Cognition, Actors, and Organizations, or Why Organizations are about Managing Knowledge

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ABSTRACT

In this article knowledge types are combined with organizational forms. Knowledge is something individual actors have. This paves the way for a semio-cognitive approach to actors. Organizations in which primary and organizational (secondary) tasks are performed are multi-actor systems. Organizational processes consist of tasks, such as planning, control and communication. These tasks are performed by individuals with knowledge. Concerning knowledge not only content, but also type can be discerned. Three knowledge types are distinguished: sensory, coded and theoretical. In developing a conceptual framework for the cognitive analysis of knowledge management, I will demonstrate that dominance and various distributions of knowledge types fit well-known organizational forms and co-ordination mechanisms with labels such as machine bureaucracy, simple structure, professional bureaucracy and market. Knowledge management, therefore, is about knowledge types and cognitive actors executing tasks in organizations.

1 INTRODUCTION

In his beautiful novel *The curious Enlightenment of Professor Caritat*, Stefan Lukes (1995:257) describes the journey of his main character, Professor Caritat, in a fictitious world. Just like Voltaire's Candide (Pangloss), Caritat is looking for the best possible (organizational) world. Therefore, Caritat visits several countries named after their leading organizational principle. He starts in Militaria, then goes to Utilitaria, to Communitaria, to Proletaria, to Libertaria and finally to Egalitaria. At the end of his journey, Caritat encounters another traveller (an owl) telling him the following:

> Consider the countries you have visited, all of which have left behind. Each was devoted to the pursuit of a worthy objective: one to ensure order and security, another to maximizing welfare and happiness, another to secure stable identities where people feel at home with others of their kind, another to the delirious vision of real individual freedom in harmony with all others, another to the protection of individuals and their property form interference to live as they choose. Yet each pursued its favoured goal to the exclusion of the others and in the process sacrificed countless individual human beings at the altar of its abstract ideal. How many human lives have ruined and destroyed in the name of such ideals? What human folly!

"What," Nicolas asked, "is the alternative?" "Only connect," replied the owl. "The alternative is to see that none of these ideals is worth anything without the others. Only then will you create a world fit for humans, and also," he added as if as an afterthought, "for owls."

The journey of Caritat is full of wit, philosophical discussions, and references to the Enlightenment. Although Caritat does not talk with countries but with leading persons in every country, he does not look at the inhabitants of countries as cognitive, emotional, and active individuals.

My argument in the remainder of this article is that in the same spirit as Caritat does - and the owl implicitly criticizes - humans as information processing systems that behave intelligently and use and interpret knowledge are often neglected in discussions about organizations (Sorge and Warner, 2001). Organizational and societal principles are on the hand the expression of thought processes of human individuals. On the other hand they are present, active and relevant because of the individuals that interpret and represent the principles as beliefs, opinions and knowledge. The point is that this argument requires a conceptual framework at another level of aggregation than is usually practised in discussions about knowledge and knowledge management in organizations (Laudon, 2001). Instead of starting with organizational principles, coordination mechanisms and organizational forms, we have to start with individual actors with their avowed and tacit knowledge, with their interpretations and representations. Discussions about organizational principles and goals and the realized coordination mechanisms are a matter of knowledge and knowledge management. Obviously, leading principles are always also the result of discussions in terms of the **content** of knowledge. I do not argue about that. What I want to emphasize is that the **types** (forms) of knowledge and their distribution and dominance within and between people in relation to tasks in an organization or soci-

ety are important in explaining the various organizational forms and the operationalization of what connection - as the owl to Caritat says - mustmean.

Important in this whole discussion is the presence of a conceptual framework to deal with forms of knowledge within organizational settings. In this article I will unfold a first version of this framework and its application to organizational principles. I will start, in section 2, with some definitions of organization after which I will focus on a multi-actor perspective. In the next section (3) I will go into the details of what is meant by an actor and what the consequences are of this interpretation in terms of knowledge and its realization in types of knowledge. In section 4 I will discuss various types of knowledge. In section 5 , I will relate the knowledge types to organizational forms and coordination mechanisms. Section 6 gives conclusions in relation to knowledge management, innovation, and information systems.

2 AN ORGANIZATION IN A MULTI-ACTOR PERSPECTIVE

Let me start with some strange questions. Everybody is talking about organizations, but where is the organization? When does an organization exist? Everybody will agree that Shell as an organization not only exists from nine to five and is also an organization closed on Saturdays and Sundays. Neither buildings nor the other artifacts are the reason that we say that Shell exists. In organizational literature (Daft, 2000) it is argued that an organization exists because of the many processes that are carried out. Organizations in this sense are collections of processes. Sometimes the processes themselves are conceived of as independent entities (Allport, 1962). Daft (2000:12), for example, says that 'organizations are social entities that are goal directed, are designed as deliberately structured and coordinated activity systems and are linked to the external environment. 12). Sorge (Sorge and Warner, 2001) says that two meanings of organization should be discerned: organization may refer to a social unity (or collectiveness) and organization may refer to organizational properties. In more general terms an organization can be defined as 'the simultaneous functionalization and coordination of human actions with regard to objective goals' (van Dale, 1995, p. 2144). In this definition the emphasis is on actions that can be integrated in tasks that, in turn, are constituting elements of processes. In the definition goals and coordination are mentioned. A goal is immediately related to a primary process, that is to say the reason that the organization exists. Coordination is needed because 'entities,' such as actions, tasks, or processes, do not form natural units. They need some kind of coherence or cohesion structure. This coherence can be organized ex-

ternally, in a legal or financial way, or internally by an interpreting and meaning given entity, that is to say a human actor.

In general, the structural (organizational) coherence in processes executed by humans and machines, consisting of actions and tasks, is regulated by legal and financial constructions. This means that ultimately an organization is a (legal or financial) construction or a construct. In the past, for example in the19th century and earlier, this construction consisted as a unity in time, place and action. Organizations were small, people worked face-to-face, there were clear boundaries and besides the realization of the primary process, an implicit goal was always to realize consolidation (Sorge, 2001). Much has changed since. The unity of action does not exist anymore. Work, labour and action have been divided and distributed. Since the abundant presence of digital communication, the unity of place and of time is also disappearing. Many suggestions to overcome the disadvantages of the loss of unity in action, time, and place (Thompson, 1967; Gazendam, 1993) are presented in organizational literature. If this results in virtual organizations based on ever more digitalizations ('E-lization'), it requires a new view on organizations.

The perennial corner piece in definitions of 'organization' is ' process'. A process is 'an action in its progress' (van Dale, 1995: 2378). I want to argue that in the analysis of processes - that is to say the collection of action sequences - the executing entity is often neglected. A process needs a material carrier. A process runs on something, just like software runs on a computer. In production environments the carriers are often the machines, the instruments, the tools, the computers and the employees. In service and administration environments the material carriers of processes are the employees and the computers. It is interesting, however, to see that the details and the interpretation of what the employees are and what sort of mental and cognitive mechanisms are involved in performing tasks are often vaguely formulated. The same holds for the realization and interpretation of what is called the coordination mechanisms in an organization. Often the realization of processes is a highly abstract, almost metaphysical affair in many organizational studies (see Sorge and Warner, 2001). From a knowledge perspective this abstract meta-individual perspective is strange, unwanted and unnecessary. Especially, with regard to knowledge in organizations, an organization basically consists of individuals executing tasks. Individuals, alone or in groups, execute tasks by which they use interpretation, intelligence, and knowledge. Even coordination, planning, and control - normally called the secondary or organizational processes (see section 4)- as separate tasks or as part of a palette of tasks in a function are in the hands of individuals.

Furthermore, an organization is rooted in the individuals that are part of the organization and can think of the organization. Without thinking of an organization, there is no organization, even if there are constructs and artifacts as buildings and machines. As Sorge (2001: 7) says 'Of course, there would not be any organization behaviour without human behaviour.' The basic ingredients of an organization are the intelligent actors. This means that there exists a nesting of a) actors within organizations and b) organizations within actors. The first nesting means that an organization always consists of a collection or group of actors. This makes an organization a multi-actor system. The second means that a set of actors can form an organization, but only in the sense that an actor can think of and reason about what the other actors can do. The other actors in turn have opinions and beliefs, that is to say representations, about the first actor. This implies that an organization as a construct consists of the overlap and sharing of individual representations. The key notions, here, are ' representation' and ' interpretation.' An organization is a 'representation' and an 'interpretation' in the eyes of intelligent interacting actors.

This fundamental cognitive interpretation of the building blocks in an 'organization' puts a stop to the unlimited misuse of metaphors. An organization as a human-made construct is not an object such as a car, a bridge or a computer. By talking about actors with representations and interpretations unjust reification is restricted. An organization can be described by a metaphor, but so called properties as 'the will', 'cognition', 'memory' and 'motives' of organizations should not be taken literally. This also settles the discussion whether organizations have knowledge, have a memory and can learn. These expressions only metaphorically have meaning. Literally, or materially, speaking organizations have no memory, no knowledge and cannot learn.

In the remainder of this article an organization is conceived of as a multi-actor system consisting of natural actors and coordination mechanisms. Although an actor principally refers to a human individual, it might and will in the (near) future also include software actors (or agents), which may develop into intelligent information and knowledge processing entities. In the next section I will go into the details of the specific characteristics of actors, especially human actors. What does it mean to have cognitively and psychologically plausible actors?

3 ASPECTS OF ACTORS

To view an organization as a multi-actor system requires a more detailed analysis of the characteristics of actors (Gazendam and Jorna, 1998) and of the coordination mechanisms the actors use (Gazendam, 1993). In this section actors are discussed, in section 5 coordination mechanisms.

Actors can be discerned regarding the presence or absence of the following components: a) perception, b) interaction (including learning in the sense of habit formation), c) representation and interpretation (including learning in the sense of chunking and creation) and d) autonomy and self-consciousness.

With (a) perception I mean that a system must be able to accept input in a general sense. This input may include visible, audible, and tangible stimuli and the accepting system may vary from a lobster to a human being or even a computer system. Interaction (b) is the process by which a system has contact with its environment. Stimuli as input to the system lead to output in the sense of responses. The reaction patterns of the system may result in learned behaviour, that is to say that habits areformed.

Asystem that internally symbolizes the environment is said to have and use representations (c). Representations consist of sets of symbol structures on which operations are defined (Jorna, 1990). Examples of representations are words, pictures, semantic nets, propositions or temporal strings (Kosslyn, 1980; Anderson, 1990). A representational system learns by means of chunking mechanisms and by the creation, manipulation and transformation of symbol structures.

A system is said to be autonomous, self-organized and self-conscious (d) if it is able to have a representation of its own (physical and conceptual) position in the environment. This means that the system has self-representation. An autonomous system has reconstructing representational interaction patterns.

The four aspects, together, result in a sort of actor hierarchy. An actor that only has perception is at the lowest level and cannot be called an intelligent actor, whereas an actor with self-organization, including perception, interaction, and representations, is the highest level. This last kind is what we regularly call an actor that is reflective, intelligent, and thoughtful. Human beings are good instantiations of such actors. Computers are said to have representations, but not self-organization. If computers can do tasks for which it is indicated that humans perform these tasks with intelligence, computers have

intelligence, at least to a certain degree. This depends on what one's definition of intelligence contains.

Not every actor is intelligent, but every intelligent system is an actor. The above-described classification in perception, interaction, representation, and autonomy can be related to a qualification of actors. Firstly, we make a distinction of actors in response function systems, representational systems and representational response function systems. The use of the term system implies that we consider an actor to be a coherent whole, consisting of several components, for example motor parts, sensory parts, including perception, and cognitive parts. The parts will not be discussed in detail, here (see Posner, 1989; Newell, 1990). Secondly, we can make a distinction in single actors and multiple actors. Concerning multiple actors the surplus component is a (complicated) communication and coordination mechanism that realizes the interaction of actors. Although this mechanism works at the organizational level, in the' ultimate analysis' it also is incorporated in human actors.

To explain the kinds of actors I start with an environment in which an 'entity' is present. We are talking about a cohesive, structured, and organized entity. This entity operates in an environment, but no specifications of its operations are given. In a sense this entity is an actor, because it is self-contained, strives toward continuation and, looking at the actor characteristics, has perception and interaction including the possibility of learning in the sense of habit formation. I emphasize that this actor does not have internal representations. Its cognitive domain is absent or empty. I call this actor a response function system (RF-system), or Actor I, and it can be compared with the ant in the sand (Simon, 1969). In discussing complex behaviour of systems Simon stated that the behaviour of an ant on the sand can be called complex, although not intelligent, because the behaviour is a function of the complexity of the sandy irregular environment that the ant has to cross.

Keeping the environment the same, I can conceive of another actor that I call a representational system (R-system). This actor has representations and is able to project external events internally into its cognitive domain. I call this Actor II. This kind of actor has representation, autonomy and perhaps perception. The interaction is problematic, that is to say that there is no device that semantically interprets causal input and output. As far as we talk about interaction it is a rather low-level reaction to stimuli. If we look at present day cognitive science, most linguistically and logically oriented researchers have such a kind of actor in mind (Phylyshyn, 1984).

The third possible interpretation of an actor is the representational response function actor (RRF-system). This actor incorporates a really intelligent, interactive, and cognitive system. I call this Actor III. This actor is able to perceive, to interact, to represent, and to be autonomous. Cognitive processes include symbols, operations, and semantic interpretable response functions. RRF-systems behave on the knowledge level, as Newell called it. 'There exists a distinct computer systems level, lying immediately above the symbol level, which is characterized by knowledge as the medium and the principle of rationality as the law of behaviour.' (1982, p. 99) Newell is proposing this knowledge level for natural (humans) as well as artificial (computers) intelligent systems. The actor equipped with the integration of representations and responses has knowledge. 'Knowledge', says Newell, 'is whatever can be ascribed to an actor, such that its behaviour can be computed according to the principle of rationality.' (Newell, 1982, p. 105) The principle of rationality is expressed in the belief that an acting person will undertake those actions by which his goals are reached. The actors are restricted to what Simon (1947/76) called: 'bounded rationality' (Fig. 1).

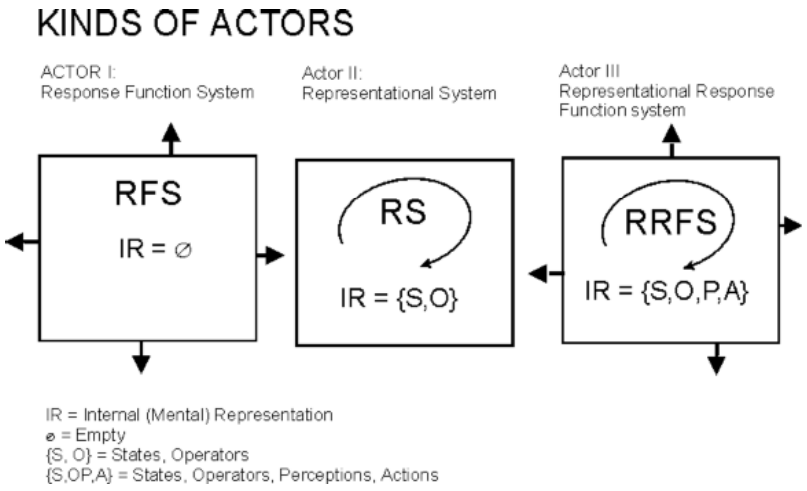

Figure 1: Kinds of Actors

The various kinds of single actors may be elements in the composition of multi-actor systems. In the first place we have a multi-actor system in which the actors just are response function systems (Fig. 2). In this multi-actor system other actors are considered to be parts of the environment. The only difference is that there is a proximal and a distal environment. The system borders define an inner and an outer area. The actors all have perception and interaction. To take up the example of Simon's ant we are talking here about a group of ants perceiving and interacting with each other. Coordination is absent

or only defined in terms of reactions to behaviour of other actors. To make a provocative statement, I state that although organizational theory speaks about the coordination of multiple intelligent actors, in practice the actors are mostly defined as response function systems, that is to say as Actor I (Klos, 2000).

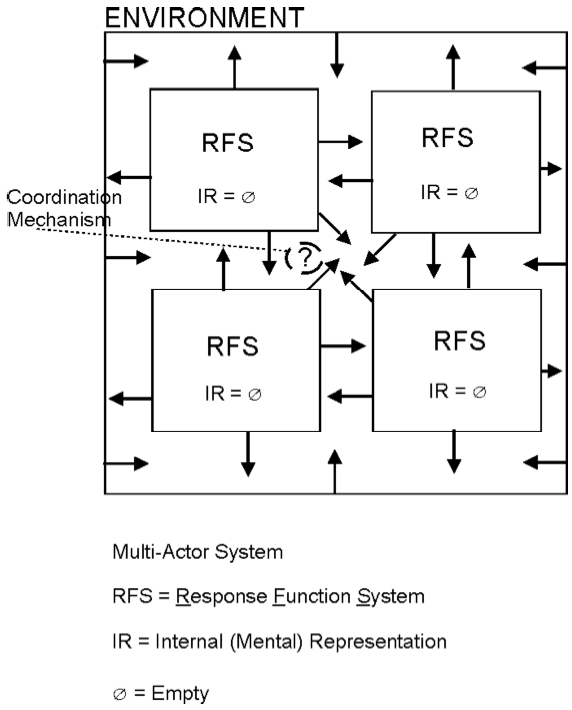

Figure 2: Response Function System (MAS)

In the second place we have a multi-actor system consisting of representational systems (Actor II) (Fig. 3). Every actor has internal representations in the sense of symbol structures and operations. It is of course doubtful whether interaction between the actors is semantically meaningful. In discussions about social cognition the issue of semantic interaction is ticked off, but not resolved (Kunda, 1999). Intelligent coordination without communication in terms of strongly defined sign systems - notations (Goodman, 1968) - is hardly handled.

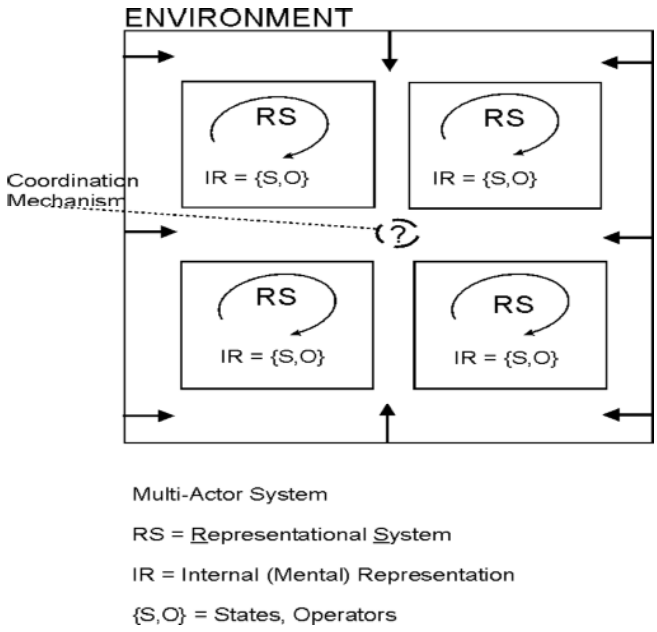

Figure 3: RS (Multi-actor system)

In the third place a multi-actor system may consist of representational response function actors (Fig.4). The actors perceive each other and react to each other in a semantically rich and intelligent way. Each actor has perception, interaction, representation, and autonomy and manages to integrate this into the organization as a multi-actor system. A collection of human information processing systems - the organization in a multi-actor perspective - is an example of multiple representational response function actors. This is the situation of so called organizations in practice. They consist of various actors in the sense of actor typeIII.

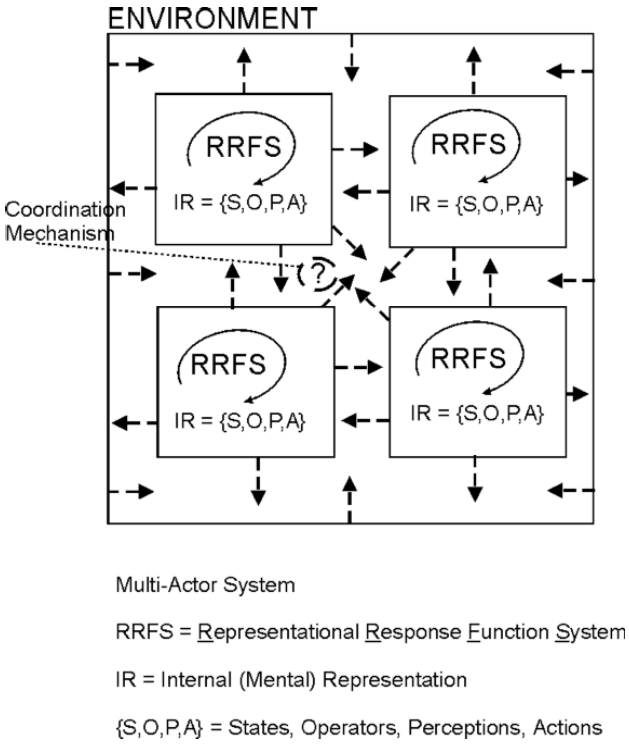

Figure 4: Representational Response Function System (MAS)

Finally it is also possible to have a combination of several kinds of actors (Fig. 5). Various combinations of actors can be distinguished, such as combinations of actors I and III, actors II and III, and actors I, II and III. A combination of actors I and II seems difficult because at last one of the actors in a multi-actor system should consist of autonomy and self-organization. Other multi-actor systems, that partly coincide with actors I, II and III, will consist of natural and artificial intelligent actors. Under the influence of developments in ICT more and more artificial actors will behave as actors III, which even now seems to be horrifying to many people.

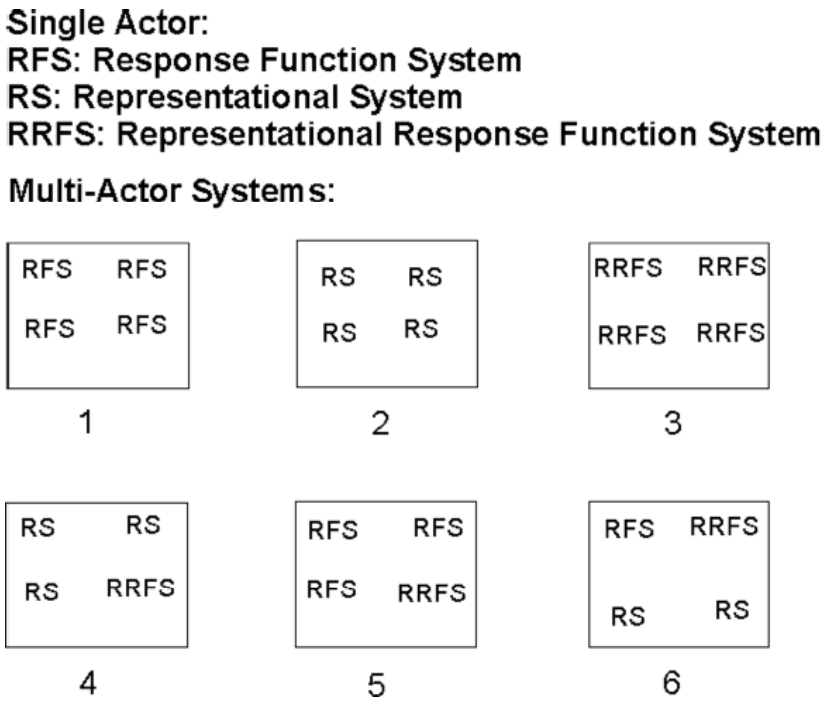

Figure 5: Multi-Actor Systems

The only meaningful incorporation of knowledge, cognition, and representation in organizational theory is in a representational response function actor. This holds for a single actor as well as for multi-actor systems. As already indicated, this does not mean that all actors in such a multi-actor system have to be RRF-actors. Some actors may be RF-actors or R-actors, but at least one of the actors has to be a RRF-actor. The interpretation of an actor or a multi-actor system as a RRF actor makes it possible to introduce concepts such as cognition, knowledge, interpretation, and symbol/sign manipulation. This combination of terms refers to cognitive science (Posner, 1989), to knowledge management (Jorna, 1998) and to semiotics (Michon, Jackson and Jorna, 2001). Cognition and knowledge will be discussed in section 4. I will end this section with some remarks about the entities that perform coordination and communication: signs and symbols, i.e., semiotics

The coordination and communication between actors is expressed in signs and symbols. This implies that an organization also is a semiotic entity. It is semiotic as an entity, because of its participants, its processes, and outcomes. By semiotic I mean that an organization as an artifact, a construct or a representation, basically is a sign type or sign token. The relevance of looking at an organization as a semiotic entity can be found in the different sorts of signs that turn up in the communication and information structures of the various actors. In semiotics it is normal to distinguish signals from signs and to

subdivide signs in icons, indexes and symbols. Icons emphasize the similarity aspect, indexes the contiguity aspect and symbols the conventional aspect of signs. In relation to a deeper discussion of characteristics of actors of type III - the RRF-actors - semiotics gives a conceptual apparatus that deals with knowledge, communication, representations, symbol structures, interpretation and meaning (Nöth, 2000; Michon, Jackson, Jorna, 2001)

4 KNOWLEDGE AND KNOWLEDGE TYPES

In our view on organizations as multi-actor systems the actors in these systems are representational response function systems (Gazendam and Jorna, 1998). Within this actor perspective, knowledge consists of representations and learning consists of the change and conversion of representations and resulting behavior. This perspective is in line with the received view within cognitive science (Posner, 1989; Newell, 1990; Stillings et al., 1995). Important is the discussion of how we can deal with knowledge management and learning in organizations within this multi-actor - actor as semio-cognitive entity - perspective. Therefore, we first discuss the relation of knowledge, data, and information. Then we will return to knowledge: its content and its form.

Knowledge, information, and data are closely connected. The raw material of data is the unformatted unstructured material in the world (Jorna and Simons, 1992; Schreiber et al. 2000). Data are such things as the various signals - acoustic, visual, tactile and otherwise - that are around us that can be interpreted as (having) information. The relation between data and information formally is that information is a structuring of data that reduces uncertainty. The information value of a message is higher the more it reduces uncertainty. In an informal way it could be said that information is interpreted data. Knowledge is the interpretation of information in the eye of a beholder using his own history, his experiences and interpretation schemes. That is the reason the same information may lead to different knowledge for different individuals.

What we have just indicated for the triplet data, information and knowledge implies a static and stable model of knowledge. This is not true. Knowledge in contrast to either data or information is tightly connected to the person who has the knowledge. However, knowledge itself is not something that is ready made in someone's cognition (Newell, 1990). It has to be mentally restructured and constructed again and again. That is also the reason it is so difficult to grasp or to lay a hand on knowledge in content or in form. Formulated more dynamically, the relation between data, information, and knowledge means

that a person (a human information processing system) receives data and with the knowledge he or she has, data becomes information, which in turn changes the knowledge of the interpreting person.

The various aspects of knowledge make it almost impossible to define types of knowledge unambiguously. Traditionally conflicting epistemological, psychological and cultural categories can easily be distinguished. To avoid debates, we start from a semiotic perspective. Based on the information concepts of Boisot (1995), we define a more dynamic model for knowledge types (van Heusden and Jorna, 2001). We start with three types of semiotically inspired knowledge: a) sensory (or tacit), b) coded, and c) theoretical knowledge. This typology of knowledge types refers to the number of semiotic dimensions involved in the representation. It should be borne in mind that we are not talking about the knowledge **content**, but about the knowledge **type**.

The first type is about **sensory** (or tacit) knowledge. It starts from a perception of difference that is interpreted in terms of an analogy. The first semiotic step is always to recognize the situation in terms of a situation (or state of affairs) you already know. This is particularly clear when we look at the interpretations of works of art. In art, perception is rendered problematic. Art confronts us with contradictory signs and forces us to find coherence. The operationalization is that some of us have an acute sense of differences; they are intense perceivers, while others tend to overlook most differences and concentrate on identities. We find ourselves, at this point, at the level of 'sense making' (Choo, 1998).

Michael Polanyi has coined the term' personal knowledge' to describe this first type . He describes the semiotic process involved in this (sensory or) tacit knowledge as being 'aware of that from which we are attending to another thing, in the appearance of that thing'(Polanyi, 1966:11).Tacit knowledge is also bodily knowledge: 'when we make a thing function as the proximal term of tacit knowing, we incorporate it in our body - or extend our body to include it - so that we come to dwell in it'(Polanyi, 1966: 16).This type of knowledge cannot be coded, it is about concrete experiences, and it can be shared only with those who are co_present. Because Polanyi's notion of tacitness may also include 'compiled' expert knowledge, I will refer to a one-dimensional representation as 'sensory knowledge' and not just as ' tacit knowledge.'

Differentiation of this type of knowledge can be done by the measurement of detail. Sensory knowledge can be very rough, but also very detailed. Knowledge of details is of course relative to a certain domain, and to the knowledge about the domain of others in

the same field. Thus a professional will be able to perceive more when looking at a certain activity than an amateur. The determination of this sensory knowledge certainly is not easy. One cannot rely upon verbal reports. Personal knowledge must therefore be determined through the analysis of behavior, that is, of what someone is able to do in a certain situation.

A knowledge type becomes two-dimensional when, out of the relation between the two events in the process of representation, a new dimension emerges. This new dimension is the dimension of the sign as **code**. With the two-dimensional sign codes emerge. A code is nothing else than a convention establishing a relation of substitution. The two-dimensional sign requires communication and makes communication easier. The two-dimensional sign is therefore basically a social sign.

Although categorization in codes (mostly) is conventional and rests upon the grouping of features, this knowledge enables us to communicate about our experience. In other words, the diffusion of knowledge becomes easier where two-dimensional signs (codes) are available (Boisot 1995). Giving names and categorizing are the basic process in this phase of semiosis. Externalization and diffusion requires coding.

The two-dimensional sign also is tied to a context, but this is not any longer the context of a concrete state of affairs. In terms of Boisot (1995): the diffusion of the sign now takes place along the lines of a social community. It is important to realize that the second dimension presupposes the sensory one. First, there must be the difference in perception that triggers the semiotic process and only then the substitution takes place. This means that one can discuss substitutions (codes) without relating them to concrete events. Effective communication depends on a mixture of words and gesture, text and example. Partners do not need to be co-present. Basic knowledge at this level, therefore, is social and communicative knowledge, needed for the decision-making that underlies all coding (Choo, 1998). Taxonomies are a good example of coded knowledge.

How can we differentiate the codedness of knowledge? Codes can be differentiated by taking into account the number of elements and combination rules a code consists of, as well as the degree of ambiguity allowed. Thus, musical sign systems (scores) are more strongly coded than natural languages. At the lowest level of codification, codes tend to dissipate into concrete, that is, one-dimensional sensory knowledge. Therefore, in the use of images and metaphors, coded knowledge comes closest to the non-coded concrete knowledge of the first dimension. Operationalization for the levels of codification can be

found in Goodman (1968) who uses five syntactic and semantic requirements to distinguish weaker and stronger sets of signs (see also Jorna, 1990).

The third type of knowledge, theoretical knowledge, emerges when to perceptual difference and codification (substitution) a third dimension is added, which is that of the logical or formal relation. Knowledge is theoretical when coded signs relate to the events represented, not on the basis of a convention, but on the basis of formal or structural qualities (their number, for instance). In the third phase, knowledge becomes even more abstract. Perception (sensory) and categorization (coded) are extended with the aspect of (necessary) structure. Basically, theoretical knowledge is knowledge about the necessary relations between events and categories of events. Most scientific knowledge belongs here. This knowledge is the result of scientific inquiry – empirical as well as theoretical, inductive, and deductive. It is the result of answers to the perennial question: why is so and so the case? Knowledge may be discovered, but it may also be 'invented'; that's why it is about the (logical) structure. It should be clear that theoretical knowledge makes diffusion even easier than coded knowledge does: theoretical knowledge is not, in principle, conventional, but universal. Although codification is needed to communicate theoretical knowledge, the knowledge goes beyond coding. Codification is the vehicle. However, basically it is independent of historical contexts, unlike systems of categorization such as, for example, the natural languages.

Various attempts to differentiate theoretical knowledge may be formulated. One such a differentiation is in terms of levels of abstraction. The more entities belong to a concept the more abstract the concept is. Mammal is more abstract than dog, which is more abstract than poodle. Another proposal is the more complex the knowledge is, the more abstract it is. Another is to make distinctions in chains of answers to the question why. The longer the chain the more abstract the theoretical knowledge is.

Based on Boisot 1995 we developed the so-called Knowledge Space (van Heusden and Jorna, 2001) for the different types of knowledge (see figure 6: the K-Space). All forms of sensory knowledge are on the horizontal axis. This knowledge is not yet coded, nor abstract, and ranges from the very global to the highly detailed. In the horizontal plane, then, we also find coded knowledge. But codification presupposes sensory knowledge and therefore the horizontal axis is part of this plane. In the three-dimensional cube, finally, we included all kinds of theoretical knowledge, ranging from the concrete to the abstract. Again, as theoretical knowledge presupposes coded and sensory knowledge, the two axes are also part of the theoretical cube. Movements through the knowledge space

can now be schematized as movements along the one-dimensional linear axis of sensory knowledge, movements through the two-dimensional plane of codification, and, finally, movements through the three-dimensional theoretical space. Conversion of knowledge, in our view, occurs when one goes from one dimension into another. Sense perception continually intrudes and disrupts, and thus secures the openness and the external dynamics of the system. It also promotes reflective observation that, of course, may appear in all the different guises of knowledge.

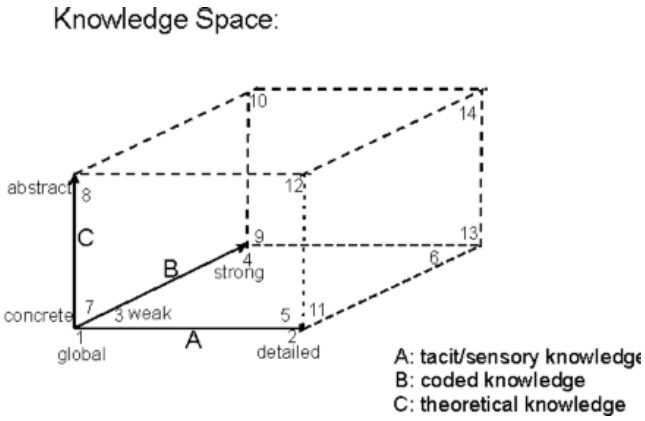

Figure 6: The Knowledge Space

One can schematize different learning processes within this scheme: the learning of a skill means moving along the sensory knowledge axis. The learning of codes, that is, moving through the codification plane, eventually together with a movement along the sensory knowledge axis. The learning of abstractions through a movement upward, eventually in combination with two other movements toward the right end of the sensory knowledge axis and the far end of the codification plane. Scientific experiments, for instance, would be instances of highly detailed, highly abstract, but relatively non-coded knowledge; one would find this knowledge near the front on the right of the Knowledge Space.

In reality sensory, coded and theoretical knowledge are not in a clear-cut way divided over actors executing tasks. It is the distribution of the types within and over actors and the dominance of one type in a task or a collection of tasks that matters. As indicated, theoretical knowledge builds upon coded knowledge that in turn builds upon sensory knowledge. This means that even if the dominant type is theoretical, sensory knowledge is always present. Learning and experience in this context not only mean an extension of

existing knowledge, of whatever type it is, but it also means a change or conversion of type. I repeat that fundamental in our approach is that humans as information processing systems with knowledge and cognition execute tasks and that irrespective of the content of the knowledge used in executing the task the type of knowledge can be characterized. I will now elaborate this perspective with respect to organizational forms.

5 KNOWLEDGE TYPES AND ORGANIZATIONAL FORMS

A discussion about organizational forms is all about coordination, cooperation, and the design of organizations. It is not about primary process within the organization. Primary processes are what an organization produces, yields or brings forth. Examples are hospitals that in treating and curing patients yield health or food processing industries that produce, for example, canned food or custard. They need specialized knowledge of the respective domains for the execution of the primary processes. The way these primary processes are structured and interrelated concerns organizational processes, also called secondary processes (Porter, 1985).

Organizational processes can be realized in three different ways. First, they can be mixed up with primary processes. In that situation coordination of machines or operations rooms cannot be separated from primary processes. Coordination, cooperation, and structure constitute elements of the primary process. Secondly, they can be lifted out and be separated from primary processes. These are what I would like to call separated organizational processes. They can be considered as helping, coordinating or servicing processes. Mostly, organizational processes are performed in separate units or departments. Thirdly, to make things even more complicated, organizational processes can be completely cut off from the original organization and can be put into a new organization or department. Then their primary process is execution of organizational processes. I call these 'second order primary processes.' In this article it will not matter whether we are talking about integrated organizational processes, separated organizational processes or second order primary processes. For reasons of clarity I will only refer to organizational process separated in units or departments.

Organizational processes can be described in terms of their constituting tasks. Examples of these tasks are control, planning, administration, monitoring, communication, maintenance and to a certain degree contracting (Daft, 2000). Control concerns the task in which the right and power to command, decide, rule and judge is executed. Planning is the task in which the courses of actions for staff, products, machines, vehicles, and activi-

ties at a strategic, tactical, or operational level are determined. Administration is here meant to concern the task(s) by which all kind of information regarding the primary (and organizational) processes is set down and established. Monitoring means the task is to follow and assess the progress of the various products, services, or primary processes in the organization. Communication is the task to keep in contact, orally or in written form, with the other members, inside as well as outside the organization. Maintenance concerns the support and up keeping of the means of production and services. Contracting is the task to manage and arrange the promises and appointments within and outside the organization in a formal (legal) manner.

All these tasks are executed by (groups of) individuals using knowledge in terms of content and form or type. My main interest in combining organizational forms and knowledge types is **not** in the content of organizational tasks, but in the types of the knowledge that can be discerned. As indicated in section 4 the types of knowledge are sensory, coded, and theoretical. Although in practice all types of knowledge exist for every individual, it does not mean that uniform distributions exist. It is to be expected that one type is dominant over the others with regard to the various tasks.

The determination of dominance of knowledge type for one individual can also be applied to all individuals, active in the organizational process. It can also be determined for the separate tasks out of which organizational process exists, that is to say for planning, contracting or administration, separately. We then have three possible orientations to look at the distribution and dominance of knowledge types. First, we can take one task as part of the organizational process and determine for all individuals involved the dominant knowledge type. Second, we can look at one individual, executing various tasks within the organizational process, and determine the overall dominance of a type of knowledge. Third, we can generalize over tasks and individuals and determine the distribution and dominance of knowledge types in the organizational process in general. For reasons of brevity I will neglect the level of one task and one individual. I will only look at the organizational process at large. Theoretically, eight possible combinations of the presence and absence of the three knowledge types can be determined. However, the absence of any dominance of knowledge type is hardly realistic. Therefore, seven combinations are left, ranging from sensory (+), coded (+) and theoretical (+) to sensory (+), coded (-) and theoretical (-) knowledge. We should keep in mind that present (+) means dominant and absent (-) means subordinate.

For the moment we now turn away from the knowledge types and direct our attention to the other end of the spectrum where organizational forms are labelled. Many labels can be found (Sorge, 2001), but the most prominent ones are from Thompson, Mintzberg and Boisot. Concerning forms of organizations Thompson (1967) describes the coordination within an organization in terms of (task or process) interdependence. Examples are: pooled interdependence, sequential interdependence and reciprocal interdependence. Pooled interdependence concerns independent departments, that is to say a divisional structure. Sequential interdependence relates to the situation where the output of A is the input for B. In reciprocal interdependence the output of A is the input for B and the output for B is the input for A. Mintzberg (1983) in describing the development of organizational forms enumerates five forms: a simple structure, a machine bureaucracy, a professional bureaucracy, a divisionalized form and an adhocracy. On the one hand the various forms indicate a kind of evolution of a particular organization in time. On the other hand a determination of any organization can be made, because of the dominance of the operating core, the strategic apex, the techno-structure, etc. Boisot (1995) in a similar way as Mintzberg dealing with the evolution of organizations makes a distinction in fief, clan, market and bureaucracy. Boisot distinguishes organizations in terms of the codedness, the concreteness and the diffusion of information. The organizational forms discussed by Thompson, Mintzberg and Boisot are based on decomposition structures, ways of coordination and the characterization of information. Other divisions take into account the authority relation - for example, the subdivision into monarchy, bureaucracy, aristocracy, meritocracy, democracy or technocracy (see also Sorge and Warner, 2001) institutional factors (Williamson, 1975) or organizational strategies (prospector, defender, analyser, reactor; Miles and Snow, 1978). It is also possible to start from leading principles. In that case markets are based on competition, bureaucracies are based on rules, and clans are based on trust. Whatever categorization is taken, I find it remarkable that types of knowledge are not mentioned or used as an interesting dimension to distinguish organizational forms.

The question is how do organizational forms fit the distributions and dominance of types of knowledge. Below (Table 1) the combinations of dominance of knowledge type and organizational form are presented. The level of analysis is the organizational process. More detailed determinations can be made for the constituting tasks within the organizational processes and for the individual actors. The combinations are not the result of empirical research. They are the result of analytical reasoning and could be reformulated

as hypotheses. I will illustrate the reasoning by shortly discussing the various combinations, from clan (s +; c -; th -) to market (s +; c +; th +).

Table 1: Organizational forms in terms of the dominance of knowledge types for organizational processes ((+) means dominant and (-) means subordinate; theoretical presupposes coded which presupposes sensory).

Sensory	Coded	Theoretical	Organizational form
+	-	-	Simple Structure; Adhocracy: Clan; Fief; Family
+	+	-	Divisionalized form
-	+	-	Machine bureaucracy
-	+	+	Professional bureaucracy
+	-	+	R & D department; University research
-	-	+	Not applicable
+	+	+	Market (but organizational processes are also external)
-	-	-	Not applicable

A clan(s +; c-; th -) consists of a limited group of actors that cooperate on the basis oftrust, sometimes justified by family or very close friendship relations. Boisot (1995: 259)
saysthat 'the term clan refers to a non-hierarchical group of limited size transacting on the basis of shared intangible knowledge and values.' These values are implicit and well known by the members of the clan, but they are very difficult to formulate. Clans often are small and local, which means that different clans have different interpretations of what trust, loyalty, responsibility and obedience mean. If a clan is large, it normally consists of sub-clans, because of the nature of physical presence or proximity. The organizational process, rooted in trust and loyalty, does not work in impersonal relations. This does not mean that clans do not use coded knowledge, of course they do, but the interpretation of the codes is guided by knowledge of the sensory type. Theoretical knowledge is largely absent. Questions and explanations of 'why governance and coordination are what they are' are not posed nor given.

The divisionalized form (s +; c +; th -) is only one of the many structures where sensory and coded knowledge are dominant and theoretical knowledge is subordinate. In a

divisionalized form the middle line (in the terms of Mintzberg, 1983) is responsible for the development of new business and the control of operations. Often within the larger organization divisions are formed that operate mainly independently, but also have to communicate with the other divisions. The organizational process to coordinate, cooperate and communicate is by means of rules and procedures which are often available and used in coded form. Because the divisions belong to a larger organization and because the coordination within the division requires personal knowledge, sensory knowledge is also dominant. The more autonomous the divisions are the less dominant coded knowledge becomes.

A very good example of the situation where coded knowledge alone is dominant is the machine bureaucracy (s -; c +; th -). Machine bureaucracies are famous for their self-willed search after procedures and guidelines. Everything within the organizational process has to be coded; otherwise it is not suitable and usable. Sensory knowledge is avoided and if it turns up it will be converted into coded knowledge. Theoretical knowledge is also absent because the rules are so to say self-evident. Explanations in terms of theories, models or scientific regularities or laws are not used. Often these theories are considered as undermining the procedures and rules formulated in codes.

In a professional bureaucracy (Mintzberg, 1983) the operational core consists of highly trained and well-specialized professionals. Many of them may have an academic background. This means that the organizational processes of coordination, control, and planning are executed in close relation to the internal structure - the primary process - of the professions (s -; c +; th +). The knowledge they use is coded in the sense that it is represented and documented in rules, procedures, and scripts. The knowledge is also theoretical because in answer to ‘questions why’ explanations, theories and ‘logical necessities’ can be formulated. Very little knowledge is sensory, which can be illustrated by the long explicitly structured training period the novices in this kind of organization have to undergo. Examples of these organizations are hospitals, universities and ministries in certain fields (agriculture, economics or justice). In contrast to the governmental ministries, the local government is a machine bureaucracy, because of the absence of theoretical knowledge. Local government officials use rules and procedures and not theories and models.

In organizational studies (Sorge and Warner, 2001) no clear-cut organizational form matches the dominance of sensory and theoretical knowledge. In this situation coded knowledge is subordinate. If we search for organizational situations where this combina-

tion (s +; c -; th +) is applicable the most striking example is a Research and Development (R&D) unit. The dominance of theoretical knowledge is clear in such units, because the development of theories is the reason for their existence. However, much of the knowledge that is developed is immature, provisional, and tentative. This means that codification may be the result or the outcome of the research, but it is not the knowledge type by which the organizational process works. Everyone working in university research is familiar with the tension between the real research attitude (sensory and theoretical knowledge) and the red tape (coded knowledge) of the university officials. The sensory nature of knowledge is relevant because oral explanations, demonstrations, intuitive insights, and sophisticated imitation are essential in hypotheses and educated guesses.

Concerning the dominance of theoretical knowledge (s -; c -; th +) it is very difficult to match this with one organizational form in particular. It should be an organization where theories dominate the coordination, cooperation, and communication of the organization. Sensory and coded knowledge are of course present, but they are guided by the true theoretical insights. The only real organization that comes close to this division of knowledge types is, I guess, the Roman Catholic Church. It is relevant not to identify theoretical knowledge only with scientific knowledge. Scientific knowledge is an example of theoretical knowledge, but not the other way around. Although the Bible as coded knowledge is very important for the Roman Church, the interpretation and extension of this document is guided by theoretical knowledge Islam could also be an example, but in contrast to the Roman Catholic Church the Islam does not have a centralized authority with regard to the doctrine. This example also makes clear that other principles besides the division and dominance of knowledge types should not be neglected. The Roman Catholic Church has a hierarchical structure, whereas Islam has a network structure (Beinin and Stork, 1997).

A market (s +; c +; th +) is characterized by many autonomous organizations. The coordination as a organizational process is done by means of an ‘invisible hand’, it is realized external to the organization itself. The interaction is based on rivalry and competition. In theory organizations are said to be equivalent, but in practice they are very different. Internally organizations work on the basis of local information, whereas external comparison is done interms of prices. Because organizations are so diversified in reality, it implies that an organization with much sensory knowledge competes with an organization with much coded and theoretical knowledge and that two organizations with both dominant coded knowledge could negotiate with one another. The variety of organizations, involved in the market, explains the presence of all types of knowledge (s +; c +;

th+). It also explains the complexity of market situations. One could also reason the other way around and call a market a coordination, cooperation, and communication structure without the dominance of any kind of knowledge (s -; c -; th-). Principally it does not matter whether none or all knowledge types are dominant, but for reasons of the assumed intelligence of the actors within the organization, I prefer the overall dominance of knowledge types.

The various organizational forms are interpreted in relation to the organizational processes. The forms are idealized in relation to the division and dominance of the knowledge types. Just as with any other description of organizational forms and structures, organizational practices are more opaque. If one goes one level deeper into the tasks that are the building blocks of the organizational processes, it might be the case that for control coded knowledge is dominant in the organization, whereas for planning in the same organization sensory knowledge is dominant. In order to test the fit of organizational forms and knowledge types it is necessary to collect data at the level of tasks, task execution, and individual actors.

In discussing the organizational forms and the knowledge types the role of the various kinds of actors has remained in the background. However, the actor is the entity where knowledge, organization, task, and process come together. An actor as a (human) information processing system has the knowledge, forms the organization, communicates with other actors, and executes the tasks. Knowledge management in the sense of controlling, running, mastering and communicating knowledge can only be realized if the carriers and processors of knowledge are also taken into account.

6 CONCLUSION: KNOWLEDGE MANAGEMENT AND ORGANIZATIONAL FORMS

The intention of this article is to combine knowledge types with forms of organizations. Conceptually a big distance had to be bridged. Knowledge is something individuals have within a cognitive system. Organizations are social units or collectives consisting of actors and the cooperation and coordination of their divided and distributed tasks as part of primary (and organizational) processes.

I showed how we bridged this gap by interpreting organizations as multi-actor systems. This paves the way for the semio-cognitive approach to actors. Second, I gave a behaviour and cognitive interpretation of the characteristics actors (might) have. Third, I

analysed the organizational (or secondary) process in terms of tasks, such as planning, control and communication. This operationalizes the perspective that humans as information processing systems execute tasks by which they use knowledge. Fourth, I argued that besides the content of knowledge also the type of knowledge is important. Three types of knowledge were distinguished: sensory, coded, and theoretical. Finally, I showed that various distributions and dominance of knowledge types fits well-known organizational forms and coordination mechanisms with labels such as machine bureaucracy, simple structure, clan, or market.

I argue that the above argument gives an operationalization of knowledge management with respect to the tasks that constitute the organizational process. The same can be done for the primary processes, but that is not the issue, here. If knowledge is used in the organizational process, and no one would deny that, than in order to be managed that knowledge has to become observable and 'measurable'. The point I tried to make, here, is that more than just random matches seem to exist with organizational forms. I repeat again that the above argument is not (yet) based on empirical investigations. That is the next step that has to be taken. In the remainder I will re-emphasize the relevance of actors, their cognition, the tasks they execute (1) and its implications for knowledge management (2). After that I will make some remarks regarding organizational processes (3) and I will point to the empirical research we started into knowledge types and innovation (4) and knowledge types and the implementation of software for planning support (5).

6.1 ACTORS.

Our basic starting point is that an organization does not exist without its actors. Leaving aside for the moment the development of software agents, I want to state it explicitly: no human information processing systems, no organization. The key terms in humans as information processing systems are cognition and representation. At a functional level of description - the functional stance as Dennett (1978) called it - the fundamental elements of the human cognitive system are a cognitive architecture, mental representations consisting of symbols and operations or manipulations on these representations. Humans have, develop, change and use representations: of their colleagues, of their tasks, of the rules, routines and procedures in the organizations, of information systems, of the coordination mechanisms and of many other (important) things.

6.2 KNOWLEDGE MANAGEMENT.

As I argued earlier (Jorna, 1998) there are three basic interpretations of knowledge management. First, knowledge management can be seen as a kind of human resource management. In that case the discussion is about the assessment of skills, abilities and the intellectual power of people. A second perspective sees knowledge management as a kind of upgraded information management. In that case a technical interpretation is given of the relation between humans (and their knowledge) and information systems, database systems, decision support systems and knowledge systems.

The third interpretation of knowledge management takes actors and cognition as its starting point and is about cognition, representations, and presentations. Basically the terms in this perspective are related to signs and symbols (systems) and the categorization of kinds of signs/symbols. This is important because until now almost all actors are human actors. In the very near future the 'good old' physical office will be replaced by more or less intelligent computer systems. Perhaps, it will take another ten or twenty years, but the office of the future will be a combination of our own cognition and the power of intelligent (artificial) actors. Knowledge will be determined by the way we are able to handle the intelligence of various actors that are able to get information from all over the world. That information, however, still has to be interpreted by us. Forms of giving expression to this information are important in three ways. First in relation to what we know of ourselves, second in relation to the interpretation of this information in the sense of what it is, where it stands for and which action has to be taken and third in relation to the transfer of interpreted information to others. Adequate presentations and representations are indispensable in realizing this.

It seems that the debate about knowledge management functions as the well-known box of Pandora. Management researchers (and managers) started a debate that they could hardly overlook. Knowledge and learning are complicated matters and it is not easy to grasp them. However, there also is a lack of conceptual frameworks to deal with these non-physical entities within management and parts of information science. Of course, this depends upon the meaning of 'knowledge management'. If knowledge management means human resource management with a strong emphasis on the assessment of the skills and competencies of staff it is just old wine in new bottles. The same can be said if knowledge management means (advanced) information management. As soon as knowledge management is about (the control of) the type and content of knowledge and as soon as 'strange' phenomena like individual people with their minds and cognitive architectures are central - and I think this is the case in discussions about knowledge and learning

- it automatically leads to questions about a conceptual framework to grasp these entities. This framework was discussed in the previous sections.

6.3 ORGANIZATIONAL PROCESSES.

In organizations primary as well as organizational (or secondary) processes are performed. If organizations are too large the organizational processes often are separated into different departments and units, such as planning, control and budgeting units. I argued that the design of the organizational processes, in terms of tasks and the accompanied knowledge types, is related to organizational forms. This analysis does not exclude another kind of analysis where the subject of research is the primary process in an organization. For example, in a specialized cancer hospital where the primary process is curing and caring, the tasks that constitute the primary process may be studied in terms of the distribution and dominance of knowledge types. Such an analysis will give insightful information about better ways of using knowledge, of communicating, of explicating knowledge and of implementing various kinds of information systems. However, it is highly unlikely that, because the primary process is curing and caring, this primary process matches only one organizational form, for example a simple structure or a machine bureaucracy. I believe that there is a wide variety in organizational forms related to the primary processes. It can be argued that the overall branch of hospitals matches one dominant organizational form, e.g., a professional bureaucracy, but the level of abstraction is extremely high and it is easy to find counterexamples. The discussion whether knowledge types for primary processes fit organizational forms boils down to the question whether the content of knowledge or the knowledge domains fit uniform distributions and dominance of knowledge types. I cannot think of any arguments in favour of this fit.

6.4 INNOVATION.

The assessment of knowledge types also gives an indication of the duration and speed of the implementation of innovation. Innovation as a radical change in, for example, ways of working and coordination and control is bounded by the types of knowledge that are present in an organizational structure. If the types of knowledge are ‘wrongly’ distributed or the ‘wrong’ one is dominant, the innovation process may be strongly impaired. Presently, empirical research with questionnaires and observation schemes is going on in the Royal Dutch Army (van der Voort, 1999) in which for two large units, the so called ‘Whites’ (office people) and ‘Greens’ (battle people), the different implementation rate and scope

of ITIL (a method for information provision) is explained by the different distributions and dominance of knowledge types on the various tasks for the various actors.

6.5 SOFTWARE AND INFORMATION SYSTEMS.

It is not a common theme, but knowledge management also is about the implementation of various kinds of information systems - artificial actors if they are sufficiently intelligent - having interdependencies with human actors. Concerning the implementation and use of information systems - digitalization or E-lization in general - the unspoken assumption is that knowledge is or can be coded. However, in communicating and working together with software, humans still have and use knowledge that for a smaller or larger part is sensory. Looking at the level of tasks it can easily be determined why certain computerization projects fail or last longer than expected. We started a longitudinal empirical research (Sjarbaini, 2001) in which we follow the change in the distribution and dominance of knowledge types during the implementation and use of planning support software. More than thirty planners are questioned and observed regarding their knowledge types for three sub-tasks of planning. Three what we call knowledge snapshots are taken: a) before the implementation of the planning software, b) during the implementation and training with the software and c) half a year later. We expect that for certain sub-tasks the knowledge will change from sensory into coded, whereas for other sub-tasks sensory remains sensory. The last situation will hamper the successful use and acceptance of the software (Van Wezel and Jorna, 1999).

Finally, what about Professor Caritat, who was mentioned in the introduction? As I have pointed out in table 2, all imaginary countries completely coded their leading principle. If the owl talks about connection, he seems to mean that various leading principles should be or could be present at the same time in one country. This can only be realized if the knowledge contained in a principle is of various types. If the leading principles are coded in one country at the same time, contradictions will occur.

Table 2: Lukes' forms as dominant types of knowledge

Lukes' forms (by Caritat)	Sensory	Coded	Theoretical
Militaria	-	+	-
Utilitaria	-	+	-
Communitaria	-	+	-
Proletaria	-	+	-
Liberitaria	-	+	-
Egalitaria	-	+	-

Contradictions can only be prevented if the knowledge types of the leading principles are diverse. Connection - the solution of the owl - can only be realized if the **types** of knowledge are interrelated and not only the **principles**. Professor Caritat still has a lot to learn if it comes down to knowledge management.

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