

Paradigm Shifts in Coordination Theory

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Abstract

Coordination – commonly defined as the achievement of concerted action - has been a phenomenon of central concern to organizational theorizing since the 1920s. Until the 1980s, information processing and contingency theorists have shaped coordination theory around the relationship between coordination mechanisms and drivers like task dependence, uncertainty, and equivocality. Recently, conceptual and empirical papers have emerged that offer new insights in coordination, emphasizing structures, processes and knowledge. As a field, however, coordination theory currently lacks coherence and focus. We suggest that paradigm shifts have occurred that have remained largely unknown and unaddressed. This unawareness constrains theoretical discussion and progress.

A paradigm is a set of ontological and epistemological assumptions that drives theory development and ultimately empirical research. According to Kuhn (1962), discussion on a paradigmatic level is needed when theory development stagnates. The objective of this conceptual paper is to formulate and compare paradigms underpinning coordination theory. The paper distinguishes three paradigms: contingency, structure-process, and inner-outer worlds. These paradigms are tied to literature, and each applied to the same example from a sports context. Analysis of the example fosters comparison and reveals the three unique perspectives on how individuals function in a collaborative setting, and how coordination is achieved. Each paradigm contributes differently to coordination theory, and has its own strong and weak points. The paper suggests that shifting the debate on coordination theory to a paradigmatic level offers new potential for a field that is of great importance to organization theory and practice.

Keywords: coordination, alignment of action, paradigm shift

Introduction

Coordination – the achievement of concerted action in situations of task interdependence (Crowston, 1997; Stokes & Hewitt, 1976; Thompson, 1967) – has captured the attention of organizational scholars since the very beginning of organization science¹. Already in the 1920s, Lichtner pointed at the importance of coordination for developing procedures (Lichtner, 1924). Parker Follet remarked in 1927 (page 167) that “the chief problem of the organization engineer was acknowledged coordination. ... he cannot get control without unity”. On the root causes of coordination problems, Gulik (1937: 3) remarked: “... a piece of work cannot be subdivided into the obvious components without great danger that the central design, the operating relationships, the imprisoned idea, will be lost. When one man builds a house alone he plans as he works; he decides what to do first and what next, that is, he ‘co-ordinates the work’. (...) It is self-evident that the more the work is subdivided, the greater is the danger of confusion, and the greater is the need for overall supervision and co-ordination”. Coordination resolves task dependencies that result from work division and specialization (Crowston, 1997; Grant, 1996b).

Since then, numerous studies have extended these ideas conceptually, and investigated its role in almost any area of organized activities, such as (military) aviation (Weick, 1993b; Weick & Roberts, 1993), space operations (NASA, 1999), ship navigation (Hutchins, 1990; Roberts & Moore, 1993), medical activities (Argote, 1982; Cicourel, 1990; Kim, 1988), new product development (Adler, 1995; Ciborra & Patriotta, 1996), software processes (Crowston, 1997), software design (Crowston & Kammerer, 1998; Faraj & Sproull, 2000; Kraut & Streeter, 1995),

¹ Webster (1992) traces coordination back to the Latin words *co* (meaning ‘together’) and *ordinare* (to arrange), resulting in definitions like ‘acting together in a smooth concerted way’, and ‘harmonizing the functioning of parts for effective results’ 1992. **Webster’s Dictionary**: Oxford University Press..

interfirm cooperation (Gandori, 1997), service delivery (Larsson & Bowen, 1989; Rathnam, Mahajan, & Whinston, 1995), sports (Seve, Saury, Theureau, & Durand, 2002), decision making (Ching, Holsapple, & Whinston, 1992), culture (Chwe, 2001), governmental organizations (Gupta, Dirsmith, & Fogarty, 1994), and multinational organizations (Edström & Galbraith, 1977; Martinez & Jarillo, 1989). Coordination is one of the essential ingredients for the ongoing functioning of our organizations and society. Understanding how coordination is achieved (or not) under different conditions should remain a high priority for organizational research.

At the same time, however, coordination theory development over the recent decades seems to lack integration and coherence. Quite recently, coordination theory was defined as the still-developing body of theories about how coordination can occur in diverse kinds of systems (Crowston, 1997; Malone & Crowston, 1994). Grant (1996: 113) recently remarked that “[a]lthough widely addressed, organization theory lacks a rigorous integrated, well-developed and widely agreed theory of coordination”. Many efforts have been undertaken to categorize coordination mechanisms (Grant, 1996b; Malone et al., 1994; McCann & Galbraith, 1981; Van de Ven, Delbecq, & Koenig Jr, 1976). While these studies resulted in valuable taxonomies of coordination modes, they cannot satisfy the need for integrative theory development. More importantly, apart from these conceptually dissatisfying results, we seem ill equipped for making important contributions to practice, like explaining coordination breakdowns (Snook, 2000). We propose that in order to further develop coordination theory, researchers must take a step back and look at the paradigms underpinning the different theories concerned with coordination. Discussion on a paradigm level will clarify different approaches and support subsequent theory development.

The objective of this conceptual paper is communicating three paradigms that we distinguish in coordination theory: the contingency paradigm, the structure-process paradigm, and the inner-outer worlds paradigm. The paper ties these paradigms to coordination literature. We illustrate the implication of each paradigm by briefly assessing three times the same short example taken from a sports setting. The paper concludes with a discussion of our contribution, and sketches opportunities for future research

Paradigms and Paradigm Shifts

A paradigm is a collection of beliefs shared by scientists, i.e., a set of ontological and epistemological assumptions (Burrell & Morgan, 1979; Kuhn, 1962; Schultz & Hatch, 1996) that underpin theory development. Kuhn (1962) assumed that researchers work within a certain paradigmatic tradition, called ‘normal science’. At some point, they can encounter findings that cannot be explained using the current paradigm. Scientific progress then depends on a transition from theory towards paradigm development. This may result in a paradigm shift – the movement of one paradigm to another one – that enables investigation from a novel perspective.

Scholars interested in coordination theory have usually relied on the contingency paradigm (Argote, 1982; Galbraith, 1973; Lawrence & Lorsch, 1967; Thompson, 1967). This perspective proposes that organizations select and apply substitutable mechanisms for dealing with task dependencies (Van de Ven et al., 1976). The selection process is aimed at matching information processing needs with capacities.

Over the past decades, other studies have emerged that seem to move beyond the contingency paradigm. They think of coordination in terms of interplay between structure and process (Weick, 1993a) (what we refer to as the second paradigm), or coordination as the process of

crafting inner and outer worlds (Boland & Tenkasi, 1995) (the third paradigm). However, this shift of paradigm usually remains implicit, masking underlying progress of coordination theory. We think that a discussion on paradigms of coordination theory will strengthen theory development and sharpen our tools for important empirical research. As a starting point, the next sections outline the three paradigms, preceded by a short example of coordination in sports.

Example: Coordination in a Soccer Game

In order to explain the different paradigms we use a coordination example from team sports. We present a brief sequence of events in a soccer match between the Dutch and the Czech national team during the Euro cup 2000 in Belgium and The Netherlands (Strengtholt, 2000). We could equally have selected other team sports like basketball game. Figure 1 through Figure 6 show a few intense seconds in which player 1 of the Dutch team passes the ball to player 2 who scores, despite defenders and the goalkeeper, the fourth goal in this match.²

Interdependencies and coordination practices pervade the scene. First, the two Dutch players are interdependent because they work for the same team and have – also literally – the same goal. This could be characterized as a combination of goal (output) (Galbraith, 1973) and team interdependence (Van de Ven et al., 1976). Second, the same applies to the Czech team players (defenders and goal keeper) involved in this particular moment. And third, coordination is vital *between* the players of the two teams. They must try to anticipate each other's moves, disrupt the opponent's game, and capture the ball for the next attack (Pentland, 1992).

² The Dutch team plays in orange shirts, the Czech team in blue ones. The goal keeper is from the Czech team. On a black-white print, the Dutch players can identified by their black shorts, the Czech players wear white shorts. In Figure 5 and Figure 6, the umpire is running towards the scene.

The short moment returns in the next sections on the three paradigms. We analyze the same event from different paradigmatic angles, thereby showing the possibilities and limitations of each paradigm.



Figure 1 – Player 1 (orange shirt) at the ball, player 2 (also orange shirt) moving away from his defender in front of the opponent's goal



Figure 2 – Player 1 running towards player 2



Figure 3 – Player 1 passes the ball to player 2

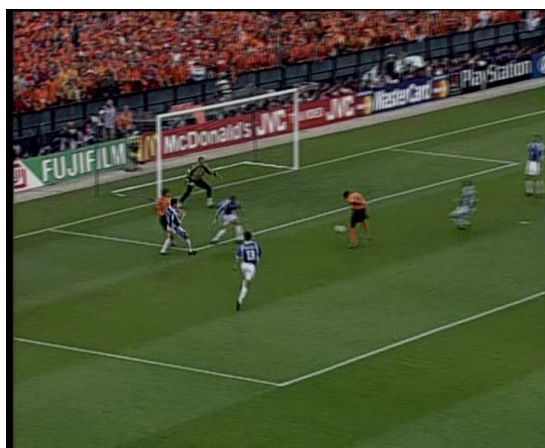


Figure 4 – Player 2 receives the ball on his right foot



Figure 5 – Upon receiving the ball, player 2 immediately shoots the ball to the far corner of the goal, unexpectedly for the keeper



Figure 6 – Player 2 scores with a minimal margin from the goal post.

Paradigm 1 – The Contingency Paradigm: Coordination by Substitutable ‘Mechanisms’

For long, contingency theory has developed the dominant perspective on coordination.

Contingency theorists perceive the organization as an open system that interacts with its environment (Scott, 1992). This interaction implies vulnerability for uncertainty in the environment. Organizations experience uncertainty when they pull inputs from the environment, and face fluctuation in the demand for their outputs (Argote, 1982; Nohria & Gulati, 1994).

Galbraith (1973: 5) defines uncertainty as “(...) the difference between the amount of information required to perform the task and the amount of information already possessed by the organization.”

Contingency theory proposes that uncertainty changes the mechanisms (or modes) used by an organization for coordinating its operations (Lawrence et al., 1967; Thompson, 1967).

Uncertainty increases the need for information processing. Since coordination mechanisms differ in their capacity to process information, the use of them should change to match environmental demands (Tushman & Nadler, 1978). Galbraith (1973) claimed that an increased need for processing information shifts coordination modes from rules and standards, to hierarchical communication and goal setting. More uncertainty requires either reduction of information processing needs by means of slack resources or autonomous work units, or increasing the capability to process information, by investing in information systems or direct lateral contact between work units.

Research on the effects of uncertainty usually employs a distinction made by Perrow (1967). He pointed at two dimensions of the construct: the number of exceptional cases actors face, also referred to as task variability (Van de Ven et al., 1976). And the analyzability of uncertain events, also called information equivocality (Daft & Macintosh, 1981). Task variety determines the amount of information processing. Task analyzability implies that actors lack a more fundamental understanding of cause-effect relationships, and do not know how to respond (Fry & Slocum, 1984).

Apart from uncertainty, contingency theorists have theorized and conducted empirical research on other factors as well. First, Thompson (1967) was among the first to recognize the role of dependencies (McCann and Ferry, 1979). Based on systems theory, he introduced a typology for physical workflows. He used pooled interdependence for describing situations where parts render a discrete contribution to the whole (Thompson, 1967: 54). Sequential dependence exists where one actor passes his work on to another one for continuing the transformation process. And reciprocal interdependence indicates situations in which outputs of each actor become inputs for others (Thompson, 1967: 54). Van de Ven et al (1976) extended the latter form with team interdependence where actors work jointly and simultaneously. These forms of interdependence become increasingly difficult and costly to coordinate (Thompson, 1967). Pooled interdependence does not require extensive coordination behaviors but may rely on a plan to schedules actors demand for a resource. Team interdependence means that people work simultaneously on the same task, like during a surgery. They watch each other closely and interact to blend their efforts. A second contingency factor is complexity. It refers to the intricate connectivity among multiple tasks and actors. It means that a “(...) problem is not easily

amenable to clearly parceling out individual jobs or discrete tasks” (Goodman, 1981: 3).

Complexity is the result of differentiating large tasks and assigning subtasks to multiple interrelated units (McCann et al., 1981). As a contingency factor, it extends and combines interdependence, uncertainty and work unit size. Complexity refers to the number of elements that are connected, and the number and type of relationships among these (Haeckel & Nolan, 1993). Hence, task complexity always includes an element of interdependence, but not necessarily uncertainty. Even when all the necessary information is available (Galbraith, 1973), tasks can represent a complex problem. Haeckel’s (1993) definition clarifies the relationship between complexity and size of a work unit or task (like programming software (Kiesler, Wholey, & Carley, 1994)). As size increases, the number of elements and relationships among these grow as well.

A third factor is functional diversity among people involved in the same process or project. Lawrence and Lorsch (1967: 11) used the term ‘differentiation’ not to describe work division, but differences “(...) in cognitive and emotional orientation among managers in different functional departments.” Functional diversity means that people approach a common problem domain from diverse angles. Dougherty (1992) reports on inter-departmental differences in a firm that develops new products. She describes how each unit has its own ‘thought world,’ that is “(...) a distinct system of meaning which colors its interpretation of the same information, selectively filters technology-market issues, and produces a qualitatively different understanding of product innovation” (Dougherty, 1990: 195). Functional diversity increases information processing needs. It makes interpersonal coordination mechanisms more important, such as working relationships (Lawrence et al., 1967).

A final contingency factor is work unit size, indicating the number of actors involved in or contributing to an aggregated task (Van de Ven et al., 1976). The effect of size is contrary to those triggered by the previously discussed contingencies. Uncertainty, interdependence and complexity imply a shift from programmed coordination (like plans and standards) to interpersonal mechanisms like mutual adjustment (Thompson, 1967) and group meetings (Van de Ven et al., 1976). By contrast, increased size of work units shows a reverse relationship. Actors shift to more formalized mechanisms and information systems as a substitute for interpersonal exchanges that are unfeasible in large scale systems (Pennings & Woiceshyn, 1987; Van de Ven et al., 1976).

The Contingency Paradigm Applied to the Case

When contingency theorists look at the example introduced above, they see a situation that has some known elements (the game, rules, physical structure), and presents actors with uncertainty. Van de Ven and Delbecq (1974) referred this condition as discretionary: “For tasks intermediate in variability, work units will use a discretionary program for structuring work activities. This specifies outputs and includes a repertoire of means (or processes) to guide unit members in task performance (March & Simon, 1958). Since different methods and procedures are required, members of such units analyze each task and apply appropriate means to perform it (e.g. (Perrow, 1970))”(Van de Ven & Delbecq, 1974).

Contingency theorists would point at the underlying program of a soccer game (rules and regulations), and the game plan of the team for this match. They could interpret the brief glances between players as an adjustment process that feeds people with sufficient information for the

next move. Players are considered information processing machines that apply pre-programmed routines, or absorb real-time information to reduce uncertainty.

Making the Contingency Paradigm Explicit

Contingency theorists have developed a variance type of theory that relates two sets of mechanisms to a set of independent variables that drive information processing needs (Mohr, 1982). The theory has a tendency to rely on equilibrium points. People either work according to a coherent program (hence equilibrium), or they develop the program as a temporary non-equilibrium state.

Contingency theorists view individuals as information processing actors. The ideal state seems to be low levels of uncertainty, implying that individuals just apply their 'program' to a situation (March et al., 1958). How this program works and results in coordination remains unclear. It seems that a program is an individual set of rules that have been internalized (reading a procedure), and then applied to a situation that conforms the context of the program.

As uncertainty increases, additional activities for coordination must be undertaken, referred to as mutual adjustment (Barnard, 1938; Mintzberg, 1979) or feedback coordination.

How people switch to this second mechanism remains unclear, i.e., when do they know that the program does not work? Contingency theorists also do not specify how mutual adjustment leads to order. People seem to develop a program by communicating. They reach a new equilibrium and re-apply the acquired program.

Coordination is achieved by selecting and applying the same mechanisms (Figure 7). The mechanisms address the problem that activities are interdependent (Malone, Crowston, Lee, &

Pentland, 1999). Actors must follow the same program, or jointly decide to engage in conversation. Program and process constitute mutually exclusive means for coordinating. The program (structure) is conceived as a rigid set of rules, almost like a computer program. If situation A, then apply action X, if situation B, then apply plan Y.

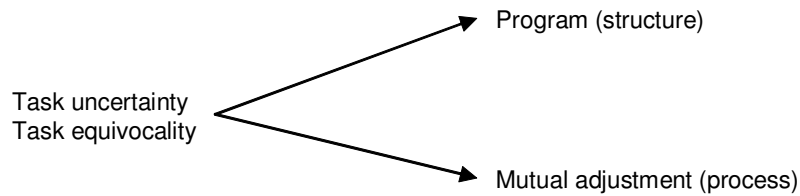


Figure 7 – The contingency paradigm

In sum, contingency theory leaves unspecified how individuals select and apply a program, or maybe switch between coordination modes. The theory's contribution is that different modes have been identified. But how these tools are used and interchanged remains unclear. They do not consider situations where people select and apply different coordination modes. Nor do they account for situations where people select the same mode (for instance a procedure) but interpret and apply it differently (Bechky, 2003b). Finally, the mechanisms seem unrelated. Either people follow a program, they have a semi-complete program, or they develop it (Van de Ven et al., 1976). Gray shades do not seem to exist. As a starting point for coordination theory, contingency theorists developed the basic grammar on which others must build.

Paradigm 2 – Coordination and the Relatedness of Structure and Process

The second paradigm comprises theories that stress the interrelating of structure and process.

They refute the contingency perspective on structure (program) and process (mutual adjustment) as mutually exclusive mechanisms. Furthermore, these theories conceptualize structure in a broader sense. Contingency theorists conceived structure as including standard operating procedures, plans, bureaucratic control mechanisms, manuals and rule books (Burns & Stalker, 1961; Jaeger & Baliga, 1985). These structures pre-define behaviors in a comprehensive manner.

Second paradigm theorists extended the idea of structure to include other non-process phenomena like frameworks (Weick, 1995), scripts (Gioia & Poole, 1984), knowledge (Adler & Borys, 1996; Hutchins, 1991), mental models (Levesque, Wilson, & Wholey, 2001), shared meaning (“mutually shared fields”) (Weick et al., 1993), and rules and resources (Giddens, 1984). What differentiates these structures from contingency conceptualizations is the fact that they are more internalized (Nonaka & Konno, 1998). They are also more dynamic, as engines of possible behaviors instead of a comprehensive script that prescribes a single pattern of behavior (Pentland & Rueter, 1994).

Different perspectives have been developed on the relationships between structure and process.

We categorize them in terms of relationship impact: (1) structure $\rightarrow$ process, (2) structure $\leftarrow$ process, and (3) structure $\leftrightarrow$ process. Arrows stand for the direction of the relationship.

First, structural theorists emphasize the impact of structure – in the broader sense of the second paradigm – as it enables and constrains processes. (Where process stands for human agency or practice (Feldman & Pentland, 2003)). For instance, a social cognition or a shared mental model (structure) enables a team to respond (process) in a coherent manner without much conversation

(Operario & Fiske, 1999). Organizational memory (Walsh & Ungson, 1991), transactive memory (Moreland, 1999; Wegner, 1987), and redundant knowledge (Hutchins, 1996) equip a collective with sufficient knowledge (structure) to operate (process) in a coordinated fashion. Similar impacts have structures like mutual knowledge (Krauss & Fussell, 1990), departmental thoughtworlds (Dougherty, 1992), communication genres (Yates & Orlikowski, 1992), common knowledge (Grant, 1996a), common experiences (Carlson & Zmud, 1999), routines (Pentland et al., 1994), classification systems (Bowker & Star, 2002), and shared linguistic structures (Clark, 1996). When the similarity or coherence of these structures is reflected in practice, coordination follows. Behaviors (process) of people complying with for instance traffic regulations (structure) are coordinated because the rules are part of an integrated system.

Second, process theorists stress the inverse relationship from process to structure. They show that ongoing conversations (Quinn & Dutton, Forthcoming), discourse (Foucault, 1971), shared human experiences (Schutz, 1967), and interaction patterns (Weick, 1979) create meaning (Bechky, 2003a), social worlds (Habermas, 1984), norms (Schein, 1992; Wageman, 1995), shared interpretive schemes (Weick, 1993a), understanding (Schutz, 1967), common rituals and knowledge (Chwe, 2001), coordination (Hutchins, 1990; Weick et al., 1993), and social order (Polanyi, 1975). As Hutchins explains after a study on ship navigation by a team: “the sequence of actions to be taken need not be explicitly represented anywhere in the system. If participants know how to coordinate their activities with the technologies and people with which they interact, the global structure of the task performance will emerge from the local interactions of the members” (Hutchins 1990, 209). Meaning (structure) is socially constructed (process) in a community of individuals (Wenger, 1998). Processes connect people with their - often different

– individual, situated understandings of a situation, tied to a particular context and community (Engeström, Engeström, & Kärkkäinen, 1995). As people reciprocally influence each other and clarify their standpoints, they polycentrically co-construct some form of meta-individual perspective and consensus emerge (Bechky, 2003a; Boland et al., 1995; Polanyi, 1975).

Third and finally, researchers propose that structure and process interrelate (DiMaggio & Powell, 1983; Giddens, 1984). This recursive relationship combines and extends the earlier mentioned categories of theories that emphasize unidirectional impacts (structure → process, or structure ← process). People draw on structures and institutional norms to shape their social activities (process) (DiMaggio et al., 1983). This agency results in modification and development of novel structures and institutes (Barley & Tolbert, 1997). Structures include resources, and rules (Giddens, 1984) or schemas (Sewell, 1992). This conceptualization of structure extends the contingency viewpoint. There, structure was considered a blueprint that is comprehensive (leaving little unclarity for action), and fixated before action takes place. Structuration theory complement this idea with the notion that structures result from human agency, and that they constrain and enable action (Adler et al., 1996). Von Hippel (1994) provides an example from coordination in software development. Software engineers construct (process) a prototype (structure) of a new system that is then reviewed by users (process) and sent back to engineers for subsequent loops (von Hippel, 1994). Structures support coordination between different knowledge communities.

The Structure-Process Paradigm Applied to the Case

Adopting a structure-process point of view, the sports example (Figure 1 - Figure 6) becomes a social phenomenon. The situation is rich in terms of structures that were and are being created at different levels (Drazin & Sandelands, 1992). First, soccer as a sports game is a generic structure that is enacted at different places and times. Second, this particular game is part of the larger Euro 2000 tournament. Third, the teams consist of players from the same country yet different sports clubs. They were trained as a collective and have developed a particular mental model (Levesque et al., 2001) and collaborative interpretation capability (Schein, 1992; Weick, 1979). And finally, this particular sequence of events has a structure to it in terms of output and shared meaning that evolves during the game (like a song in improvisational jazz). These structures were created at different times and by multiple actors. They can also be categorized in terms of generalizability (this particular game), versus specificity (this specific moment).

The structure-process view emphasizes the processes that create these structures, and the constraining and enabling impact of these structures on the way agency proceeds. For instance, player 2 in Figure 1 sees that player 1 is in a difficult position to score (structure as meaning). He therefore moves backwards (process) to a spot where he can receive the ball from player 1 and has a clear shooting line towards the right hand angle of the goal. Player 1 apparently observes player 2's move and interprets it using a similar team mental model (Levesque et al., 2001), and common rules (Giddens, 1984; Grant, 1996b). Without much communications player 1 and 2 understand the situation (structure) (Weick, 1993a), resulting in polycentrically emerging order (Polanyi, 1975). Player 1 passes the ball to player 2 who scores.

Making the Structure-Process Paradigm Explicit

Theories in the structure-process paradigm contributed to the contingency approach the conceptual relationship between structure and process. Their unit of analysis is not the selection and use of mechanisms for coordination. It is a collective of actors, which is interpreted in terms of social processes (between human beings) and structures with social relevance (like common knowledge, transactive memory, and redundant knowledge). Figure 8 illustrates the interplay of structure and process. These interrelate with a task. As people interact, they develop structures in the sense of task understanding. This feeds back to agency (process).

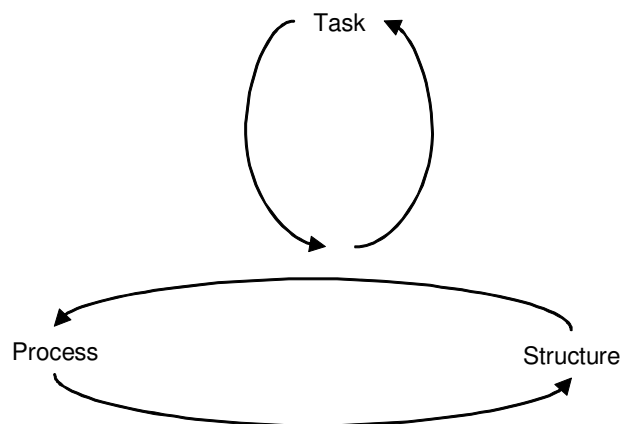


Figure 8 – The structure-process paradigm

Some aspects of collaborative situations remain implicit in structure-process perspectives. First, the translation or transition between structure and process (both ways) remains an abstract phenomenon. Most likely this occurs partly inside and partly outside human beings. The strength of the structure-process perspective lies not here but in its refined explanation of coordination as a social phenomenon. Second, processes are mainly perceived as the intertwining of individual

externally oriented behaviors. Words like ongoing conversations (Quinn et al., Forthcoming), discourse (Foucault, 1971), and interaction patterns (Weick, 1979) highlight the communicative dimension of individual functioning. Still, these external processes seem to have some form of intra-personal implications as people develop interrelated interpretations and thoughtworlds. Third, the deep structure of structure-process theories tends to be a sort of loop (Figure 8). This differentiates the perspective from contingency theories with their variance type of structure (Drazin et al., 1992). A risk of the structure-process paradigm (particularly the recursive variant) is that we conceptually ‘cage’ people involved in a setting that requires coordination (Stokes et al., 1976). They develop structures that shape their agency, which leads to structure modifications. These almost deterministic cycles downplay people’s intent and options for creative coordination. Process theories that do not include feedback from structure to process downplay the use of structures in agency – as if people were constantly creating novel structures (Stokes et al., 1976). In short, the structure-process paradigm tends to emphasize the external dimension of human functioning, and frames these in terms of ongoing structure-process loops.

Paradigm 3 – Coordination as Crafting Inner and Outer Worlds

Theories that we label as the third paradigm take individual persons as a starting point for explaining a social phenomenon like coordination. They do not frame coordination in terms of structure-process constructs. Third paradigm theories tend to reject the idea of shared structures, schemes and meaning (Boland et al., 1995). People may interpret structures (like procedures and plans) differently in general, or apply structures differently depending on their cognitive,

emotional and physical state (Snook, 2000). For instance, actors play the same script many times. One could assume that coordination between actors relies on their learning and sequential playing of a coherent script. The play becomes a shared script that guides actions in a concerted manner (Gioia et al., 1984). However, as an example of a second paradigm perspective, this means that actors are believed to apply the same script in a similar manner, night after night. Many actors will tend to disagree. They craft - even a seemingly routine performance like a theatre play - each time in a unique manner, depending on their mood (Ciborra, 1991), the audience, and their own condition (McCreary, Pollard, Stevenson, & Wilson, 1998). Recently, the Dutch actress Angela Schijf playing *The Glass Menagerie* (1945) by Tennessee Williams commented: “Not a single performance is the same, even when you play it a hundred times. Each time you must win the audience ... The magical element of theatre is the direct contact with the audience and the other players. You get only one chance, ‘take two’ is not possible. You are playing at daggers drawn” (Segeren, 2004: 9).

Starting point for the third paradigm approach is – as we see it – the human being who crafts his inner and outer worlds in a unique manner and on an ongoing basis. To this end he continues at t_0 the situation that has emerged until $t_{<0}$ (Bastien & Hostager, 2001) using resources and capabilities available in his inner and outer world. The outer world refers to artifacts and aspects of human functioning that are normally observable with human senses. When people communicate (talking) or act (driving) they fit their inner world into the larger outer world. Someone’s inner world refers to the persisting internal dialogue that constitutes his personal thoughtworld (Dougherty, 1992; Polanyi, 1958). People select and interpret external signals; they decide and craft contributions. Coordination occurs when there is some form of coherence of individual crafting behaviors (Weick et al., 1993) in the inner and outer world arena, and

interdependencies of activities are somehow resolved (Crowston, 1997). This coherence does not necessarily rely on connection (i.e., outer world), but may rely on congruent expectations (i.e., inner worlds) (Simon, 1950). Thinking about coordination along these lines implies that it is never self explanatory. Coordination is fragile and vulnerable (Weick, 1993b), and breakdowns become less unlikely (Perrow, 1984). We present some theoretical perspectives that underpin this paradigm.

First, Weick and Roberts (1993), building amongst others on Asch (1952), introduced ‘heedful interrelating’ as a lens for studying coordination on flight deck ships. They define the concept as follows: “ (...) in heedful performance each action is modified by its predecessor (Ryle, 1949: 42). In heedful performance, the agent is still learning. Furthermore, heedful performance is the outcome of training and experience that weave together thinking, feeling, and willing” (Weick & Roberts, 1993: 362). Heedfulness stands for the extent to which people assemble their behaviors “carefully, critically, consistently, purposefully, attentively, studiously, vigilantly, conscientiously, pertinaciously” (Weick and Roberts, 1993: 361). In our interpretation, heedful performance implies that an individual’s crafting of his inner and outer world. As the heedfulness of this weaving process increases, coordination becomes more likely. Weick and Roberts (1993) draw on Asch’ (1952) concepts of representation, subordination, and contributing. Individuals represent a situation that we interpret as internalization of their outer world, thereby fusing it with their inner world.³ They subordinate their functioning to people (e.g., team members) and things (e.g., traffic light) in their outer world. And finally, they contribute with their crafting process and externalizing actions to “the requirements of joint action” (Asch, 1952: 252), i.e., their outer world. If multiple persons do this real time on an

³ Similarly, if someone observes a tree, the light is projected inside his eye and then processed and interpreted by the brain depending on ex ante experiences, and the real time situation and condition of the person.

ongoing basis, a strong coordination pattern emerges. If they have been doing the same or similar tasks with the same or similar people for some time, collaborative patterns form (Weick et al., 1993). These enable coordinated individual functioning without or with hardly any outer world contact (exchanges) as shown by for instance a retail transaction (Leidner, 1993).

Second, Ngwenyama and Lee (1994), drawing on Lee (1991) and Schutz (1973), distinguish between publicly (or overtly) observable aspects of human behaviors and the subjective meaning thereof for individuals. The latter may differ for individuals at different points of time (McCreary et al., 1998; Weick, 1993b), and between individuals (Ngwenyama & Lee, 1997). Schutz (1973: 54) gives an example related to social science research: “The same overt behavior (say a tribal pageant as it can be captured by a movie camera) may have entirely different meaning to the performers. What interests the social scientist is merely whether it is a war dance, a barter trade, the reception of a friendly ambassador, or something else of this sort.”

Third, Polanyi (1958) emphasizes the personal, individual nature of knowledge. People deploy different vocabularies and idioms, leading to different actions and emotions (Brohm, 2002; Polanyi, 1958). As people interact with their outer world, they use and change their resources. This leads implies ongoing change of people’s inner and outer worlds: “Every use of language to describe experience in a changing world applies language to a somewhat unprecedented instance of its subject matter, and thus somewhat modifies both the meaning of language and the structure of our conceptual framework” (Polanyi, 1958: 104-105). Nonaka (1998) used some of these concepts to build his ‘SECI’ model, standing for a cyclic pattern of knowledge socialization, externalization, combination, and internalization. To coordination theory, the internal and external dimensions seem relevant. A collective can be metaphorically interpreted as multiple

individuals breathing in and out. They internalize stimuli from their environment, and, upon processing these internally, externalize their contributions such as actions and communications (Weick et al., 1993).

Fourth, Boland, Tenkasi, and Te-eni (1994) argue with Weick (1990) and Dougherty (1992) that individuals must share their perspectives to foster understanding of other people's perspective (Boland et al., 1995). Practices like narrating, communicating, mind mapping, and generally converting inner processes for the outer world⁴ have threefold implications. First, they help people organize their own inner world ("How can I know what I think till I see what I say?" (Weick, 1995)). Second, they result in human-independent artifacts (books, codified practices) that separate contributions from a specific person and space-time context. And third, these externalizing practices partially remove the veil hiding someone's inner world for others, meaning that others know more about someone's inner world. Consequently, people and situations become more understandable and predictable, which is one of the reasons for ongoing feedback loops in High Reliability Organizations (Roberts et al., 1993; Weick et al., 1993).

Fifth, Simon (1950) emphasized the role of mutual expectations for coordination processes: "A major purpose of the planning and organizing that precedes any administrative activity is ... to permit each to form accurate expectations as to what others are going to do". In other words, internally, people must be able to predict to a certain extent how others will behave. People thus carry the organization in themselves (comparable to the representation concept earlier introduced (Asch, 1952; Weick et al., 1993)). They must interchange their 'internal organization' with their outer world. According to Simon (1950: 72-73), this can be achieved by "providing each one with knowledge of the behaviors of the others upon which he can base his own decisions". He

⁴ Another example is Soft Systems Methodology often used in Information Systems Development. This method prescribes steps for expressing (externalizing) and comparing world views in order to resolve unstructured problem situations Checkland, P. & Scholes, J. 1990. Soft Systems Methodology in Action. Chichester: John Wiley..

defines coordination in terms of adjusting internal expectations: “Coordination involves several elements: the relation of the individual’s objectives and intermediate aims to those of other segments of the organization; the individual’s assessment of the alternatives available to him and to the other members of the group; and his expectations as to the course of action that will be followed by the others.” In groups, coordination is then achieved “when the behavior of the individual is guided by his expectations of the behavior of the other members of the group” (Simon, 1950: 124). Expectations are being formed internally in an ongoing reciprocal process of relating to others, i.e., someone’s outer world. Coordination becomes the craftsmanship of congruently interpreting, deciding and externally participating in a situation.

Sixth and finally, researchers increasingly focus their attention on organizational improvisation, often in the context of jazz or improvisational theatre (Pasmore, 1998; Sawyer, 2003). These studies offer a poignant example of situations where coordination must be successful, real time. Research show that participation in a professional improvisation setting like jazz is an intense experience in which people use their minds, emotional capabilities, and bodies (Hatch, 1999). In an unstoppable and changing process (Bastien et al., 2001), they listen intently (internalizing), interpret the music flow (representation), and craft contributions (externalizing). People re-use past experiences, knowledge of structures, and the real-time evolution of music, as it is being co-created with other musicians. Improvisational organization highlights coordination as re-harmonizing tunes so that some form of order (meta individual) proceeds (Zack, 2000). This is similar to interpersonal conversation: listening, talking, and interpreting for the next move (Sawyer, 2003). Coordination is therefore anchored in carefully (heedfully) crafting (blending and weaving) (Weick et al., 1993) inner and outer worlds.

The Inner-Outer World Paradigm Applied to the Case

The individual players are the primary point of attention for a third paradigm perspective on the soccer example. This enables a precise, situation specific analysis of coordination. During the few seconds that are represented from Figure 1 onwards, they craft inner and outer worlds that are – often imperfectly – related. The third paradigm encourages us to think of the players as people who participate in a collaborative setting in a unique mental, emotional and physical state. They use their experience, training, and observation of situational cues to craft internal representations and participate in a rapidly evolving situation. Specifically, in Figure 1, player 1 with the ball looks at the defenders surrounding him, who try to reduce his physical (and maybe mental) space. He observes (internalizing) that player 2 moves backward to get into a position where he can potentially score and receive the ball from player 1 without interference by defenders. Player 2's attitude (Figure 2) communicates (outer world) to player 1 that he is ready to receive the ball and score. The Czech defender closest to player 2 must interpret in a very short moment the logic of player 2's move backwards. He seems to expect (inner world) first of all that player 1 will score directly, leading him to a position (outer world) between player 1 and the goal (Figure 1). He might also realize (inner world) a second scenario: player 1 will pass the ball to player 2 so that player 2 will try to score. These two options overload the single defender in that position: he can't simultaneously block player 1's direct access to the goal and player 1's indirect opportunity through player 2 (who enhances the second opportunity by moving backwards, thereby making his defender's role more difficult). A split second mind-action game thus evolves as people interpret, participate, and create coordinated moves without verbal communications. As a skilled soccer professional, player 1 probably observes the two scenarios, evaluates them, and selects the second one (Figure 3). He passes the ball out of reach for player

2's defender to player 2 who translates the opportunity in a goal (Figure 4 - Figure 6). One can see that player 2's defender understands (inner world) the risk of the pass from player 1 to player 2. He dashes (outer world) to the virtual line between player 2 and the goal (Figure 5). Player 2 anticipates (inner world) his defender's action and scores in the far right corner of the goal (Figure 6). The goalkeeper also continuously represents internally the evolving situation. He seems to expect until Figure 3 a direct goal shot from player 1. With the pass from player 1 to player 2, he realizes (inner world) the potential danger coming from player 2 (Figure 4). He makes this mental switch slightly too late, running too late to the center of the goal (action). Player 2 seems to realize that the goal keeper will not expect a shot to that corner and/ or will not be able to move back to a position where he could hold such a shot, and scores (Figure 6).

Making the Crafting Paradigm Explicit

The third analysis of the soccer example illustrates how precise one can analyze a situation where multiple actors (should) coordinate their individual functioning. It encourages awareness for people's crafting of their inner and outer world. Typically, a coach will ask the Czech defenders after the game what they thought of (1) player 1 and player 2's potential behaviors, and (2) the role of them in relationship to the other team members and the goal keeper. Coordination thus becomes a process that links individuals' inner and outer worlds. This crafting depends on their mental, emotional, and physical state. Specifically, it is a function of heedfulness and attentiveness in situations that evolve constantly in a potentially unexpected manner.

Third paradigm theories show the difficulty of achieving coordination. Coordinated action seems the exception that requires hard work. The difficulty arises from the unicity and individuality of

actors. They are not machines that apply a priori known scripts. They are intricate ‘beings’ who craft understanding, expectations, and contributions on an ongoing basis and depending on their multidimensional state. Diversity is not an exception or barrier – between for instance marketing and R&D – that leads to additional information processing (Lawrence et al., 1967). It is a pervading and normal condition. People craft their inner and outer worlds by continuing a $t_{<0}$ situation, using available resources. Unlike machines, they do that with creativity and flaws, and in a manner that fluctuates with their personal condition and their evolving perception of a situation. Expecting people to communicate perfectly, and to persistently apply rules and procedures in a similar manner seems not a realistic point of departure (Snook, 2000). This perspective makes coordination breakdowns more understandable, especially under conditions of time pressure, tension, and fatigue (Snook, 2000; Weick, 1993a, 1993b). Individuals who are expected to coordinate their individual functioning must craft their inner and outer worlds in a congruent manner. Like any craftsmanship, this takes things like time, training, resources, talent, care and effort.

Conclusion

The main contribution of this conceptual paper is proposal to shift the discussion on coordination theory development to a paradigmatic level. We suggest three paradigms that underpin studies on coordination: the contingency paradigm, the structure-process paradigm, and the inner-outer worlds paradigm. We connect coordination studies to these paradigms, and show how each paradigm leads to a different analysis of the same empirical example.

This paper has implications for research and practice. Researchers may want to continue the discussion on paradigms underpinning coordination theory, as well as translating paradigms into

theories and empirical studies. Practitioners can benefit from different perspectives on coordination. This may support explanations of coordination practices and breakdowns, and prescriptive initiatives like training.

References

1992. Webster's Dictionary: Oxford University Press.
- Adler, P. S. 1995. Interdepartmental interdependence and coordination: The Case of the design/manufacturing interface. Organization Science, 6(2): 147-167.
- Adler, P. S. & Borys, B. 1996. Two types of bureaucracies: Enabling and coercive. Administrative Science Quarterly, 41: 61-89.
- Argote, L. 1982. Input uncertainty and organizational coordination in hospital emergency units. Administrative Science Quarterly, 27: 420-434.
- Asch, S. E. 1952. Social Psychology. Englewood Cliffs, NJ: Prentice-Hall.
- Barley, S. R. & Tolbert, P. S. 1997. Institutionalization and Structuration: Studying the Links between Action and Institution. Organization Studies, 18(1): 93-117.
- Barnard, C. I. 1938. The Functions of the Executive. Cambridge, Massachusetts: Harvard University Press.
- Bastien, D. T. & Hostager, T. J. 2001. Jazz as a Process of Organizational Improvisation. In K. N. Kamoche & M. Pina E Cunha & J. Vieira Da Cunha (Eds.), Organizational Improvisation. London: Routledge.
- Bechky, B. A. 2003a. Sharing Meaning Across Occupational Communities: The Transformation of Understanding on a Production Floor. Organization Science, 14(3): 312-330.
- Bechky, B. A. 2003b. Coordination as the Practice of Organizational Accountability and Common Ground. Paper presented at the Academy of Management Annual Meeting (Best Conference Paper Proceedings), Seattle, WA.
- Boland, R. J. & Tenkasi, R. V. 1995. Perspective Making and Perspective Taking in Communities of Knowing. Organization Science, 6(4): 350-372.
- Bowker, G. C. & Star, S. L. 2002. Sorting Things Out: Classification and its Consequences. Cambridge, MA: MIT Press.
- Brohm, R. 2002. The Tacit Revolt. Paper presented at the Paper presented at the Organizational Discourse: From Micro-Utterances to Macro-Inferences, London.
- Burns, T. & Stalker, G. M. 1961. The management of innovation. London: Tavistock Publications.
- Burrell, G. & Morgan, G. 1979. Sociological Paradigms and Organizational Analysis. London: Heinemann.
- Carlson, J. R. & Zmud, R. W. 1999. Channel Expansion Theory and the Experiential Nature of Media Richness Perceptions. Academy of Management Journal, 42(2): 153-170.
- Checkland, P. & Scholes, J. 1990. Soft Systems Methodology in Action. Chichester: John Wiley.

- Ching, C., Holsapple, C. W., & Whinston, A. B. 1992. Reputation, Learning and Coordination in Distributed Decision-Making Contexts. Organization Science, 3(2): 275-297.
- Chwe, M. S.-Y. 2001. Rational Ritual: Culture, Coordination, and Common Knowledge. Princeton, NJ: Princeton University Press.
- Ciborra, C. U. 1991. In the Mood for Knowledge: A New study of Improvisation, Social Study of Information Technology Workshop. London School of Economics Working paper 94, http://is.lse.ac.uk/all_wp.htm.
- Ciborra, C. U. & Patriotta, G. 1996. Groupware and Teamwork in New Product Development: The Case of a Consumer Goods Multinational. In C. U. Ciborra & W. K. Orlikowski & A. Failla & G. Patriotta & T. K. Bikson & N. T. Suetens & E. Wynn (Eds.), Groupware & Teamwork: Invisible Aid or Technical Hindrance? Chichester, UK: John Wiley.
- Cicourel, A. V. 1990. The Integration of Distributed Knowledge in Collaborative Medical Diagnosis. In J. Galegher & R. E. Kraut & C. Egido (Eds.), Intellectual Teamwork: Social and Technological Foundations of Cooperative Work. Hillsdale, New Jersey: Lawrence Erlbaum Associates.
- Clark, H. H. 1996. Using Language. Cambridge: Cambridge University Press.
- Crowston, K. 1997. A Coordination Theory Approach to Organizational Process Design. Organization Science, 8(2): 157-175.
- Crowston, K. & Kammerer, E. 1998. Coordination and collective mind in software requirements development. IBM Systems Journal, 37(2): 227-245.
- Daft, R. L. & Macintosh, N. B. 1981. A tentative exploration into the amount and equivocality in organizational work units. Administrative Science Quarterly, 26: 207-224.
- DiMaggio, P. J. & Powell, W. W. 1983. The Iron Cage Revisited: Institutional Isomorphism and and Collective Rationality in Organizational Fields. American Sociological Review, 48(April): 147-160.
- Dougherty, D. 1990. Understanding new markets for new products. Strategic Management Journal, 11: 59-78.
- Dougherty, D. 1992. Interpretive barriers to successful product innovation in large firms. Organization Science, 3(2): 179-202.
- Drazin, R. & Sandelands, L. 1992. Autogenesis - a Perspective on the Process of Organizing. Organization Science, 3(2): 230-249.
- Edström, A. & Galbraith, J. R. 1977. Transfer of Managers as a Coordination and Control Strategy. Administrative Science Quarterly, 22(June): 248-263.
- Engeström, Y., Engeström, R., & Kärkkäinen, M. 1995. Polycontextuality and Boundary Crossing in Expert Cognition: Learning and Problem Solving in Complex Work Activities. Learning and Instruction, 5: 319-336.
- Faraj, S. & Sproull, L. 2000. Coordinating Expertise in Software Development Teams. Management Science, 46(12): 1154-1568.
- Feldman, M. S. & Pentland, B. T. 2003. Reconceptualizing Organizational Routines as a Source of Flexibility and Change. Administrative Science Quarterly, 48(1): 94-118.
- Foucault, M. 1971. The Archeology of Knowledge. New York, NY: Pantheon Books.
- Fry, L. W. & Slocum, J. W. 1984. Technology, Structure, and Workgroup Effectiveness: A Test of a Contingency Model. Academy of Management Journal, 27(2): 221-246.
- Galbraith, J. R. 1973. Designing complex organizations. Reading, Massachusetts: Addison-Wesley.

- Gandori, A. 1997. An Organizational Assessment of Interfirm Coordination Modes. Organization Studies, 18(6): 897-925.
- Giddens, A. 1984. The Constitution of Society: Outline of the Theory of Structuration. Berkeley, CA: University of California Press.
- Gioia, D. & Poole, P. P. 1984. Scripts in Organizational Behavior. Academy of Management Review, 9(3): 449-459.
- Goodman, R. A. 1981. Temporary Systems. New York: Praeger.
- Grant, R. M. 1996a. Prospering in dynamically-competitive environments: Organizational capability as knowledge integration. Organization Science, 7(4): 375-387.
- Grant, R. M. 1996b. Toward a Knowledge-based Theory of the Firm. Strategic Management Journal, 17(Winter): 109-122.
- Gupta, P. P., Dirsmith, M. W., & Fogarty, T. J. 1994. Coordination and control in government agency: Contingency and institutional theory perspectives in GAO audits. Administrative Science Quarterly, 39: 264-284.
- Habermas, J. 1984. The Theory of Communicative Action. Cambridge, UK: Polity Press.
- Haeckel, S. H. & Nolan, R. L. 1993. Managing by Wire. Harvard Business Review(September-October): 122-132.
- Hatch, M. J. 1999. Exploring the Empty Spaces in Organizing: How Improvisational Jazz Helps Redescribe Organizational Structure. Organization Studies, 20(1): 75-100.
- Hutchins, E. 1990. The Technology of Team Navigation. In J. Galegher & R. E. Kraut & C. Egidio (Eds.), Intellectual teamwork: Social and technological foundations of cooperative work. Hillsdale, New Jersey: Lawrence Erlbaum Associates.
- Hutchins, E. 1991. Organizing Work by Adaptation. Organization Science, 2(1): 14-39.
- Hutchins, E. 1996. Cognition in the Wild (2nd ed.). Cambridge, MA: MIT Press.
- Jaeger, A. M. & Baliga, B. R. 1985. Control Systems and Strategic Adaption: Lessons from the Japanese Experience. Strategic Management Journal, 6: 115-134.
- Kiesler, S., Wholey, D., & Carley, K. M. 1994. Coordination as Linkage: The Case of Software Development Teams. In H. Harris (Ed.), Organizational Linkages: Understanding the Productivity Paradox, Vol. 52: 96-123. Washington D.C.: National Academy Press.
- Kim, K. K. 1988. Organizational Coordination and Performance in Hospital Accounting Information Systems: An Emperical Investigation. Accounting Review, 63(3): 472-489.
- Krauss, R. M. & Fussell, S. R. 1990. Mutual knowledge and communicative effectiveness. In J. Galegher & R. E. Kraut & C. Egidio (Eds.), Intellectual teamwork: Social and technological foundations of cooperative work. Hillsdale, New Jersey: Lawrence Erlbaum Associates.
- Kraut, R. E. & Streeter, L. A. 1995. Coordination in Software Development. Communications of the ACM, 38(3): 69-81.
- Kuhn, T. S. 1962. Structure of Scientific Revolutions. Chicago, IL: University of Chicago Press.
- Larsson, R. & Bowen, D. E. 1989. Organization and customer: Managing design and coordination of services. Academy of Management Review, 14(2): 213-233.
- Lawrence, P. R. & Lorsch, J. W. 1967. Organization and environment: Managing differentiation and integration. Boston, MA: Harvard University Press.
- Lee, A. S. 1991. Integrating Positivist and Interpretive Approaches to Organizational Research. Organization Science, 2(4): 342-365.

- Leidner, R. 1993. Fast Food, Fast Talk: Service Work and the Routinization of Everyday Life. Berkeley, CA: University of California Press.
- Levesque, L. L., Wilson, J. M., & Wholey, D. R. 2001. Cognitive Divergence and Shared Mental Models in Software Development Project Teams. Journal of Organizational Behavior, 22: 135-144.
- Lichtner, W. O. 1924. Planned Control in Manufacturing. New York: Ronald.
- Malone, T. W. & Crowston, K. 1994. The Interdisciplinary Study of Coordination. ACM Computing Surveys, 26(1).
- Malone, T. W., Crowston, K., Lee, J., & Pentland, B. 1999. Tools for Inventing Organizations: Towards a Handbook of Organizational Processes. Management Science, 45(11): 65-78.
- March, J. G. & Simon, H. A. 1958. Organizations. New York: Wiley.
- Martinez, J. I. & Jarillo, J. C. 1989. The Evolution of Research on Coordination Mechanisms in Multinational Corporations. Journal of International Business Studies(Fall): 489-514.
- McCann, J. E. & Galbraith, J. R. 1981. Interdepartmental Relations. In P. C. Nystrom & W. H. Starbuck (Eds.), Handbook of organizational design. New York: Oxford University Press.
- McCreary, J., Pollard, M., Stevenson, K., & Wilson, M. B. 1998. Human Factors: Tenerife Revisited. Journal of Air Transportation World Wide, 3(1): 23-32.
- Mintzberg, H. 1979. The Structuring of Organizations. Englewood Cliffs, N.J.: Prentice-Hall.
- Mohr, L. B. 1982. Explaining organizational behavior: The limits and possibilities of theory and research. San Francisco, CA: Jossey-Bass.
- Moreland, R. L. 1999. Transactive Memory: Learning Who Knows What in Work Groups and Organizations. In L. Thompson & D. Messick & J. Levine (Eds.), Shared Cognition in Organizations: The Management of Knowledge. Mahwah, NJ: Lawrence Erlbaum.
- NASA. 1999. Mishap Investigation Board, Mars Climate Orbiter, Phase I Report. Internet: ftp://ftp.hq.nasa.gov/pub/pao/reports/1999/MCO_report.pdf (Downloaded November 1999).
- Ngwenyama, O. K. & Lee, A. S. 1997. Communication Richness in Electronic Mail: A Critical Social Theory and the Contextuality of Meaning. MIS Quarterly.
- Nohria, N. & Gulati, R. 1994. Firms and their environments. In N. J. Smelser & R. Swedberg (Eds.), The handbook of economic sociology. Princeton, NJ/New York: Princeton University Press/Russell Sage Foundation.
- Nonaka, I. & Konno, N. 1998. The Concept of "Ba": Building a Foundation for Knowledge Creation. California Management Review, 40(3): 40-54.
- Operario, D. & Fiske, S. T. 1999. Integrating Social Identity and Social Cognition: A Framework for Bridging Diverse Perspectives. In D. Abrams & M. A. Hogg (Eds.), Social Identity and Social Cognition. Malden, MA: Blackwell.
- Parker Follett, M. 1927. The Psychology of Control. In H. C. Metcalf (Ed.), Psychological Foundations of Management: A.W. Shaw.
- Pasmore, W. A. 1998. Organizing for Jazz. Organization Science, 9(5): 562-568.
- Pennings, J. M. & Woiceshyn, J. 1987. A typology of organizational control and its metaphors. In S. B. Bacharach & N. Ditomaso (Eds.), Research in the sociology of organizations, Vol. 5: 73-104. Greenwich, Connecticut: JAI.
- Pentland, B. T. 1992. Organizing Moves in Software Support Hot Lines. Administrative Science Quarterly, 37(4): 527-548.

- Pentland, B. T. & Rueter, H. H. 1994. Organizational Routines as Grammars of Action. Administrative Science Quarterly, 39: 484-510.
- Perrow, C. 1970. Organizational Analysis: A Sociological Approach. Belmont, CA: Wadsworth.
- Perrow, C. 1984. Normal Accidents. New York: Basic Books.
- Polanyi, M. 1958. Personal Knowledge: Towards a Post-Critical Philosophy. Chicago, IL: University of Chicago Press.
- Polanyi, M. 1975. Meaning. Chicago, IL: University of Chicago Press.
- Quinn, R. W. & Dutton, J. E. Forthcoming. Coordination as energy-in-conversation. Academy of Management Review.
- Rathnam, S., Mahajan, V., & Whinston, A. B. 1995. Facilitating coordination in customer support teams: A framework and its implications for the design of information technology. Management Science, 41(12): 1900-1921.
- Roberts, K. H. & Moore, W. H. 1993. Bligh Reef Dead Ahead: The Grounding of the Exxon Valdez. In K. H. Roberts (Ed.), New Challenges to Understanding Organizations. New York: Macmillan.
- Ryle, G. 1949. The Concept of Mind. Chicago: University of Chicago Press.
- Sawyer, R. K. 2003. Group Creativity: Music, Theatre, Collaboration. Mahwah, New Jersey: Lawrence Erlbaum.
- Schein, E. H. 1992. Organizational Culture and Leadership. San Francisco: Jossey-Bass Publishers.
- Schultz, M. & Hatch, M. J. 1996. Living with Multiple Paradigms: The Case of Paradigm Interplay in Organizational Culture Studies. Academy of Management Review, 21(2): 529-557.
- Schutz, A. 1967. Phenomenology of the Social World. Evanston, IL: Northwestern University Press.
- Schutz, A. 1973. Concept and Theory Formation in the Social Sciences. In M. Natanson (Ed.), Collected Papers, Vol. 1: 48-66. The Hague: Martinus Nijhoff.
- Scott, W. R. 1992. Organizations: Rational, Natural, and Open Systems. Englewood Cliffs, New Jersey: Prentice-Hall.
- Segeren, E. 2004. Glazen Speelgoed: Angela Schijf als Breekbare Dochter (The Glass Menagerie: Angela Schijf as Vulnerable Daughter). Uit, Haags Uitburo - The Netherlands(January): page 9.
- Seve, C., Saury, J., Theureau, J., & Durand, M. 2002. Activity organization and knowledge construction during competitive interaction in table tennis. Cognitive Systems Research, 3: 501-522.
- Sewell, W. H. 1992. A Theory of Structure: Duality, Agency, and Transformation. American Journal of Sociology, 98(1): 1-29.
- Simon, H. A. 1950. Administrative behavior. New York: The Free Press.
- Snook, S. A. 2000. Friendly Fire: The Accidental Shootdown of U.S. Black Hawks over Northern Iraq. Princeton, NJ: Princeton University Press.
- Stokes, R. & Hewitt, J. P. 1976. Aligning Actions. American Sociological Review, 41(October): 838-849.
- Strengtholt. 2000. Highlights from EURO 2000 (Hoogepunten uit EURO 2000 Belgie - Nederland): Strengtholt MultiMedia DVD.
- Thompson, J. D. 1967. Organizations in Action: McGraw-Hill.
- Tushman, M. L. & Nadler, D. A. 1978. Information processing as an integrating concept in organizational design. Academy of Management Journal, 3: 613-624.
- Van de Ven, A. H. & Delbecq, A. L. 1974. A Task Contingent Model of Work-Unit Structure. Administrative Science Quarterly: 183-197.

- Van de Ven, A. H., Delbecq, A. L., & Koenig Jr, R. 1976. Determinants of Coordination Modes Within Organizations. American Sociological Review, 41(April): 322-338.
- von Hippel, E. 1994. "Sticky information" and the locus of problem solving: Implications for innovation. Management Science, 40(4): 429-439.
- Wageman, R. 1995. Interdependence and group effectiveness. Administrative Science Quarterly, 40: 145-180.
- Walsh, J. P. & Ungson, G. R. 1991. Organizational memory. Academy of Management Review, 16: 57-91.
- Wegner, D. M. 1987. Transactive Memory: A Contemporary Analysis of the Group Mind. In G. Mullen & G. Goethals (Eds.), Theories of Group Behavior. New York: Springer Verlag.
- Weick, K. E. 1979. The Social Psychology of Organizing. Reading, MA: Addison-Wesley.
- Weick, K. E. 1990. Cognitive Processes in Organizations. In L. L. Cummings & B. M. Staw (Eds.), Information and Cognition in Organizations. Greenwich, CT: JAI Press.
- Weick, K. E. 1993a. The Collapse of Sensemaking in Organizations: The Mann Gulch Disaster. Administrative Science Quarterly, 38: 628-652.
- Weick, K. E. 1993b. The Vulnerable System: An Analysis of the Tenerife Air Disaster. In K. H. Roberts (Ed.), New Challenges to Understanding Organizations. New York: Macmillan.
- Weick, K. E. & Roberts, K. 1993. Collective Mind in Organizations: Heedful Interrelating on Flight Decks. Administrative Science Quarterly, 38: 357-381.
- Weick, K. E. 1995. Sensemaking in Organizations. Thousand Oaks, CA: Sage Publications.
- Wenger. 1998. Communities of practice: The social fabric of a learning organization. New York, NY: Cambridge University Press.
- Yates, J. & Orlikowski, W. J. 1992. Genres of Organizational Communication: A Structural Approach to Studying Communication and Media. Academy of Management Review, 17: 299-326.
- Zack, M. H. 2000. Jazz Improvisation and Organizing: Once More from the Top. Organization Science, 11(March/ April).