

Staying on Track: A Voyage to the Internal Mechanisms of Routine Reproduction¹

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All evil deeds, all crimes, all self-sacrificing actions, all heroic exploits, as well as all the actions of ordinary life, are controlled by the moon. (Gurdjieff, 1949)³

Routines are a dominant feature of human existence. We use routines when we walk, talk, read, answer the phone, or write an email. It is hard to think of any domain of activity that does not involve some kind of routine. Even innovation, improvisation, and thinking involve routines⁴. Our engagement with routines is so vast, it is almost nauseating (Sartre, 1965). It seems we are essentially Gurdjieffian meat machines, sleepwalking through our lives with *eyes wide shut*.

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³ George Ivanovitch Gurdjieff, as quoted by P. D. Ouspensky in his book, "In Search of the Miraculous: Fragments of an Unknown Teaching". First published by Routledge and Kegan Paul Ltd 1949.

⁴ Thinking routines can be found in heuristics and pattern recognition ("habits of mind", Louis and Sutton, 1991). Interestingly, feelings also involve routines, a notion inherent in the figure of 'habits of the heart'.

Clearly, such an autopilot perspective on human existence can be a bit disturbing. But it also highlights the most curious feature of routines – their capability of staying on track. Routine execution tends to follow automatically the path of prior iterations of the routine. The experience is a common one. We commute along the same routes, we shop at the same groceries, and we use the same tools. Of course, we do introduce variation occasionally – out of capriciousness or need – but such variations are merely dramatic punctuations on otherwise unremarkable paths of repetitive events (Lyman, 1990). Our experience with routines is dominated by sameness. We adhere to the cow paths of prior routine iteration even if alternatives are clearly available – there are different routes to work, different grocery stores to shop at, and different tools that could do the same job. In that view, one wonders, what keeps routines on track?

The question is not fortuitous. It is intimately related to the status of routines as core concepts in theories of social and economic order (where routines increasingly play a central role). If routines were merely transient phenomena, lacking internal forces that maintain their shape and boundary, there would be no point in making them the cornerstone of theoretical models that aim to explain how social and economic order emerges and persists. If routines can arbitrarily morph into each other, it would be impossible to observe them because we would not know when a routine starts or stops; nor would we be able to tell if a given routine has ‘re-occurred’. If routines can be readily reduced to external forces such as power or rationality there would be little need for a separate theory based on routines – the reduced form would be sufficient. However, if routines stay on track by virtue of routine-based mechanisms, they assume a degree of independence from external forces that justifies their theoretical treatment as autonomous units with causal effects of their own, e.g., in the form of ‘genes of organizations’, as ‘grammars of organizational action’, as ‘building blocks of organizations’, or as ‘pillars of organizational legitimacy’.

The question of what keeps routines on track is different from the question of how routines change. Although staying on track implies routine stability (i.e., absence of change), falling off track normally introduces variation without shifting the average pattern. Of course, routine change can happen when departures from the normal track are systematic and regular. But that requires an additional account of the events that lead to such departures. This paper focuses

instead on the question of routine stability; how action comes to be locked into narrow channels that we re-cognize as ‘same’; how action within routines stays on the ‘normal’ track. It aims to contribute to theories of order, and the issue of routine change is discussed only tangentially⁵.

So far, systematic research on what keeps routines on track is lacking. This paper will attempt to carry together several strands of thought that have addressed this question from various perspectives. I will focus mainly on sociological and psychological work, although at times I also borrow from neighboring disciplines. I start out with a review of several influential notions of routines as they were introduced in the social sciences and then proceed to a focused exploration of the mechanisms that keep action within routines on track.

(A) Notions of Routines

Routines have been approached from a number of different angles -- if the field of routines were a meal, it would be a flavorful stew made from pungent ingredients and exotic spices. Due to the field’s diverse roots, the literature on routines is multifaceted, rich and sometimes bewildering. Notions of routines are diverse and often overlapping and appear under a variety of guises. Many ideas are scattered around, and their potential has not yet been established. Any sampling from this flavorful stew will leave out important ideas. My sampling is less driven by adequate representation than by striving for maximum variety.

Early work considered routines in the context of system stability and rationality. In Weber’s work on the ‘routinization of charisma’ (Weber, 1976: 143, 661), the development of routines marked the transition of an organization (or, more generally, a system of domination) from an

⁵ This does not mean that I assume that routines are inherently immutable. Of course, routines do change. But I think that the degree to which routines change is mainly an empirical matter, and cannot be decided on a priori grounds. The important issue here, however, is that routines possess an inherent degree of stability that is worth understanding and exploring. It is that aspect of routines that allows routines to exist. And thus, the question of what stabilizes routines is logically anterior to the question of how routines change.

extraordinary ('ausseralltägliche') state to an ordinary ('alltägliche', everyday) state. Through such routinization (which is essentially a low form of rationalization) the system can achieve significant stabilization. Weber argued that organizations based on charismatic authority are inherently unstable because the reaffirmation of supernatural powers of leaders is precarious⁶ and the legitimacy of successors of the original leader is easily challenged (the problem of succession, [Weber, 1976](#): 144). Those charisma-based organizations (e.g., religious movements) can achieve permanence and stability by routinization of charisma – by development of a staff to manage disciples (via recruiting and training), to collect resources (via donations), and elaborate and enforce the rules of the movement ([Weber, 1976](#): 661). From this perspective, 'routine' captures a shift from passion to discipline, moving the system to a higher level of legitimacy and thereby assuring more reliable domination. At the same time, routinization marks a progression towards rationalization ([Kieser, 1987](#)) since routines are relatively more rational than revelations, epiphanies, or other forms of otherworldly inspiration (although, if they merely form traditions, they are inferior to the rational order prevailing in rational-legal forms of organization).

A quite different image of routines arose after WWII, when interest in cognition and its limitations started to gain attention. Scholars of the Carnegie School portrayed routines as fixed responses to defined stimuli ([March & Simon, 1958](#): 142). This conceptualization was intended to capture the difference between two types of problem solving situations: those involving complex search and those that had been simplified by the development of automatic (but not necessarily simple) responses to specific stimuli. Routine behavior was thereby defined by the absence of complex search, and degrees of routine behavior could be distinguished based on the amount of complex search involved. Clearly, satisficing behavior would be routinizable, while maximizing behavior less so.

Closely related to and a derivative of the Carnegie approach, organizational learning theories have made major contributions to the notion of routine. Early work focused on how organizations develop routines. In their *Behavioral Theory of the Firm*, Cyert and March highlighted the role of organizational learning ([Cyert and March, 1963](#)). Organizations

⁶ After all, the reliable fabrication of miracles is tricky business (outside Hollywood).

developed routines, or “standard operating procedures” through a learning cycle where the organization responded to external shocks by varying the likelihood of reusing specific routines. Routines that lead to preferred outcomes were subsequently used more frequently, and those that lead to substandard performance were abandoned or revised. Subsequently, organizational learning evolved to become a key paradigm of organizational theory. [Levitt and March \(1988\)](#) made routines the cornerstone of their approach to organizational learning, defining organizational learning as a process of encoding experiential lessons into routines. Their work stressed the nested and path-dependent nature of routine-based learning. Routines were seen as subject to competency traps that can lock learning processes into suboptimal positions. This routine-based notion of learning gave rise to several streams of empirical research, including work on the evolution of jobs ([Miner, 1987, 1991](#)), the dynamics of organizational rules ([March et al, 2000](#); [Schulz and Beck, 2002](#), [Beck and Kieser, 2003](#)), and research on the relationship between rules and routines ([Reynaud, 2005](#); [Grote, Weichbrodt, Günter, 2007](#)).

From an institutional perspective, routines can be considered as micro-institutions. [Berger and Luckman \(1966\)](#) explored how “habitualization” contributed to the formation of institutions: “All human activity is subject to habitualization. Any activity that is repeated frequently becomes cast into a pattern, which, *ipso facto*, is apprehended by its performer *as* that pattern.” (53) Habitualized patterns would “become embedded as routines in his (the actor’s) general stock of knowledge, taken for granted by him and at hand for his projects into the future.” (53) Berger and Luckman stressed the cognitive efficiencies that arise from habitualization: “Habitualization carries with it the important psychological gain that choices are narrowed. While in theory there may be a hundred ways to go about the project of building a canoe out of matchsticks, habitualization narrows these down to one.” (53) Social institutions would then arise when different actors would reciprocally typify each other’s patterns and recognize these patterns as external and objective facts. (Berger and Luckman, 1966: 56, 58)

A different image of routines, called “scripts”, emerged from research on social cognition and artificial intelligence (roots shared with the Carnegie School) to describe the action sequences that occur in mundane situations, such as ordering food in a restaurant. The view was that many ordinary situations are scripted into “a predetermined, stereotyped sequence of actions that

define a well-known situation” (Schank and Abelson, 1977: 41). For example, Jack goes to a restaurant, he orders a hamburger and a coke, the waitress brings his meal, he eats and asks for the check, the waitress gives him the bill, he pays and leaves. The imagery is theatrical – both the customer and the waitress follow the lines of a script. Parts of the script are essentially expectations, shared by the participants, about the events that are to occur and the order of their occurrence. Scripts thus consist of actions that have a temporal relationship to each other (read menu first, then order food, then receive food, and so on). It is important to recognize a critical difference between scripts and the routines of the Carnegie school. While scripts are knowledge structures, routines in the sense of the Carnegie school are real world structures that focus more on observable stimuli than on internal states of actors.

A notion of routines related to the Carnegie approach was presented in the *Evolutionary Theory of Economic Change* (Nelson and Winter, 1982). Like the Carnegie School, the Evolutionary Theory is deeply skeptical about classical (‘orthodox’) notions of rationality in economic theory. It presents an inspiring vision of routines as essential ingredients of organizations and as a core concept of a new approach that aims to supercede the orthodox, rational choice focused economic model. The conception highlights the suppression of choice as a key aspect of routines. In this view, routines are automatically executed without conscious volition, comparable to the execution of computer programs. Participants have mostly tacit knowledge of the routine and select options automatically (Nelson and Winter, 1982: 73, 75). As a result, routines have “deep channels in which behavior normally runs smoothly and effectively.” (84) Because routines are comparatively stable patterns of behavior, they can act as organizational *genes* that reproduce behavior and thereby facilitate the duplication and scaling of operations (135). They can recreate action patterns on individual and organizational levels. In evolutionary theory, the term ‘routine’ refers to three related things: “a repetitive pattern of activity in an entire organization, to an individual skill, or, as an adjective to the smooth uneventful effectiveness of such an organizational or individual performance.” (Nelson and Winter, 1982: 97) Although routines are characterized as effective ways of getting things done, routines are not considered to be optimal – “One cannot infer from the fact that an organization functions smoothly and successfully in a particular range of observed environments that it is a rational and ‘intelligent’ organism that will cope successfully with novel challenges” (Nelson and Winter, 1982: 126). Even if an

organization optimizes its routines, or even builds dynamic capabilities that keep lower-order routines matched to changing environmental conditions, there is no guarantee that these efforts yield better results than “ad hoc problem solving.” (Winter, 2003: 994).

During the late eighties and early nineties, a series of articles emerged that shared a skeptical tenor about the benefits of routines. Routinized behavior was considered to be of the “non-thinking variety” (Weiss and Ilgen, 1985:57), typically lacking “depth of situational analysis and the explicit consideration of alternatives behaviors”. Routinization would involve a reduction of awareness apparently caused by repeated experience – “if the same environment is repeatedly experienced there is little new to think about.”⁷ “Repeated successful responses to similar situations” (59) reduce uncertainty and cognitive activity and as a result, individuals “acquire confidence in the validity of their behavior patterns” (59), problem relevant cues are overlooked, and organizations can become “desensitized to environmental changes” (64). Routines may even persist when outcomes are suboptimal because “these outcomes may still be sufficiently positive to prevent noticing the possibility for even more satisfying outcomes which might be attainable by changing behaviors” (62), a notion that subsequently was explored under the heading of competency traps (Levitt and March, 1988).

The mindlessness of scripted action in organizations was highlighted by Ashforth and Fried (1988). They identified six conditions that contribute to mindless enactment and cuing, including the existence of event schema, easily categorizable cues, minimal behavioral effort, absence of subroutines that require problem solving, and absence of interruptions. Because these conditions prevail in many work situations (including political settings), much of everyday organizational behavior occurs quite mindlessly (Ashforth and Fried, 1988: 311). The outcomes are a lack of vigilance as workers “go automatic”, and a loss of authenticity that interferes with the display of emotions required by roles such as the friendly flight attendant or the hostile bill collector (317). Mindlessness would also negatively affect decision making because it “effectively blinkers perceptions of the task environment”, because initial cues can prematurely trigger the execution

⁷ Weiss and Ilgen (1985:57) refer to Langer (1978) at this point.

of entire scripts (“premature closure”), and because it perpetuates inaccurate causal attribution based on superstitious learning (Ashforth and Fried, 1988: 317-319).

The automatic launching of routines in response to stimuli was analyzed by Gersick and Hackman (1990). Their paper starts out with the harrowing story of Air Florida Flight 90 which crashed because the pilots (who were from Florida where de-icing is not necessary) habitually skipped the de-icing of their airplane even though they were taking off in January from Washington, DC. The Gersick and Hackman approach appears to extend stimulus-response theory to the group level (and is similar in that respect to [March & Simon, 1958: 149](#)). They observed that the group “exhibits a functionally similar pattern of behavior in a given stimulus situation without explicitly selecting it over alternative ways of behaving.” ([Gersick and Hackman, 1990: 69](#)). This may explain why all life guards rush into the water after seeing one lifeguard racing to the water. The automatic triggering of routines has advantages for groups such as speed and comfort for members, but can have disadvantages, such as miscoding of stimuli, groupthink, and stagnation. Habitual routines settle in over time, they are automatically repeated the next time the appropriate stimulus appears. They are often kept in place due to sentimental attachments to the routine, social entrainment, when activity patterns become very persistent due to long or intensive training, or through reticence, when members wait for others to break out of the routine ([Gersick and Hackman, 1990](#)).

Connections between individual-level skills and organizational routines were drawn in research that explored how routines are stored in “procedural memory” ([Cohen, 1991; Cohen and Bacdayan, 1995](#)). The argument builds up from the assumptions that “routines are stored in procedural memory” of individuals, that organizations ‘concatenate’ (see below) individual routines to form multi-actor, organizational routines, and that routines on both levels have noteworthy features related to *procedural memory*. Procedural memory “stores the components of individual skilled actions” involved in a routine and can be distinguished from *declarative memory* which stores “facts, propositions, and events” ([Cohen and Bacdayan, 1995:557](#)). Cohen and Bacdayan’s laboratory-based study suggests that procedural and declarative memory have different features: “Procedural knowledge is less subject to decay, less explicitly accessible, and less easy to transfer to novel circumstances.” ([Cohen and Bacdayan, 1995: 557](#)). The arguments

here appear to reflect the increasing enthusiasm within the organizational science field in the early nineties regarding the notion of tacit knowledge (e.g., [Zander and Kogut, 1995](#)). The key idea here is that the tacit, procedural memory of routines makes them inert: “routines often emerge through gradual multi-actor learning, and exhibit tangled histories that may frustrate both understanding and reform” (Cohen and Bacdayan, 1995: 556). Cohen and Bacdayan illuminate their argument with Morison’s fabulous example of “British artillery crews pausing for three seconds before firing because they ‘were holding the horses’”. (556) Apparently, routines can produce reliability and speed, but can also “become 'contaminated' with extraneous, historically-specific and arbitrary components” (Cohen and Bacdayan, 1995: 556). They are also hard to change, and can misfire, as illustrated in [Allison’s \(1971\)](#) story of the “civilian-clothed Soviet troops arriving secretly in Cuba who nonetheless formed into ranks on the dock and marched conspicuously away” (Cohen and Bacdayan, 1995: 555). In that story, the collectively tacit side of this organizational routine reproduced a pattern that was easily identified by US spy satellites.

Routines exist on two levels – on the cognitive level in the form of conceptions held by participants, and on the empirical level in the form of factual actions. A routine held in the mind of participants can have a variety of functionally similar ([Gersick and Hackman, 1990](#)) observable instantiations (or “performances”). For example, a restaurant routine might include various types of courses (dessert or not) and different types of payment (cash or credit). [Pentland and Rueter \(1994\)](#), building on [Salancik and Leblebici’s work \(1988\)](#), explored these two sides of routines with a novel approach that compared routines to languages. Languages have grammars that determine the formation of proper sentences. In a similar manner, grammars of routines would determine the range of proper performances of the routine. The analogy implies that an “organizational routine is not a single pattern but, rather, a set of possible patterns – enabled and constrained by a variety of organizational, social, physical, and cognitive structures—from which organizational members enact particular performances” (491). The conceptualization of routines as grammars of action is indeed intriguing, harking back to notions of social accounts and vocabularies of motive ([Scott and Lyman, 1968](#); [Mills, 1940](#)). Just as grammars constrain language, so they might constrain action within routines. The identification of the grammatical rules of organizational routines is not easy, however. Pentland and Rueter analyzed 335 customer support calls at a software company, each coded as a sequence of

‘moves’ such as opening, transfer responsibility to user, work on the call, etc. They used half the sample of calls to identify a series of grammar rules that they then tested on the other half of the sample. The grammar (consisting of 13 rules) was able to parse (‘rewrite’) more than half of the action sequences in the second half of the sample, meaning that a significant part of the firm’s support calls would follow patterns consistent with the grammar⁸, suggesting that performances of routines share an underlying grammatical structure. What is less clear in this approach is how grammars become relevant for action. The authors suggest that grammars reflect constraints arising from the limited lexicon of moves available to actors and “logical dependence” among moves (e.g., calls must be opened before they can be closed). But direct effects of grammars on actions of actors are so far not part of the model. Grammatical rules “need not be thought of in the usual sense of rules that organizational members follow or refer to while doing their work ... phrase structure rules of the kind used here are simply devices for describing patterns observed in the coded data.” (498). It seems that more research will be needed to explore how routine grammars relate to action, where the grammars come from, how they evolve, and how they get transmitted between participants. Clearly, grammars are a promising and inspiring area for future research.

Routines are executed by agents (usually humans), and if one considers agents to be part of the routine itself, then the internal life of routines becomes much more complex and dynamic. Routines then can be seen as a source of change (Feldman, 2000). For example, in the student residences explored by Feldman, the building directors felt they had an educational mission regarding students who often would not assume personal responsibility for the damage they had incurred to their rooms, even though their parents usually paid for all damages, which then led to a modification of the check-out routine that assured that the students would personally meet with staff members before they moved out. Feldman and Pentland (2003) propose to see the internal dynamic of routines driven by two key ‘aspects’ of routines, the ostensive and performative aspects: “The ostensive aspect is the ideal or schematic form of the routines. It is the abstract, generalized idea of the routine, or the routine in principle. The performative aspect of the routine

⁸ Some departures were caused by inaccuracies in the database, and others would “contradict our normative sense, based on insights from the fieldwork, or what constitutes a

consists of specific actions, by specific people, in specific places and times. It is the routine in practice.” (Feldman and Pentland, 2003:101). According to Feldman and Pentland, change of routine comes about because “[p]eople combine elements of past repertoires of a particular routine .. with present situations, with a view to how this particular combination affects future understandings of what the routine is. This movement between performative and ostensive provides many opportunities for people to produce variations on a routine, to select these variations, and to retain them as what it means to do this particular routine” (112-113). In later work, Pentland and Feldman (2005) added “artifacts” as a third component of routines, and argued that divergence between the three would lead to routine change. The conceptual apparatus in this line of work is complex but intriguing, and leaves quite a few questions for future research.

In sum, it appears there are many diverse notions of routines in this field. Routines are seen as kernels of rationality, fixed responses to stimuli, repositories of organizational knowledge, micro institutions, theatrical scripts, genes of organizations, a reduction of awareness, mindless behavior, functionally similar patterns of behavior, procedural memory, grammars of action, and sources of change (for a more extensive review, see Becker, 2004). As a result, researchers have struggled to develop a unified conception of routine (e.g., Cohen et al, 1996). Nevertheless, there is a fair amount of agreement that routines involve recurrent patterns of action, that the cognitive effort required for their execution decreases with repeated performance, and that routines operate on multiple levels.

Research on routines is still very much in flux, however, and it might be premature at this point to impose a rigid definition of routines. Instead, it might be more productive to focus the analysis on those social situations we normally refer to as “routine”. This means using language as a guide, or perhaps common cultural understandings of what routines are. This also means taking

complete, competent call” (Pentland and Rueter (1994: 503).

into account how we recognize routines. It is an approach that considers routines as curious phenomena that manage to coagulate separate actions into distinctive and persistent patterns⁹.

(B) Internal Mechanisms of Routine Reproduction

Although routines have found considerable attention over the last twenty years, we understand surprisingly little of how action within routines comes to be guided by forces that arise from within the routines. Such routine-based forces are strong and prevalent. They reproduce the same behavior in individuals, groups, and organizations, and they can do so in a remarkable reliable fashion. Yet, the degree to which routines stay on track varies considerably. Sometimes a routine situation is an exact replication of the sequence of steps taken in the past; sometimes there is only a rough resemblance, e.g., because steps are added or skipped or executed in a different manner. What determines the degree to which routines stay on track? What keeps action locked within narrow channels?

To some degree, the question of how routines stay on track is an epistemological one. How do we recognize routines as such? Apparently, routines emerge clearer to us the more the actions within them stay on track. The more action within routines stays on track, the more we get the *sense of sameness* so typical of our experience with routines. The more action goes astray, the more we lose that sense of sameness. The systematic sources of that sense of sameness are not too well understood (although its curiosity is recognized, e.g., [Birnholtz, Cohen, and Hoch, 2007](#)). A key mechanism could likely be the inherent capability of intelligent agents to recognize repetition (e.g., [Shanks and Perruchet, 2002](#); [Gupta and Cohen, 2002](#)). Our capacity to recognize things when they re-appear is at the core of our experience of sameness and, more generally, is at the heart of all notions of identity¹⁰. We recognize routines because they repeat. Because they repeat, we recognize routines as separate entities that exist independently of us as

⁹ By using the word ‘manage’ I do not intend to anthropomorphize routines. I do assume however that routines have capabilities comparable to the way that molecules, genes, cells, organs or insects have capabilities.

¹⁰ Our capacity to re-cognize sameness is curiously coupled with a universal preference for familiarity – humans seek out familiar situations.

exterior and objective phenomena (Berger and Luckman, 1967; Zucker, 1977). Not only do routines repeat; the steps within routines repeat as well. We recognize the steps when we re-encounter them during another pass through the same routine (perhaps even backwards when we walk home from a trip to the post office). We recognize them as being part of the routine, and we expect to re-encounter them, and recognize them as the ones we took last time we passed through the routine. So, the capability of recognizing sameness in a world of differences is critical to our experience of routines as things that tend to stay on track.

But the question of *what* keeps routines on track is foremost a question about the psychological and sociological mechanisms that operate on the path of action that unfolds during normal routine execution¹¹. What mechanisms operate there? Clearly, any such mechanisms need to connect the prior history of the path to its continuation, perhaps via signals and traces left behind, via memories and stories of participants, via structures and artifacts developed on prior passes through the routine, and so on. Action can stay on the normal routine track only if there are mechanisms in place that connect current action in some way to prior history. This means that action in routines is path dependent. Continuation of the path of action during routine execution depends on things that happened on the way traveled so far. Prior actions have produced conditions (material, social, psychological, informational) that allow, and often force, continuation of work in a particular direction and preclude other directions. Often, the interactions between steps on a routine path are complex and produce rugged fitness landscapes (Siggelkow, 2001), meaning that variations of a path can have dramatic performance implications.

It is important to recognize here the difference between the current path and prior paths. Both form different histories. Both affect the course of action taken in a given situation. Both can conspire to keep routines on track. On the current path, earlier actions prepare the necessary

¹¹ By the way, there are some explanations that are popular but probably more speculative than helpful. For example, ‘agency’ is probably not a viable candidate for explaining how routines stay on track because it is too broad as a category and does not offer sufficient regularity to produce regular patterns. And the phases of the moon (unless amended by complex elaborations) are probably not a viable candidate either.

conditions that enable and constrain (Pentland and Rueter, 1994; Ashforth and Fried, 1988) the next actions within the routine. From an abstract perspective, one could say that prior actions of a routine *select* (Luhmann, 1995) consecutive actions. “Selection” here means that prior actions shape the availability and probability of next-step alternatives. Only after the wheels have been removed from a car (prior actions), do the brake components become accessible, and inspection and replacement of the brake pads (next steps) become possibilities with different probabilities.

Prior paths traveled through a routine in the past can create conditions that steer action in ways that align the current path with prior paths. For example, specific brake repair tools acquired in the past might demand a specific way of executing the brake job, the application of competencies developed during prior iterations might steer routine performance on specific tracks, and signs and instruction sheets created in the past might offer comfortable guidance.

Both types of paths affect the course of action taken within a routine. They interact in complex ways and thereby affect the degree to which action stays on track. Competencies, expectations, norms, rules, and so on, developed during prior iterations of the routine need to be able to handle the diverse conditions lining the current path. Conversely, prior steps taken on the current path need to offer opportunities and signals that support and trigger things developed in prior iterations, such as rules, expectations, obedience, and neuronal connections to related steps. If the histories of the current and prior paths are misaligned, routines are likely to get thrown off track¹². The two histories (of the current and prior path) are the primary referents for the selection of consecutive action during routine execution because the applicability (subjectively and objectively) of the routine to a given situation depends critically on the path traveled so far and on its match with prior paths. The match can easily be disrupted, as many might have discovered after finding themselves – on a Sunday morning – on the road to work instead of to the supermarket, the intended destination.

¹² This is apparently a common problem for the replication of routines (and leveraging of knowledge assets) across different locations (Winter and Szulanski, 2000).

For action to stay on track the selection of consecutive action within routines needs to occur in ways that reproduce the ‘normal’ path of the routine¹³. For this to happen, prior actions taken within a routine need to facilitate (i.e., make available relevant conditions and increase the probability of) those next-step alternatives that lie on the normal path of execution of the routine. This means that routine-based selection mechanisms need to be in place that become active when actions taken so far on a path match those of the normal path. Such *routine reproduction mechanisms* keep action on track by selecting those next step alternatives that lie on the normal path of the routine.

Routines thus stay on track by virtue of reproduction mechanisms that select consecutive action in ways that are related to both the history of the current path and the history of prior paths. The history of the current path produces the conditions necessary for action to stay on track, and the history of prior paths creates the conditions that orient action selection toward the normal path. Yet, because reproduction mechanisms keep action on track, they also help to create the normal path. Reproduction mechanisms thus co-evolve with the routines that they help to stabilize.

If reproduction mechanisms shape the paths on which earlier actions select later actions and they are shaped by the history of prior passes through the same routine, how do they stabilize action, and how do the mechanisms themselves function and evolve? Although the literature on routines has not penetrated very deeply into this terrain, scattered discussions on such mechanisms can be found. In the following I will discuss a smattering of ideas on reproduction mechanisms gleaned from the sociological and psychological debates on routines and related phenomena, focusing in particular on the aspects of mechanisms that address how prior actions select consecutive action, and how the mechanisms co-evolve with routines. The mechanisms are located on individual and collective levels and involve varying degrees of conscious attention to outcomes. Some mechanisms overlap partially with others, as thinking about routines has evolved in rather dispersed and sporadic ways.

¹³ By ‘normal path’ I mean the path of action usually traveled within the routine (perhaps some weighted average of prior paths), and which often is perceived by participants as the

Habitualization occurs usually on individual level, when actors develop expectations about themselves. The process is illuminated by Berger and Luckman's story about "solitary man", proverbially stranded on a desert island and building a canoe out of matchsticks, and who "mumble(s) to himself, 'There I go again,' as he starts on step one of an operating procedure consisting of, say, ten steps" (Berger and Luckman, 1967: 53). He becomes aware of the procedure, recognizing it as a separate entity that has stepped into his lonely island existence, bearing familiarity and friendship: "even solitary man has at least the company of his operating procedures." (53). Each of his procedures has identity by virtue of the different activities it involves. It forms a distinct pattern "which, *ipso facto*, is apprehended by its performer as that pattern" (53). It is an individual-level typification of action patterns which needs to be distinguished from more collective forms discussed below. The key to habitualization is an awareness of which actions belong to a routine and which do not. The selection of consecutive action is based on *familiarity* with things personally experienced in the past. At each step of the routine, solitary man selects those actions that fit into the familiar pattern of his routine. He is kept on track by a mental image (a private 'script', Schenk and Abelson, 1977; 1995) that tells him which actions need to be taken next in order to complete his routine. An important aspect of habitualization is that it is often mindless, and can be knocked off track when unfamiliar situations arise, for example, when tools break, or materials become unavailable. Habitualization is closely related to notions of skill and "knowing the job" in evolutionary economics (Nelson and Winter, 1982). Habitualization is strengthened by recurrent passes through the routine as this intensifies familiarity. Habitualization can also be accompanied and strengthened by pride. In his discussion on the relationship between bureaucratic structure and personality, Merton noted that bureaucrats develop a way of life and a "pride of craft" which leads them to resist change of bureaucratic routines (Merton, 1968: 255). Pride of craft seems to play a significant role especially in professions where the craft is visible to customers. Just consider the pride of craft often displayed by doctors, TV chefs, referees in sports, and waiters of classy restaurants.

Priming. Habitualization within individuals is probably accompanied and facilitated by processes on the neuronal level. On that level, steps in a routine prime subsequent steps through

normal course of action.

spreading activation within neuronal networks (Collins and Loftus, 1975; Sheperd, 1979; Reggia and Sutton, 1988). Each step in a routine creates a situation with elements that remind the actor of the steps he took the last time he passed through the routine. Prior executions of the routine have left neuronal connections in the actor's mind. The actor recognizes the current situation as one that he has encountered before and that last time led to specific next steps. The path of action is driven forward by *attention spreading from activated areas to connected areas*. The mechanism is akin to singing a familiar song. The singer follows a well-practiced sequence of words and sounds. Consecutive syllables are linked fluidly together. The mechanism of selection is spreading activation. Familiarity of the melody and lyrics leads the singer from one phrase to the next. The effect of priming is strong. It is well known, for example that stuttering is significantly reduced during singing, because of the subjects' familiarity of the melody and lyrics (Healey, Mallard and Adams, 1976). Priming is strengthened by recurrent passes through the same routine because neuronal connections are strengthened (Gupta and Cohen, 2002). An interesting feature of priming is self-validation, where the actor interprets ambiguous stimuli in a manner consistent with an anticipated script (Ashforth and Fried, 1988), for example, when stock movements by insiders trigger sell-off routines, when overzealous 'experts' jump to conclusions, or when politicians filter (or even fabricate) evidence to justify military responses to difficult situations. Priming is also intriguing because it can be extended to multi-actor situations (Cohen and Bacdayan, 1994; see also the discussion on procedural memory below).

Reciprocal typification. This mechanism represents an extension of habitualization to relationships between participants. Reciprocal typification occurs when actors develop expectations about each other. In the solitary man scenario, typification starts when Robinson is joined by another person, Friday, who first observes, then recognizes Robinson's recurrent patterns of action as Robinson's routines. Friday might think "Aha, there he goes again", recognizing a certain pattern of action as one of Robinson's routines, thus forming a typification of Robinson's behavior. Moreover, the typification is reciprocal. Robinson and Friday form reciprocal typifications of each other's behavior, and if they become involved in each others' projects or actions, they might say "There *we* go again". As a result, outcomes of actions become predictable and a division of labor can be established between the actors (Berger and Luckman, 1967: 56-59). In reciprocal typification, the selection of consecutive action is guided by

perceptions about the expectations and potential reactions of others. Robinson is aware that Friday expects him to continue working on the canoe, not use it as a source of firewood, and that if he burns the canoe, that Friday might treat him as if he has lost his mind. Their joint history serves as the source of expectations that guide their action. Their expectations evolve and strengthen with recurrent passes through the routine. It appears that expectations developed through a shared history can make a relationship more efficient. For example, research on interorganizational routines has found that partner-specific experiences have positive effects on alliance performance (Zollo, Reuer, and Singh, 2002), while research on networks suggest that embedded ties generate economies of time (Uzzi, 1997). Departures from the typical path raise questions from the other party and can produce coordination problems and conflict -- negotiation might ensue, agreement might be sought, contracts and truces might be established (Nelson and Winter, 1982). Routine execution guided by reciprocal typification tends to be more pliable than that based on institutionalization (see below). It is a comparatively private social formation that allows things to be changed on an ad-hoc basis.

Institutionalization. This mechanism extends habitualization even further to the collective level. It starts when routines are passed down to new generations. For new generations, the origin of the routines is opaque as their history antedates their arrival. As a result, they accept the routines as the way of “how these things are done”, as “historical and objective facticity”. The transmission of routines to large numbers of participants and generations can “thicken and harden” the routines and may turn them into coercive norms (Berger and Luckman, 1967: 59-60). Within the institutionalization mechanism, the selection of consecutive action is guided by *widely accepted and usually taken for granted conceptions of what the next step ‘ought’ to be.* After the groceries have been rung up by the cashier, the customer is expected to pay – little chance of negotiation there. Institutionalization is related to the ostensive side of routines, the “abstract, generalized idea of the routine, or the routine in principle” (Feldman and Pentland, 2003: 101). Although institutionalization can provide strong guidance for selection of consecutive action, it is usually not monolithic. Degrees of institutionalization vary as different roles arise for different types of actors, meanings become misaligned, and “institutional segmentation” sets in (Berger and Luckman, 1967: 84). Misalignment can weaken the degree of institutionalization of routines, while alignment can strengthen it: “The ostensive aspect of

organizational routines gains in apparent objectivity and concreteness as the views of different participants come into alignment.”(Feldman and Pentland, 2003: 101). The degree of institutionalization of routines affects how closely routines stay on track. Weak institutionalization of routines will lead to more deviance while strong institutionalization will assure more faithful execution of the routines. Institutionalization blends into coercion when routines include mechanisms that enforce compliance (coercion is discussed below).

Value Infusion. Value infusion is based on Selznick’s view that institutionalization means “infused with value beyond the technical requirements of the task at hand” (1957:17). It captures those routine situations in which participants attach sentimental or symbolic value to the steps of the routine. It could be seen as similar to institutionalization insofar as the values come to be taken for granted and are shared among participants. The selection of consecutive action is guided by those *values* that actors hold about each step that should be taken along the path of action of a routine. In the case of symbolic values, the routine becomes a ritual, and steps are taken based on beliefs about the sacredness of the routine and its components. Value infusion is likely to intensify with repeated passes through a routine, as participants develop sentimental or superstitious attachments with the routine and its components. Often the presence of vestigial elements in rites can be traced back to value infusion.

Formalization. Routines can become encoded in rules, job descriptions, and structures (March et al, 2000; Miner, 1987; Schulz and Jobe, 2001; D’Adderio, 2003). Formalization can require extensive effort and might encounter considerable resistance from rule users (Conradi and Dybå, 2001). It nevertheless plays a critical role in popular management techniques, such as process mapping, TQM, and re-engineering. Formalization establishes explicit directives that can provide guidance for action and facilitate monitoring and enforcement. Within formalized routines, action stays on track due to *compliance*. Compliance is not guaranteed, however, since actors often circumvent rules, often for good reasons. Rules are often incomplete and inconsistent, and they are usually rigid and quickly fall obsolete (Schulz, 1998b). It appears however, that some types of formalization (“enabling bureaucracies”, Adler and Borys, 1996) are more conducive to compliance. Drivers of formalization have found a bit of attention in prior research. Formalization tends to accelerate with organizational size and differentiation (Hage,

1980; Kralewski, Pitt, and Shatin, 1985), but it decelerates with the number of rules in the system (i.e., rule birth rates decline with rule density, see Schulz, 1998a). Formalization is likely to intensify with recurrent passes through the routine because this produces recurrent exposure to the same problems (“problem sorting”, Schulz, 1998a). A critical outcome of formalization is the enhanced capability to maintain and refine routines. This can be very important for power management and the cultivation of critical ties to outside parties (Staggenborg, 1988). Because formalization usually involves a considerable degree of analysis and articulation of informal arrangements and tacit knowledge, it can significantly contribute to knowledge production in organizations (Nonaka and Takeuchi, 1995).

Artifacts. Routine action is situated in a context that guides the selection of necessary steps of a routine. Ethnographic studies find that “wall spaces and boards were plastered with pieces of paper containing checklists, diagrams, how-tos, company policies, flow charts, and various instructions” (Kogan and Muller, 2006: 726). Such routine artifacts help workers to get through their routines. They guide routine action from one stage to the next. Here, the selection of subsequent action is guided by *routine artifacts that enable and signal subsequent actions that need to be taken next*. The effect is likely to strengthen as artifacts become elaborated and entrained by recurrent passes through the routine. Artifacts can contribute to routine change if they diverge from the performative and ostensive aspect of routines (Pentland and Feldman, 2005). An important aspect of artifacts is that they are not unequivocal. The same artifact can be interpreted in different ways (Barley, 1986), and can play different roles in different routines. The meaning of artifacts is thus dependent on the routine within which they are used. An important artifact is technology which can be extremely effective in keeping action on track within a routine, but even they can be re-interpreted and used in ways that contradict the intentions of the technology’s designers (DeSanctis and Poole, 1994). Tools are another type of artifact, and because of their prevalence in work settings play a tremendous role in keeping action on track. Normally, workers develop tool-specific skills through the repeated use of the tools, which contributes to keeping action on track (see the related discussion on competency traps below).

Concatenation of procedural memory. Because procedural memory is largely opaque to participants, routines reside partially in an “organizational unconscious” (Cohen and Bacdayan, 1994: 556), and thereby tend to be taken for granted. Insofar, procedural memory keeps routines on track in ways similar to institutionalization. However, one can identify a second line of argument in the procedural memory literature that is related to the way organizations connect individual-level routines to form organization-level routines: “As individuals become skilled in their portions of a routine the actions become stored in their procedural memories and can later be triggered as substantial chunks of behavior. The routine of a group can be viewed as the concatenation of such procedurally stored actions, each primed by and priming the actions of others (Tulving and Schacter 1990)” (Cohen and Bacdayan, 1994: 557). The mechanism of selecting consecutive action is based on *reciprocal triggering*. Routines stay on track because each action is primed by and primes the actions of others. Patterns of concatenation are likely to evolve and strengthen by recurrent passes through the routine.

Calculation¹⁴. The mechanism of “calculation” could be seen as an extension of habitualization into the realm of mindful behavior. Returning to the image of solitary man, it is likely that he not only develops an awareness of routines as separate entities, but also an awareness of how individual actions taken within a routine contribute to the outcome of the routine. He uses the routine instrumentally to achieve his goals, and might reflect on the contribution of each step to his goals. His goals might include a close matching of the current path of routine execution with prior iterations of the routine, a situation that one could label “routines as targets” (Nelson and Winter, 1982: 113). In calculation, the selection of subsequent action is guided by *awareness of action-outcome relationships*. At each step, he selects those actions that he considers to be *relevant* for specific outcomes of the routine. Calculation can involve various levels of cognitive effort, ranging from an “inkling” to full-blown Weberian instrumental rationality. It might involve varying degrees of goal-seeking behavior, and includes, as limiting cases, the painstaking adherence to a superstitious ritual and the meticulous performance of a drill (at this

¹⁴ It seems the English term ‘calculation’ is similar to ‘deliberation’ insofar as both involve cognitive effort directed towards achievements of the intended outcomes of a routine. However, my sense is that most use of ‘deliberation’ implies a volitional component that is usually not included in ‘calculation’.

point, calculation blends into value infusion and habitualization¹⁵). Calculation is error-correcting and can repair routines when interruptions occur, for example, due to external shocks. Calculation thereby can also contribute to routine flexibility and adaptation (Howard-Grenville, 2005; Feldman, 2000). It is therefore an important ingredient in organizational capabilities development (Gavetti, 2005). Calculation is likely to become more accurate through recurrent passes through the routine as action-outcome relationships become better understood (Duncan and Weiss, 1979). The degree of calculation involved in a routine probably declines with the frequency of executing the routine and increases with the level and scope of the routine (Nelson and Winter, 1982: 83) – for example, an organizational product design routine usually involves more calculation (including political maneuver by different participants) than an individual level skill. Calculation also increases in the presence of interruptions and operational and semantic ambiguity of the routine (Nelson and Winter, 1982: 83, 88). Furthermore, calculation can be affected by mood. Psychological research has shown that good mood leads to mindlessness (Bless, Clore, Schwarz, & Golisano, 1996). An interesting aspect of calculation is that it is often (if not always) complemented by less-mindful behavior, such as when rational action draws on repertoires of automatic routines (Levinthal and Rerup, 2006).

Competency traps are closely related to calculation. One could even see them as a special case of calculation. “A competency trap can occur when favorable performance with an inferior procedure leads an organization to accumulate more experience with it, thus keeping experience with a superior procedure inadequate to make it rewarding to use” (Levitt and March, 1988: 322). This mechanism applies not only to whole routines but also to their parts. Competencies developed in connection with a given action which is part of a routine make it more rewarding to re-use that action than to explore potential alternatives (March, 1991; Weiss and Ilgen, 1985). Competency traps operate to keep routines on track because they encourage actors to select those actions with which they have developed greater *competencies* during prior iterations of the routine. Competency traps are a special case of calculation insofar as competency traps involve a *consideration of how returns from competent action contribute to the outcomes* of the routine.

¹⁵ The currently fashionable fascination with zombies, robots, and meatpuppets might reflect the common mind’s curiosity about this transition.

The type of calculation involved here is only limited rational. Competency traps imply a deliberate choice based on poorly formed estimates of potential returns from alternatives. It is important to note that competency traps deepen over time as recurrent passes through the routine increase competencies with the steps that currently are part of the routine. The reduction of cognitive effort that typically accompanies routines and that often serves as a source of efficiency can lock behavior in potentially suboptimal channels.

Escalation of commitment. Action within a routine might continue on a prescribed path because of psychological investments made in prior stages. Actors might reason, “we started on this path, we might as well continue.” It is often associated with behavior that can be described as “throwing good money after bad”. The underlying reasons for such escalation of commitment include psychological needs of actors to justify prior action and needs to satisfy social norms of consistency (Staw, 1981). In the extreme, actors might engage in wishful thinking and superstitiously assume that the intensity of clinging to their beliefs has a positive effect on the probability that their beliefs come true. Expression of commitment is then seen as critical for success. As a result, they engage in ‘trying harder’, ‘praying harder’, ‘envisioning’, ‘staying the course’, and ‘positive thinking’. They abstain from action that would signal a weakening of their commitments. Their selection of subsequent action aims at maintaining consistency with prior beliefs. Routines are kept on track because actors take actions that *extend and re-affirm prior beliefs*. Escalation of commitment is likely to intensify the more ‘staying the course’ produces failures. The more failures are experienced in prior passes through the routine the more actions are taken that express steadfast commitment to the current course of action. Escalation of commitment is similar to institutionalization because it involves actors’ conceptions of action patterns that give meaning to the current path and offer guidance for its completion. It can also be seen as a case of (flawed) calculation insofar as it involves consideration of sunk costs as a reason for continuing the current path.

Coercion. Routines and rules are usually considered as modes of organizing that can substitute for hierarchical controls. Nevertheless, routines can include some form of coercion that constrains the range of actions that are selected by actors. Wide acceptance of routines can make them coercive (Berger and Luckman, 1967); for example, the custom of displaying flags can turn

into a coercive norm in patriotic countries. Research on self-managed work teams has found that the teams establish 'concertive controls' around their routines and team members exert peer pressure on each other to assure productivity and efficiency goals are met (Barker, 1993). Under coercion, routine execution is usually kept on track by an apparatus that monitors and enforces the faithful execution of some or all steps of a routine. Coercion involves imposition of *sanctions* for behavior that departs from the prescribed course of the routine. Selection of consecutive action is driven by *avoidance of pain*. Insofar as the sanctions are considered by the routine's actors as a form of outcome to be avoided, coercion can be seen as a special case of calculation. Coercion can be strengthened when prior passes through the routine lead to the creation and elaboration of a power apparatus, however coercion is far from fool-proof as intelligent agents tend to make efforts to evade the coercion mechanisms. Coercion is accompanied by a host of problems which make it a comparatively inferior mode of controlling operations (e.g., Gouldner, 1954; Martin and Freeman, 2003). To be effective for keeping routines on track, coercion needs to be accompanied with detailed commands, rules, or plans that can guide behavior and that are effectively communicated to the users of the routine.

Leadership. This mechanism is similar to coercion as it involves a power relationship. However, for leadership, the power is typically based on voluntary submission to the leader and the order he has established. Followers adhere to routines because they consider them to be part of a legitimate order. The selection of subsequent action is based on *obedience*. Leadership is often facilitated by plans that prescribe the path that followers are supposed to take (e.g., House, 1996). Leadership is likely to become more efficient by recurrent passes through the routine as leaders and followers learn to accommodate and inspire each other. However, the lessons the leaders learn are often spurious because the world is complex and rapidly changing and produces ambiguous signals that can be interpreted in a number of ways (Cohen and March, 1986: 195-203).

Dimensions and Typologies

The list of reproduction mechanisms presented above is most likely neither final nor exhaustive. Other types can be identified, and further research on this subject is likely to unearth additional

candidates. Furthermore, there is a fair amount of overlap between the mechanisms. Mechanisms could be grouped and labeled in different ways. The list clearly reflects the conceptual choices of the scholars who introduced the mechanisms, and who often had totally different theoretical intentions in mind. Of course, the list also reflects the attention limits of this author and the idiosyncrasies of the search path followed. Therefore, the list should be treated as an invitation to think about routines in new ways, and not as a complete theory of routine reproduction mechanisms.

To organize the terrain and get a feeling for its shape, one could potentially develop a formal typology of mechanisms. To do so, one could start with the dimensions inherent in the current mechanisms. Several dimensions come to mind. One dimension is the degree of calculation (or mindfulness) involved. Another is the level of aggregation (individual, dyad, group, organization, society). A third is the degree of intrinsic or extrinsic motivation involved.

Although one could probably develop a typology on the basis of these dimensions, it is not clear how constructive that would be. Many mechanisms occupy broad bands on these dimensions, and additional dimensions might emerge in future research. For these reasons, it might be wise to hold back on typology building efforts until the terrain has become more established.

Predictions

Reproduction mechanisms contribute to keeping action on track within routines. The discussion above suggests a few general predictions that are neither surprising nor complicated¹⁶, but can establish reasonable baselines for future research that might uncover interesting departures from them.

The first prediction is the most basic one, focusing on the presence of reproduction mechanisms in a given routine situation. The claim is that *the presence of a reproduction mechanism in a given routine situation will have a positive effect on the likelihood that action stays on track.*

¹⁶ Nor are they tautological – note that the focus here is on routine situations (not routines) and the degree to which action stays on track in those situations.

Clearly, some reproduction mechanisms might be stronger than others, and comparisons of their strength and the accommodating conditions that moderate their strength are important areas for future research.

More than one reproduction mechanism may be present in a given routine situation. It seems plausible to assume that their contributions might add up and produce a combined effect that increases with the number of mechanisms at work. Thus, the second prediction is that *the larger the number of reproduction mechanisms concurrently at work in a routine situation, the more likely that action will stay on track*. A similar prediction arises if one assumes that each mechanism can operate with some level of intensity, e.g., by being more or less dominant in a given situation. In that case, it seems likely that the likelihood of action staying on track is a positive function of the cumulated intensity of the reproduction mechanisms in place. The intensity of a reproduction mechanism can be conceptualized as its probability of guiding action in a given type of routine situation, and the cumulated intensity can be conceptualized as the sum of the intensities of the mechanisms operating in a given routine situation. Then the third prediction can be formulated as: *The larger the cumulated intensity of reproduction mechanisms in a given routine situation, the more likely that action will stay on track*. Clearly, the last two relationships might not be linear as different mechanisms might amplify each other or impede each other. But unless combinations of mechanisms are mutually incompatible, one would expect a positive effect.

Reproduction mechanisms evolve and strengthen with use of the routine. The way this happens is quite underexplored at this point (a few initial explorations can be found in [Espedal, 2006](#)), but it seems likely that it happens in different ways for each mechanism. Habitualization is strengthened when recurrent passes through the routine intensify familiarity. Priming is strengthened by recurrent passes through the routine because this strengthens neuronal connections. Expectations and roles involved in typification evolve and strengthen with recurrent passes through the routine. Institutionalization is strengthened by recurrent transmissions of the routine to large numbers of participants. Formalization intensifies with recurrent exposure to problems in prior iterations of the routine. Artifacts become elaborated and entrained by recurrent passes through the routine. Patterns of concatenation are likely to evolve and strengthen

by recurrent passes through the routine. Calculation is likely to become more accurate through recurrent passes through the routine as action-outcome relationships become better understood. Competency traps deepen as recurrent passes through the routine increase competencies with the steps that currently are part of the routine. Escalation of commitment is likely to intensify the more failures are experienced in prior passes through the routine and the more actions are taken that express steadfast commitment to the chosen course of action. Coercion can be strengthened when prior passes through the routine facilitate the elaboration of the power apparatus. Likewise, leadership is likely to become more efficient by recurrent passes through the routine as leaders and followers learn to accommodate each other.

Although more research, particularly empirical research, is needed to explore these relationships in further detail, it seems likely that prior passes through a routine strengthen the reproduction mechanisms in ways that produce a positive relationship between the number of prior iterations of the routine and the likelihood that action stays on track. The fourth prediction is thus: *the larger the number of prior passes through the routine, the more likely that action will stay on track during the current pass*. It is conceivable that this relationship is non-linear or even non-monotonic, for example, repeated passes through a routine can create burn out (exemplified in Charlie Chaplin's *Modern Times*) or even give rise to forces that encourage straying off track when members figure out how to play the system or engage in conflict among themselves (e.g., Crozier, 1964; Espedal, 2006). The effects of such complications will have to be explored in future research.

(C) Conclusion and Outlook

Routines govern an astounding proportion of behavior of individuals and organizations. Perhaps as a result, they also play an increasingly important role in theories of social and economic order. If routines are really a source of social order (as these theories seem to imply) then they should be equipped with internal mechanisms that stabilize them. If their stabilizing effect could be reduced to external forces, then we would not need a concept of routine. So, for routines to be able to explain social order they need to be relatively independent from external forces.

My search for internal sources of stability has led me to a list of reproduction mechanisms that keep routines on track. Each of the mechanisms has its own way of shaping the selection of consecutive action. Each connects the selection of next steps to the prior history on the current path and the history of prior paths in ways that reproduce the routine. The reproduction mechanisms tend to strengthen over repeated passes through the routine, suggesting that they co-evolve with the routines that they help to stabilize.

The list of reproduction mechanisms is not short, suggesting that routines are held in place by internal forces and that it would be difficult to reduce routines to ‘grand’ external forces such as rationality, power, and agency. Rather, routines are self-reinforcing phenomena that have an “Eigendynamik” that can keep action on track and thereby produce stable patterns of order that guide and coordinate action in organizations and societies. In that view, routines do have a justifiable claim to be treated as central elements of theories of order.

Of course, this eigendynamic feature of routines merely offers an auspicious backdrop for deeper explorations of the relationship between routines and reproduction mechanisms. How do they co-evolve? How do routines shed mechanisms and adopt new ones? How tolerant are routines with respect to disruptions of reproduction mechanisms? How can reproduction mechanisms contribute to routine adaptation? Clearly, there is much to do in this rapidly developing terrain, especially empirical work. But the path ahead looks promising.

References

- Adler, Paul S.; Borys, Bryan 1996. Two Types of Bureaucracy: Enabling and Coercive. *Administrative Science Quarterly*, Vol. 41: 61-89
- Allison, Graham T. (1971), *Essence of Decisions: Explaining the Cuban Missile Crisis*, Boston, US: Little, Brown.
- Ashforth, Blake; Fried, Yitzhak 1988 "The Mindlessness of Organizational Behaviors", *Human Relations*, Vol. 41, No. 4, 305-329
- Barker, James R. 1993 "Tightening the Iron Cage: Concertive Control in Self-managing Teams", *Administrative Science Quarterly*, 38, 1993: 408-437
- Barley, Stephen R. 1986 "Technology as an Occasion for Structuring: Evidence from Observations of CT Scanners and the Social Order of Radiology Departments" *Administrative Science Quarterly*, Vol. 31, No. 1. pp. 78-108.
- Beck, Nikolaus; Kieser, Alfred (2003) "The Complexity of Rule Systems, Experience and Organizational Learning" *Organization Studies*, Vol. 24, No. 5, 793-814
- Becker, Markus 2004. "Organizational Routines: A Review of the Literature", *Industrial and Corporate Change*, Vol 13: 643-677
- Berger Peter L.; Luckmann, Thomas 1967 (orig: 1966) *The Social Construction of Reality*. New York: Anchor Books
- Birnholtz, Jeremy P., Cohen, Michael D., Hoch, Susannah V. 2007 "Organizational Character: On the Regeneration of Camp Poplar Grove" *Organization Science*, March-April 2007; 18: 315 - 332.
- Bless, H., Clore, G. L., Schwarz, N., & Golisano, V. (1996). "Mood and the use of scripts: does a happy mood really lead to mindlessness?" *Journal of Personality & Social Psychology* , 71, 665-679.
- Cohen, Michael D. 1991 Individual Learning and Organizational Routine: Emerging Connections *Organization Science*, Vol. 2: 135-139.
- Cohen, Michael D.; Paul Bacdayan (1994), "Organizational routines are stored as procedural memory: Evidence from a laboratory study", *Organization Science*, Vol 5: 554-568
- Cohen, Michael D., Roger Burkhart, Giovanni Dosi, Massimo Egidi, Luigi Marengo, Massimo Warglien and Sidney Winter (1996), "Routines and other recurring action patterns of organizations: Contemporary research issues." *Industrial and Corporate Change*, 5(3), 653-698.

- Cohen, Michael D., March, James G. 1986 *Leadership and Ambiguity* (Second edition). Harvard Business School Press: Boston, MA
- Collins, A.M. & Loftus, E.F. (1975). A spreading activation theory of semantic processing. *Psychological Review*, 82, 407-428.
- Conradi, Reidar; Dybå, Tore 2001 "An Empirical Study on the Utility of Formal Routines to Transfer Knowledge and Experience," *Proceedings of the European Software Engineering Conference 2001(ESEC 2001)*, ACM Press, New York, pp. 268-276.
- Crozier, Michel 1964 *The Bureaucratic Phenomenon*. The University of Chicago Press, Chicago
- Cyert, R. and March, J. G.: *A Behavioral Theory of the Firm* (Englewood Cliffs, NJ: Prentice-Hall, 1963).
- D'Adderio, Luciana 2003 "Configuring software, reconfiguring memories: the influence of integrated systems on the reproduction of knowledge and routines." *Industrial and Corporate Change*, Volume 12, Number 2, pp. 321-350
- DeSanctis, Gerardine; Poole, Marshall Scott 1994 "Capturing the Complexity in Advanced Technology Use: Adaptive Structuration Theory" *Organization Science*, Vol. 5, No. 2. pp. 121-147
- Duncan, Robert; Weiss, Andrew 1979 "Organizational Learning: Implications for Organizational Design" *Research in Organizational Behavior*, Vol. 1, 1979: 75-123
- Espedal, Bjarne 2006 "Do Organizational Routines Change as Experience Changes?" *The Journal of Applied Behavioral Science*, Vol.42, Iss. 4; pg. 468-490
- Feldman Martha S. 2000 "Organizational Routines as a Source of Continuous Change" *Organization Science*, Vol. 11, No. 6., pp. 611-629.
- Feldman, Martha S.; Pentland, Brian T. 2003 "Reconceptualizing Organizational Routines as a Source of Flexibility and Change" *Administrative Science Quarterly*, Vol. 48, 94-118
- Gavetti, Giovanni 2005 "Cognition and Hierarchy: Rethinking the Microfoundations of Capabilities' Development." *Organization Science* Vol. 16 Issue 6, p599-617
- Gersick, C. J.; Hackman, J. R. 1990. "Habitual routines in task performing groups." *Organ. Behavior Human Decision Processes* 47 65–97.
- Gouldner, Alvin W. 1954 *Patterns of Industrial Bureaucracy*. New York: The Free Press
- Grote, Gudela; Weichbrodt, Johann; Günter, Hannes 2007 *Coordination in high-risk organizations: The need for flexible routines*. Conference Paper for the Third International

Conference on Organizational Routines "Empirical research and conceptual foundations",
Strasbourg, 2007

Gupta, Prahlad; Cohen, Neal J. 2002 "Theoretical and computational analysis of skill learning, repetition priming, and procedural memory." *Psychological Review*, Vol 109(2), Apr 2002. pp. 401-448.

Hage, Jerald 1980. *Theories of Organizations Form, Process, and Transformation*. New York: John Wiley

Healey EC; Mallard AR 3rd; Adams MR. 1976 "Factors contributing to the reduction of stuttering during singing." *Journal of Speech and Hearing Research*, 19(3):475-80.

House, Robert J. 1996, Path-goal theory of leadership: Lessons, legacy, and a reformulated theory, *The Leadership Quarterly*, Volume 7, Issue 3: 323-352.

Howard-Grenville, Jennifer A. 2005. "The Persistence of Flexible Organizational Routines: The Role of Agency and Organizational Context", *Organization Science*, Vol. 16, No. 6: 618-636

Kieser, Alfred 1987 "From Asceticism to Administration of Wealth. Medieval Monasteries and the Pitfalls of Rationalization" *Organization Studies*, Vol. 8, No. 2, 103-123

Kogan, S. L., Muller, M. J. 2006 "Ethnographic study of collaborative knowledge work", *IBM Systems Journal* 45, 4: pg. 759-771

Kralewski, John E., Pitt, Laura, Shatin, Deborah. 1985 Structural Characteristics of Medical Group Practices *Administrative Science Quarterly*. Vol.30, Iss. 1; pg. 34-45

Langer, E.J. 1978 "Rethinking the Role of Thought in Social Interactions" in J.H. Harvey, W.J. Ickes and R.F. Kidd (eds.), *New Directions in Attribution Theory*, Vol 2, Hillsdale, NJ: Erlbaum

Levinthal, Daniel; Rerup, Claus 2006 "Crossing an Apparent Chasm: Bridging Mindful and Less-Mindful Perspectives on Organizational Learning," *Organization Science*, Vol. 17, No. 4: 502-513

Levitt, B. and March, J. G.: "Organizational Learning," *Annual Review of Sociology*, 14 (1988), 319-340.

Louis, M. R., R. L. Sutton. 1991. Switching cognitive gears: From habits of mind to active thinking. *Human Relations* 44 55-76.

Luhmann, Niklas. 1995 *Social Systems*. Stanford, CA: Stanford University Press.

Lyman, Stanford M. 1990 "The Drama in the Routine: A Prolegomenon to a Praxiological Sociology," *Sociological Theory*, Vol. 8, No. 2, pp. 217-223

- March, J. G. and Simon, H. A.: *Organizations* (New York: John Wiley, 1958).
- March, J. G.: "Exploration and Exploitation in Organizational Learning," *Organization Science*, 2 (1991), 71-87.
- March, J. G., Schulz, M., and Zhou, X.: *The Dynamics of Rules: Change in Written Organizational Codes* (Stanford: Stanford University Press, 2000).
- Martin, Kirsten, Freeman, R. Edward 2003 "Some problems with employee monitoring". *Journal of Business Ethics*, Vol.43, Iss. 4: 353-361
- Merton, Robert K. 1968 (orig. 1957) *Social Theory and Social Structure*. New York: The Free Press
- Mills, C. Wright 1940 "Situated Actions and Vocabularies of Motive", *American Sociological Review*, Vol 5, 904-913
- Miner, A. S.: "Idiosyncratic Jobs in Formalized Organizations," *Administrative Science Quarterly*, 32 (1987), 327-51.
- Miner, A. S.: "Organizational Evolution and the Social Ecology of Jobs," *American Sociological Review*, 56 (1991), 772-785.
- Nelson, Richard R.; Winter, Sidney G. 1982 *An Evolutionary Theory of Economic Change*. Cambridge: Belknap
- Nonaka, I.; Takeuchi, H. 1995 *The Knowledge Creating Company*. Oxford: Oxford University Press
- Pentland, Brian T.; Feldman, Martha S. 2005 "Organizational routines as a unit of analysis" *Industrial and Corporate Change* 14(5): 793-815
- Pentland, B. T and Rueter, H. H.: "Organizational Routines as Grammars of Action," *Administrative Science Quarterly*, 39 (1994), 484-511.
- Reggia, J.A.; Sutton, G.G., 1988 "Self-processing networks and their biomedical implications" *III Proceedings of the IEEE*, Vol.76, Iss.6, Pages:680-692
- Reynaud, B. 2005. *The Void and the Heart of Rules: Routines in the Context of Rule-Following. The Case of the Paris Metro Workshop*. *Industrial and Corporate Change* 14(5) 847-871.
- Salancik, Gerald R. and Leblebici, Huseyin (1988), "Variety and Form in Organizing Transactions: A Generative Grammar of Organizations," In N. DiTomaso and S. B. Bacharach (Eds.), *Research in the Sociology of Organizations* Greenwich, CT: JAI Press.
- Sartre, Jean Paul 1965 *Nausea*. Harmondsworth, Penguin

Schank, R. C. & Abelson, R. P. (1995). "Knowledge and memory: The real story." In Wyer, R. S. (Ed.), *Knowledge and memory: The real story*. *Advances in social cognition*, 8, 1-85.

Schank, R. C.; Abelson, R. P. 1977. *Scripts, Plans, Goals and Understanding: An Inquiry into Human Knowledge Structures*. Hillsdale, NJ: Lawrence Erlbaum Associates

Schulz, Martin 1998a "Limits of Bureaucratic Growth: The Density Dependence of Organizational Rule Births". *Administrative Science Quarterly*. Vol 43, No 4, Winter, 1998

Schulz, Martin 1998b "A Model of Obsolescence of Organizational Rules," *Journal of Computational and Mathematical Organization Theory*, Vol 4, No 3, Fall 1998: 241-266

Schulz, Martin and Jobe, Lloyd A. 2001 "Codification and Tacitness as Knowledge Management Strategies: An Empirical Exploration." *Journal of High Technology Management Research*, Vol. 12: 139-165

Schulz, Martin and Beck, Nikolaus 2002. "Die Entwicklung organisationaler Regeln im Zeitverlauf." *Kölner Zeitschrift für Soziologie und Sozialpsychologie* 42 119-150.

Scott, Marvin B.; Lyman, Stanford M. 1968 "Accounts", *American Sociological Review* 1968, Vol 33, 46-82

Selznick P. 1957 *Leadership in Administration*. New York: Harper & ROW, Pub.

Shanks, D. R.; Perruchet, P. (2002). "Dissociation between priming and recognition in the expression of sequential knowledge." *Psychonomic Bulletin & Review*, 9, 362-367.

Shepherd, G. 1979. *Synaptic Organization of the Brain*. London, England: Oxford

Siggelkow Nicolaj 2001. "Change in the presence of fit: The rise, the fall, and the renaissance of Liz Claiborne", *Academy of Management Journal*, 44: 838-857

Staggenborg, Suzanne 1988 "The Consequences of Professionalization and Formalization in the Pro-Choice Movement" *American Sociological Review*, Vol. 53, No. 4.: 585-605.

Staw, Barry M. 1981 "The Escalation of Commitment to a Course of Action" *The Academy of Management Review*, Vol. 6, No. 4: 577-587.

Tulving, E. & Schacter, D.L. (1990). Priming and human memory systems. *Science*, 247, 301-306.

Uzzi, Brian. 1997. "Social Structure and Competition in Interfirm Networks: The Paradox of Embeddedness," *Administrative Science Quarterly* 42: 35-67.

Weber, Max 1976 *Wirtschaft und Gesellschaft*. Fünfte Auflage. J.C.B. Mohr (Paul Siebeck) Tübingen

Weiss, Howard M.; Ilgen, Daniel R. 1985 "Routinized behavior in organizations", *Journal of Behavioral Economics*, Volume 14, Issue 1, Winter 1985, Pages 57-67

Winter, Sidney G. 2003. "Understanding dynamic capabilities". *Strategic Management Journal*. Vol.24, Iss. 10; pg. 991-995

Winter, S., & Szulanski, G. (2000). "Replication of organizational routines: Conceptualizing the exploitation of knowledge assets." In N. Bontis, & C. W. Choo (Eds.), *The strategic management of intellectual capital and organizational knowledge: A collection of readings*. New York: Oxford University Press.

Zander, Udo; Kogut, Bruce 1995 "Knowledge and the Speed of the Transfer and Imitation of Organizational Capabilities: An Empirical Test" *Organization Science*, Vol. 6, No. 1, Jan-Feb 1995: 76-92

Zollo, Maurizio; Reuer, Jeffrey J.; Singh, Harbir 2002 "Interorganizational Routines and Performance in Strategic Alliances." *Organization Science* 13: 701-713

Zucker, Lynne G. 1977 "The Role of Institutionalization in Cultural Persistence", *American Sociological Review* Vol 42: 726-743