and McDaniel 1998). However, routines are also themselves embedded within enabling and constraining structures such as hierarchies or division of labour. These structures are partial explanations of the forces giving rise to regular patterns of action, i.e. routines (cf. Pentland and Rueter 1994).

The role of routines in enabling certain activities has been empirically supported as well. 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 2000). 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 crises situations shows that while routines presented '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, 3-4).

Another interesting empirical finding is that the constraining and enabling effects of routines can come in different degrees. Logical dependence among parts of routines or various routines, for example, might give 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, 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, 484). The metaphor of grammar 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, 485).

3.10 Co-ordination and control

One empirical study finds that the co-ordinating role of routines in firms is fulfilled by controlling the stimuli of individual decision making such that a sequence of individual decisions can be integrated into a cohesive whole without conscious effort (Knott and McKelvey 1999). Another study finds that routines, to the extent that they are standardised, are controlling (Sherer, Rogovsky and Wright 1998). The idea of standards being influential in the control aspects of routines is also supported in other empirical studies (Segelod 1997). A possible reason is that 'routine behaviour is necessarily easier to monitor and measure than non-routine behaviour' (Langlois 1992, 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).

Very recent empirical results show that in a control- and co-ordination-role, routines are more efficient 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 (cf. Alchian and Demsetz 1972) – the problem that if the monitor of contracted labour is contracted herself, the monitoring of the monitor presents the same

problem, and so on. The only way out of this regress, according to principal-agent theory, is to let the monitor have residual claims, thus providing an intrinsic motivation to monitor. However, recent empirical research has shown that routines are much more efficient and have a greater value than residual claims (or perfect incentive alignments) (Knott and McKelvey 1999).

3.11 Truce

Empirical studies have found that social relations and potential conflicts may disturb routines in operation. Thereby, they support the idea that what Nelson and Winter describe as 'truce' is important (Lazarcic, Mangolte and Massué 2000; cf. Inam 1997). Denis and Lazarcic (1999) identify the impact of the codification of knowledge on the two levels – cognitive and political – and show that it has an effect on both. Examples for the impact on the political level are changes in the organisational chart, conflicts between company members, the emergence of new actors and other incentives that trigger or break organisational change (Denis and Lazarcic 1999).

3.12 Economising on cognitive resources

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, for example by way of 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), thereby economising on resources by re-using appropriate elements, or by economising on the time necessary for reaching a solution (Betsch, Fiedler and Brinkmann 1998), a characteristic which becomes particularly relevant under severe time pressure. This role of routines is particularly valuable when actors cannot decode all available information. In this case, behaving in a routinised way is more efficient than using all available information (Egidi and Narduzzo 1997).

3.13 Reducing uncertainty

Empirical results support the idea that routines can reduce uncertainty (Avery 1996, Egidi 1996, Inam 1997, Becker and Knudsen 2000). An experimental study concluded that routines 'enable individuals to ... radically reduce the complexity of individual decisions' (Egidi 1996, 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, 3). A survey-based study has tested a set of hypotheses pertaining to the uncertainty-reducing effect of routines (Becker and Knudsen 2000). In particular, routinisation was tested against increased intelligence dissemination (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.

3.14 Inertia

Empirical studies have 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).

Implications of rigidity and inertia that have been identified are: routines are quite inflexible so that they occasionally 'misfire' when transferred to inappropriate environments and situations, and they carry the risk of highly inappropriate responses and occasional suboptimality (Cohen and Bacdayan 1994).

3.15 Stability

Empirical findings support the hypothesis that routines can lead to inertia. However, importantly, empirical findings have also pointed out that routines give stability to organisations and a direction to their recurring activities (Knott and McKelvey 1999). Multiple case studies have come to the conclusion that routines are not completely inert but that they are capable of incorporating change.

However, changes in routines are slower than changes elsewhere in the organization (Costello 2000, 1).

3.16 Triggers

There are some detailed empirical findings regarding the triggering of routines. Most importantly, the development of a fixed response to defined stimuli eliminates search (Pentland and Rueter 1994), simplifying choice and decision making. Triggers are the complement to fixed responses, calling them into action. It is in this process of calling into action a fixed response that knowledge and past experience are embodied. Once a successful solution to a problem has been figured out, the solution is very likely to be highly accessible whenever the same problem is encountered again – a routine is a behavioural option that comes to mind as a solution when the decision maker is confronted with a certain decision problem (Betsch, Fiedler and Brinkmann 1998).

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). Also, 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 act as a trigger, too. The importance of interruptions for triggering search was 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 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, 577). Also, it matters after how many repetitions a trigger is received. At least for the case of negative feedback, triggers are leading to a change in routines more when failure was experienced after one execution of the decision-making process

than after a series of continuous successes (Schneier 1995).

Triggers attract attention and consume information processing capacity (Weick 1990). Triggers also are one 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).

Empirical research has thus much improved our understanding of the micro-processes of triggering.

3.17 Embodying knowledge

Empirical research has supported the idea that routines contain knowledge (Costello 2000), including tacit knowledge (Cohen and Bacdayan 1994). It has also supported the notion that practical knowledge of the type represented by routines is important: 'Moves provide the building blocks of organisational knowledge because they embody the possibilities for knowledgeable performances' (Pentland 1992, 545). The term 'procedural knowledge' has been chosen to characterise this kind of 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, change routines and can put them and the 'truce' surrounding them in question (Denis and Lazaric 1999; Lazaric, Mangolte and Massué 2000).

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 leads to a situation of only partial knowledge of what is required to execute a certain task. Routines have been proposed as one way to deal with this situation:

Players do not need to keep all knowledge and information they need to play stored in memory: they only have to remember the cognitive 'atoms' which allow to generate the organisational routines. This means that they are able to explore and 'recreate' missing

knowledge (Egidi 1996, 331).

The most interesting empirical finding, however, has uncovered a new way in which routines do embody knowledge. Routines serve as 'quarry', that is, they are used as

a check list of activities' or 'a system of manipulable elements. ... The formal procedure is not merely executed neither ignored, but instead it is used as a 'structuring resource' ... for manipulating the list of activities and restructuring their position in time (Narduzzo, Rocco and Warglien 1997, 19).

Routines do serve as heuristics: instead of being executed in a precise way, they are followed as a guideline, with a rather high portion of variation injected⁹. This new aspect is consistent with other empirical findings, which indicate that

[r]outines serve as the 'first guess' in many choice situations. Thus they provide a major device for achieving mastery of the situation. They are superior to other strategies because they allow for spontaneous reactions, even under constraint situations in which reflective decision making is no longer possible (Betsch, Fiedler and Brinkmann 1998, 875-6).

3.18 Terminological distinctions

As for the relationship of rules and routines, Pentland has developed the 'routines as grammars' approach (Pentland 1994, 1995; Pentland and Rueter 1994). This approach is a very interesting treatment of the rules-routines relationship and will be explained in depth in chapter V.

⁹ I will come back to this link between the close and loose following of routines in chapter VI where I deal with variation.

3.19 Conclusions: The findings in the empirical literature

Empirical studies of real-life routines have produced a number of contributions: they have introduced new distinctions based on empirical relevance, pointed out overlooked issues, added detail, raised research questions, identified underlying causes, and lent empirical support to hypotheses. Thereby, they have also enriched the picture of routines in organisations and enhanced our understanding of the role of routines in organisations. Enriching our understanding of the characteristics and roles of routines also enhances the concept of routines, as we achieve a better understanding of its potential dimensions.

Empirical research has consolidated and enriched the preliminary answers to the question 'What roles do routines have in organisations?' derived in chapters II and III. 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. The 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 other important dimensions of the concept of routines. Further, it has been pointed out that an implication of path dependence is that local heterogeneity of routines persists despite pressure for organization-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, 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.

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