

# Manifestations of Knowledge

## Observing Intermediate Outcomes of Knowledge Production

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This paper refers to recent approaches of *Science and Technology Studies* (STS) in order to show how structures and objects evolve in an organisation during the process of knowledge production. Since these studies focus on the practice of knowledge acquisition they uncover remarkable similarities to those issues that are of importance for knowledge management and organisational learning, too. Affected by changing assumptions in theories of scientific knowledge they focus on the technical and social conditions that shape path-dependent trajectories. Their thorough regard to these issues helps to deconstruct the black-box-like notion of 'organisational knowledge' into observable manifestations. Once manifest, these entities do not any longer have just an epistemic ontological quality but a *real* one, which is observable. *Boundary objects* and *standardized packages* promise to be interesting manifestations in order to serve as anchors for conducting empirical research as well as to control knowledge production and to conduct management activities. By referring to the 'translating' capability (of knowledge and more) of *boundary objects* and *standardized packages* I like to call for epistemic heterogeneity and division of labour, an issue that sometimes tends to be neglected in knowledge management but still remains important – especially in geographically extended knowledge management.

### 1 Introduction

Recent empirical management studies witness an increasing interest in issues that address knowledge creation as a process of interaction of people among each other as well as of people interacting with their environment. Very prominently, Nonaka and Takeuchi (1995) demonstrated how Polanyi's (1966) concept about the 'tacit dimension' of knowledge can be used in order to describe every day knowledge creation. It shows a process of innovation by learning from somebody else's skills. We may remember the example, when, during an apprenticeship in a bakery, an employee of Matsushita had been able to learn how to knead dough in a way that she, later on, described as "twisting stretch". This metaphor was used in order to communicate the needs for the adequate performing of the machine. Nonaka and Takeuchi described this process as 'socialisation' (of tacit knowledge from the baker to the apprentice) and 'externalisation' (of the apprentice's newly acquired tacit knowledge to explicit knowledge by means of using the metaphor "twisting stretch" among Matsushita's development group).

Apart from Nonaka and Takeuchi, Cook and Brown (1999) state that no conversion of knowledge took place in the Matsushita example but the creation of a diversity of new knowledge. By adding on 'knowing', which occurs during practice, to 'knowledge' as an entity that can be possessed, they somewhat open the black box 'knowledge' as it is discussed in recent knowledge management literature. Even though there might be differences of scope, by focussing on the epistemic features of every day practices they position the knowledge-creating and knowledge-managing literature close to issues of organisational learning. Actors, in the process of interacting with others as well as with the world around them, do not stop learning.

By extending Nonaka's (1994) concept of tacit and explicit knowledge and criticising his view towards the interplay of different forms of knowledge, Cook and Brown (1999) open up a perspective that also follows contemporary *Science and Technology Studies* (STS). These have learned much from holistic empirical research by ethnographers and social anthropologists when, in the 1980s, they started their endeavour for investigating the production of knowledge or 'truth', respectively (Latour and Woolgar 1979; Knorr Cetina 1979; 1999; Star and Griesemer 1989; Traweek 1992).<sup>1</sup> But first they have also had to deconstruct the notion of knowledge – and of 'truth' in particular. They, like Cook and Brown and other theorists of management (e.g. Brown and Duguid 2001; Carlile 2002; Orlikowski 2002; Elkjaer 2004), went to study the every day practice of scientists in laboratories or in other institutional settings of the science system.

However, STS did not stop investigating 'practice', but very soon explored manifestations of knowledge work, which serve as tools of 'translation'. This sounds familiar when we think of Nonaka's (1994) concept of knowledge 'transfer', but it is not. Cook and Brown as well as the STS immerse in the notion of knowledge and in what happens during the process of practice – to the individuals as well as to the institution these are part of. Manifestations of knowledge as intermediate outcomes of interacting in the course of knowledge production serve for translating of epistemologies and knowledge, but also of interests and motivations, etc.

Knowledge and questions about epistemology have been constituents of many theories of the firm, even classical ones of the early 20<sup>th</sup> century. But, according to Spender, these approaches were lacking "the specificity necessary for empirical research" (Spender 1996: 45). This statement is already ten years old. However, the argumentation of my paper is based on the presumption that, especially in terms of empirical research, theories about knowledge in organisations need to deconstruct the notion of knowledge to observable consequences of organisational activity towards its production. For knowledge management these observables and translating devices, first, may serve as entities that can easier be investigated than practice itself; second, they may be used as devices for control.

This paper shows how manifestations of knowledge occur and how they may be utilised. I will start by a critical assessment of knowledge and organisational learning with

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<sup>1</sup> Cf. (Hess 1997) about an overview of this field.

reference to American pragmatism. Then, I will demonstrate how a pragmatist organisational theory in combination with STS contributes to identifying intermediate manifestations of knowledge. The paper concludes with illustrating some implications for knowledge management and organisational learning. These implications are: a) corporate knowledge *is observable* by focussing on intermediate manifestations of knowledge producing processes; b) these manifestations may serve as control devices for management; c) division of labour in and beyond the organisation is a decisive element of knowledge production.

## 2 Knowledge, Knowing, and the Course of Practice

### 2.1 A Pragmatist Point-of-View

By expanding the notion of knowledge Cook and Brown (1999) particularly draw on the conception of ‘practice’ and Dewey’s notions of ‘knowing’ and ‘inquiry’ in order to explain how individuals interact with their world and shape new forms of knowledge by this activity. For them, questions about individual and collective knowledge must overcome the ontological status of an entity that somebody may ‘possess’. They rather speak about “knowledge *used in action* and knowing *as part of action*” (Cook and Brown 1999: 383). Knowledge, then, is a resource that can be activated in order to act. But the very form of action does not happen only with reference to knowledge that has the quality of an entity, be it tacit or explicit. There is also ‘knowing’, which is inherent of action itself, but, according to Cook and Brown, it is *no* tacit knowledge (1999: 388). Tacit knowledge may be activated or not; knowing happens in a given situation by interacting with the world.

This pragmatist viewpoint refutes Cartesian dualism’s strict divide between mind and body.<sup>2</sup> One consequence is that not just a stimulus induces learning but it is always a stimulus *in a context* (Dewey 1972; 1938). Hence, we learn something different according to the context in which we are stimulated.

“If one is reading a book, if one is hunting, if one is watching in a dark place on a lonely night, if one is performing a chemical experiment, in each case, the noise has a very different psychical value; it is a different experience.” (Dewey 1972: 100; cited by Elkjaer 2004)

The same happens the other way around. With different situations we react differently to those stimuli. This kind of acting accompanies the individual in each moment of live. It is, furthermore, an inherent feature of individual knowledge acquisition. For Dewey, thinking itself is a *tool* in the course of everyday activity (Elkjaer 2004: 425). This is the pragmatist viewpoint against introspective theories of psychology. Knowing and thinking is not a human feature that serves for its own right. It rather helps solving problems when encounter-

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<sup>2</sup> American pragmatists’ anti-Cartesianism can, for certain extend, be seen as in opposition to cognitivism without being behaviouristic in the sense of Watson and Skinner. It is most elucidative with Charles Sanders Peirce (1931), William James (1890), John Dewey (1938) and George Herbert Mead (1934) – for the role of James in knowledge management see Spender (1996). Similar critique on Cartesian dualism with close reference to ‘practice’ derives from the philosophy of ordinary language (Wittgenstein 1953; Ryle 1949), whereas a different view on the notion of ‘practice’ goes back to Bourdieu (1977; cf. Lave and Wenger 1991).

ing the world; and it is important to remark that it is most often only activated according to a given situation. Thinking, therefore, is an inherent feature of the individual's ongoing interaction with the world, and knowledge is the experience of this interaction. A certain state of knowledge as experience, however, is only a short moment in time and space, attributed to an individual in a certain mood; this is the *situation* in which an *inquiry* takes place.

Experience does not necessarily need to be conscious experience, i.e. it does not need to be an outcome of reflected thinking. Instincts or habits that refer to norm following behaviour are not problematised by an organism (or a social group). And if there is no problem, there is no conscious action (Mead 1934). Learning may happen on the basis of non-conscious action as long as the organism can handle the problem without reference to the conscious mind. With Mead, conscious action emerges when there is an irritation that inhibits further non-conscious action. It follows the Deweyan problem solving process of *inquiry*. It is this ability to inhibit and to scrutinise that constitute higher life-forms.

Each state of knowledge bears new problems that are to be solved. Hence, knowledge is not something that is acquired and will then be utilised. It bears consequences in action and behaviour. Past experiences of individuals are different, their interests within groups and their future prospects, too. With each problem-solving process each actor involved in this process changes his epistemological ground – even if most often only slightly. When speaking about group action we can speak of multi-perspectivism towards a given situation, e.g. learning to use new software, but also perspectives towards a R&D project, or towards the future of a company. All perspectives, no matter how different, are *real* in that they bring forth real consequences by their holders (Thomas and Thomas 1928; cf. also Mead 1959). The organisation's reality is constructed by the activity of its members that derives from those different perspectives. However, the perspectives differ not arbitrarily. There is a certain kind of homogeneity, depending on the structural background on which the actors are situated.<sup>3</sup>

Referring to Nonaka and Takeuchi's (1995) above mentioned bread-making example, Cook and Brown called the metaphor "twisting stretch" as a "genre" on which different actors with different perspectives have reached a mutual understanding "that straddled bread making and machine making" (Cook and Brown 1999: 395). However, this understanding is not homogeneous. It reaches a level of workable common ground on which, nevertheless, several perspectives exist. We get an idea about how many sorts of individual *knowledge* and, in the course of activity, individual *knowing* is involved. There are as many knowledge assets as there are perspectives; there are as many *knowings* as there are individuals acting in as many situations. Hence, the notion of 'knowledge transfer' (Nonaka 1994) bears difficulties as well as the view of knowledge *as an entity*. However,

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<sup>3</sup> This reminds us of approaches of self-reference such as systems theory (Luhmann 1999) or cybernetic approaches. However, in this paper I will draw further on the pragmatist framework because it, similarly, refers to self-reference but offers itself an access to organisational 'Social Worlds' (Strauss 1978; cf. Clarke 1991) that is particularly interested in models which derive from empirical social research rather than from theoretical and normative deductions.

this background is not particularly new to management literature.<sup>4</sup> The point here is that we focus on knowledge as a means for problem solving – problems that are not just of an epistemic nature and, hence, refer to solutions *apart from* epistemic ones. Furthermore, focussing empirically on different actors' perspectives takes particularly bottom-up structures of knowledge production into consideration (Star and Griesemer 1989; Yanow 2004).

## 2.2 Paths of Incommensurability

Science and Technology Studies (eg. Latour and Woolgar 1979; Latour 1987; Star and Griesemer 1989; Clarke 1990; Fujimura 1992; Knorr Cetina 1999) take – more or less explicitly – the pragmatist position into account. In social anthropologic studies of laboratory work, for example in Latour and Woolgar's (1979) and Knorr Cetina's (1999), the process of knowledge production is not illustrated by referring to theories of scientific reasoning (most prominent probably Popper 1959). Apart from Thomas Kuhn (1962), they do not even care very much about questions about truth. They are rather interested in the problems that are solved in the course of producing theories or 'truth'. This shifting focus has some intriguing parallels to the extension of issues about knowledge in management literature. Similarly to Cook and Brown's (1999) adding on of *knowing* to *knowledge as an entity*, Science and Technology Studies beforehand have been becoming interested in the every day activity within laboratories. How do theories evolve? What are the social circumstances of particular kinds of theories etc. (Callon 1995)?

Research efforts of the most recent approaches (Latour 1987; Star and Griesemer 1989; Fujimura 1992; Knorr Cetina 1999) give Kuhn's (1962) notion of incommensurability a new drive. They extend science models towards directions that show some similarities to economic theories about path dependence (David 1985; Arthur 1989). Here, the notion of tacit knowing (Polanyi 1966) is also getting its merit. Different conditions of knowledge production lead to incommensurabilities of skills, of trajectories in the timeline that aroused by technologies at hand, politics etc., and, in the end, they lead to incommensurable scientific paradigms.<sup>5</sup> Hence, the course of the production of scientific truth is path dependent. Locality, humaneness, technology, and history are crucial for the kind of theories that are developed and, hence, for the kind of knowledge that is produced.<sup>6</sup>

At first glance, incommensurability issues in organisations might be too different in order to compare them to the science system. Scientific paradigms are seen as competing theories that describe the same phenomenon differently, whereas in organisations issues are of a rather different nature. However, if we deconstruct the notion of 'phenomenon'

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<sup>4</sup> Cf. Orlikowski (2002) for a review of organisational studies that similarly address the practice perspective of knowledge production, and Schultze and Stabell (2004) for further comparisons of differences between several Knowledge Management schools.

<sup>5</sup> This extension of Kuhn is different to STS approaches during the 1970s, when the notion of incommensurability in Science Studies most often led to single-sided political assumptions about the role of power. Those theories held that those, who are in power, are determining what truth is. The argumentation of STS refers rather to the power of processes themselves.

<sup>6</sup> Ludwik Fleck (1979) and Karl Mannheim (1936) were among the first who brought this topic to light in the early 1930s.

that is to be described by theories, we get an idea that there are as many ‘phenomena’ as there are actors involved, e.g. scientists, assistants, politicians, ethical philosophers, secretaries, etc. This is the argumentation of *Science and Technology Studies*. If we now take the role of observers of organisational activity,<sup>7</sup> we may start debates about several topics, e.g. different paths towards similar outcomes, questions about desired outcomes, etc. However, the point is that, first, paths are not describable by just one single rationale, and, second, that the actors are involved with respect to path-dependent trajectories. So, pre-theoretical, and to a certain extent pre-managerial, issues are involved in the process of knowledge production.

This process starts with questions about problem perception in the course of interacting with the world. If we do not have a problem, we will not acquire knowledge. This counts for individuals as well as for larger social aggregations. Let us think of the deep sea, for instance. Scientists hardly know anything about the deep sea. Of course, it is difficult to explore, but it is not impossible. The technology is available, nowadays. Different from the universe, which is seen by everybody who is looking into the night sky, the deep sea does not get very much consideration. *Many people watching stars* cause problems, i.e. they ask questions about the universe. In the long-term, this will likely cause interests of many different kinds, enable funding of research, etc., and eventually it produces theories about the universe. Nothing of this is happening with the deep sea. It constitutes a frontier of research for only a small amount of scholars. But those researchers are a minority; hence, they are not powerful enough to induce structures and efforts to do large-scale empirical research. There are, for example, comparatively few scientists who get trained in handling high pressure, either a) theoretically (e.g. for developing diving techniques) or, with reference to the situation’s “dynamic affordance” (Cook and Brown 1999: 390), b) tacitly and c) *in practice* (e.g. pressure equalisation by ear clearing). As a result, there is hardly any literature available and almost no (public/scholarly/scientific) awareness about these issues. And therefore, maritime science funding hardly exists because *there is no problem*; and, consequently, the deepest parts of the ocean remain a big secret.

Having this in mind we see intriguing analogies to research in knowledge management and organisational learning. A scientific theory or a result from research may be regarded analogously to an end product that derives from R&D activities or otherwise. Such analogies are even more evident when we follow discussions that address the role of science systems in terms of exploitation of research results for the benefit of society (e.g. Gibbons et al. 1995). The ‘practice turn’ (Schatzki et al. (eds.) 2001) from exploring scientific theories to investigating scientific *work* brings those science studies close to research in knowledge management and organisational learning.

So, if we employ this stance of path dependency to the problem of knowledge transfer we may be aware that there is no way that a given knowledge base can be transferred one-to-one, neither from one individual to another, nor between larger social aggregations.

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<sup>7</sup> Cf. Scherer and Steinmann (1999) for the discussion about incommensurability in organisation science.

When trying to substitute investment brokers' activity by technological tools with which knowing and implicit knowledge of the brokers is to be simulated,<sup>8</sup> this kind of acquired knowledge is completely different from, and hardly comparable with that of the brokers themselves. At a certain point, 'externalisation' by metaphors (Nonaka and Takeuchi 1995) would face its limits. In order to *work* like an investment broker, simulating would have to include psychological assets such as mood etc., something that is possible at most rudimentarily. However, acquiring knowledge is not an end in itself. The aim is to simulate the *consequences* of knowing, which refers to the output of brokers' work, rather than to their knowing itself.<sup>9</sup>

An example of broader scope may show that several paths of knowledge production are possible in order to reach similar innovative end products. The science historian Mikael Hård (1994) uncovers two completely different trajectories that both led to the development of the diesel engine for lorries at the beginning of the 20<sup>th</sup> century. In Germany, Daimler-Benz developed this engine with close reference to the physical sciences. The American way, on the other hand, was paved by trial and error processes, and by the workers' local and implicit knowledge and practice knowing as well as by that of the main character in this process, Clessie Cummings, who did not even have a formal engineering education. Here, too, we regard completely different knowledge bases. But there are other dissimilarities, too. We may speak of two completely different worlds that have led to the same (or rather: to a very similar) outcome. The difference includes money resources, motivation, world views, local knowledge, etc., which results in different design and the like (Hård 1994) but, nevertheless, produces a very similar technology.

Hård's study shows how knowledge in relation to global orientations and local closure is intertwined but not to be substituted by each other.<sup>10</sup> The remainder of this paper wants to address certain features of such processes that emerge when we look closer to the production process of knowledge. Organisational Knowledge is an abstraction of many assets that are involved in the process of organisational learning as well as in knowledge production itself, but these are not necessarily to be described as epistemic entities. Taking this into account bears some interesting implications to the management of knowledge, because representations of knowledge need not be the end-products themselves but can be located *as artefacts* in between, and occurring during processes of knowledge production. They occur as resources, gatekeepers, learning machines, means for persuasion and the like. Activity towards them is very heterogeneous. Sometimes, when representations serve as translational means,<sup>11</sup> their role has to do with acquiring knowledge, sometimes it does

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<sup>8</sup> I would like to thank Peter Pawlowsky for this example.

<sup>9</sup> This point-of-view refers, indeed, to pragmatist philosophy (but is not the same!) in which 'truth' as true belief is to be regarded from the consequence of this belief in real action. To reconcile with Nonaka and Takeuchi's point in this respect: If it is sufficient to *satisfice the outcome* by approximating the brokers' activities, analogising by metaphors might indeed be a good choice.

<sup>10</sup> Similarly Yanow (2004), to whom I will return to later.

<sup>11</sup> The notion 'translation', which is introduced in a later section of this paper, is also used by Nonaka (1994: 20), probably synonymously to the notion 'transfer'. For *Science and Technology Studies*, translation is a central term in order to describe the course of knowledge production. Their understanding of 'translation' connotes rather with the notion of 'transformation'. Carlile (2004), however, discriminates further be-

not. But each time their role is decisive in the large course of knowledge production within, and around, the organisation.

### 3 Boundary Objects and Standardised Packages

#### 3.1 Social Worlds and Arenas

During the 1980s, the ‘practice turn’ in Science and Technology Studies (Schatzki et al. (eds.) 2001) was shaping some promising approaches by social anthropological research. Even if these research programmes were focussing on every day practice of natural scientists, it was not just observing their activity that was of interest, but the role of artefacts, too. In the following I want to refer to the extension of the Actor-Network-Theory (Latour 1987) by pragmatists like Susan Leigh Star and James Griesemer (1989) on the one hand, and Joan Fujimura (1992) on the other.<sup>12</sup> Latour, as well as the pragmatists, are convinced that action means always interaction, among people, but also of people with physical entities.<sup>13</sup> Star and Griesemer, and Fujimura, follow similar ambitions like Latour with their descriptions. But while a network in Latour’s conception has one focal point through which all actions and ‘translations’ are funnelled (e.g. through the actor Louis Pasteur who, according to Latour (1988), was translating many activities within a large network to a theory about micro biology), the pragmatists’ view on a network differs decisively. For them, there is no funnelling but the network is rather diverse, with many focal points that serve for translation. As a first definition, ‘translation’ may be understood as the course from activities in which epistemic account is involved to further activities that show different epistemic accounts.

In order to get a proper background to locate focal points of translation, Star and Griesemer refer to a perspective that has mainly been developed by Anselm Strauss (1978a; 1982; 1984). Strauss has conducted research in hospitals for more than 40 years. As early as in the late 1950s he became aware that an activity in a hospital includes many different expertises, interests, skills, technologies, etc. and that a status quo of this structure would not last long. Rather, the very heterogeneity within the hospital would create new structures. Bucher and Strauss (1961) investigated this by looking at a new emerging field of pathological work: radiology. With access to this new technology the field of professional pathology changed completely. Some of the pathologists who, up to then, had been concerned with medicine rather became engineers, mainly interested in developing radiology devices. Other splits happened as well, for example diagnostics has been dividing from therapy, new medical services were developed etc. The formal organisation had changed completely. But so did the actors’ activities, values, interests, relationships, too. Some of

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tween translation and transformation. I do not follow this discussion here, but I assume that translation embraces both.

<sup>12</sup> For the nature of this alliance cf. Strübing (2005: 302f.).

<sup>13</sup> The Actor-Network-Theory holds the assumption that physical entities are enabling the same functions by action than humans do. The pragmatists do not follow this assumption (Star and Griesemer 1989; Fujimura 1991). This is one major difference between both approaches.

them became teacher for radiology, others became researcher on diseases, others became entrepreneur-like actors who forced a public implementation of this technology. This, again, brought other relationships to shattering, e.g. the emerging neglect of doctor-patient relationships by the ‘researchers’.

In order to look behind these dynamic structures, and to make analytical sense of it Strauss (1978a) was developing a network concept that he called Social World and Arena (Figure 1). In a Social World there is at least one activity that is the core (‘going concern’) towards which the participants adjust their action, as well as their values and interests. Boundary work must be done in that a Social World has to defend itself, e.g. by legitimising its existence, distancing from others, setting of standards, etc. (Strauss 1982). Social Worlds can segment to subworlds or split into competing worlds. The overall structure is an arena on which members of Social Worlds act on behalf of their Social World<sup>14</sup> when, for example, defending their realm. Everything happens by negotiating. However, Strauss

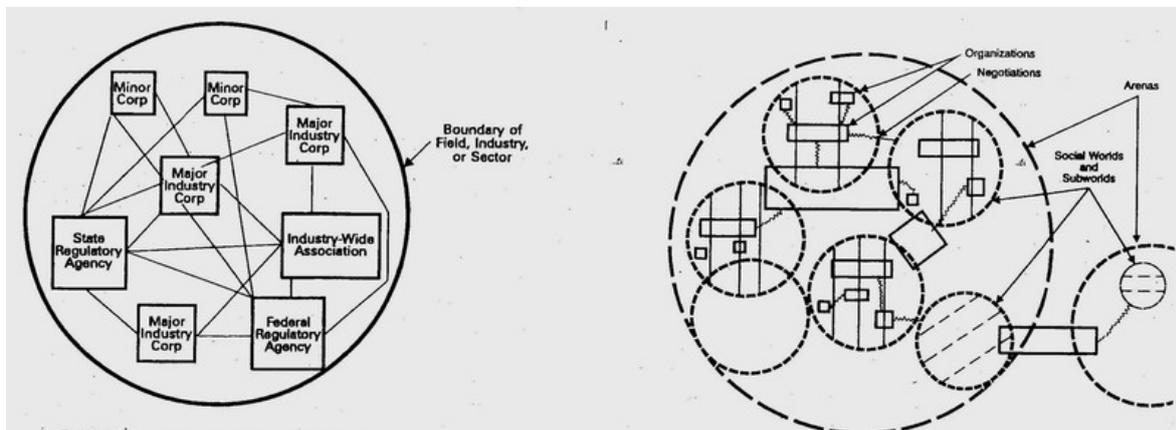


Figure 1: A Network on the Left; Social Worlds and Arenas on the Right  
Source (Clarke 1991: 122f.)

(1978b) has had a rather broad idea of this expression. The very act of accepting a contract, for example, is not just the outcome of former negotiations but bears negotiating features, too (morosely accepting or happily accepting, this difference bears future consequences as well). Social Worlds, however, can be located within formal organisations, above them, or as crossing several of them, depending on the analytical focus of the researcher.<sup>15</sup> Furthermore, the concept of Social Worlds and Arenas is scalable towards the social aggregation that is to be investigated (Strübing 2005: 307).

### 3.2 A Setting of Multiple Perspectives

*Boundary objects* play a crucial role between Social Worlds and in Arenas where they are the focal points in which Social Worlds meet – and translation takes place. Star and Griesemer (1989) coined the expression *boundary object* in order to investigate the activities of

<sup>14</sup> This is similar to Argyris and Schön’s view on collective action: “members of the collectivity begin to become a recognizable ‘we’ that can make decisions and translate their decisions into action.” (1996: 9).

<sup>15</sup> This insight is of special use in order to do research on the management of knowledge which seldom rely on the formal boundaries of an organisation.

people that were involved in the start up process of a Museum of Vertebrate Zoology in California at the beginning of the 19<sup>th</sup> century. This start up had very much in common with contemporary firms when setting up business in a competitive environment. Both relied on people with different knowledge and interests; like many firms the museum was committed to a great variety of stakeholders. The development of the museum relied on the competencies of members of very different Social Worlds. All of them shaped a competence frame that made this museum and a contribution to evolutionary theory possible. The first task in the installation of the museum was collecting the vertebrates of California in order to exhibit them in the museum.

The most important actors were: the museum director, the investor, the University of California Berkeley administration, the public, local nature-loving collectors, and professional trappers. Some objects (i.e. *boundary objects*) that occurred during in his process were money, the State of California, “specimens, field notes, museums and maps of particular territories” (Star and Griesemer 1989: 408). Preserving California’s nature was a goal for the most of the actors, but not for the trappers and not for the university where the museum was located. Their incentive was mainly influenced by money; additionally, the university’s goal was gaining prestige. A museum full of animals should point the public attention to the Californian flora and fauna in hope that despite ongoing industrialisation there would be certain awareness for preservation. The process of collection should meet the demand for stuffing the animals (i.e. not harming the skin, which was sometimes difficult with the trappers who did not really care about it) as well as the exact documentation of the collections (e.g. the location of the finding etc.). Thus, the trappers were paid money, and the nature-loving amateur collectors were persuaded to look after certain animals when being camping in the wilderness.

However, Star and Griesemer (1989) wrote a science study rather than a study about the Californian country side. So I may turn to the main character of this Social Arena, Joseph Grinnell, the museum director. Trained in biology, Grinnell wanted to conduct research in evolutionary biology. Being some kind of an enclosed biotope, California was an excellent place to set up such a study. But Grinnell identified himself also as a Westerner since he grew up in this region. So he, too, had a great interest in preserving this particular environment. On the other side, he was also interested in establishing a scientific authority in the American West as counterpart to the scientific endeavours along the East Coast. In this respect California as a biotope served as a resource for his needs. No biologist on the East Coast could conduct such kind of research unless he would move either to the West or somewhere else. At this point an interesting dynamic emerges:

“By seeking to establish a centre of authority for problems well-served by this regional focus, Grinnell simultaneously shaped his research goals and increased the value of Alexander’s [the investor, added by the author] support – not only would she be preserving a sample of California’s native fauna for posterity, she would be contributing to the establishment of a research centre.” (Star and Griesemer 1989: 400)

Annie Alexander, an autonomous rich unmarried woman (Star and Griesemer 1989: 400), was one of the nature-lovers who wanted to protect the landscape. She, too, was a hobby collector and wanted to do something to protect the Californian flora and fauna. So her ideas to establish a museum in order to communicate with the public met very much with those of Grinnell. But then she became aware that she would not only help to preserve the landscape but to establish a research authority.<sup>16</sup>

Hence, the mere State of California became a *boundary object*. “Boundary objects are objects which are both plastic enough to adapt to local needs and the constraints of several parties employing them, yet robust enough to maintain a common identity across sites” (Star and Griesemer 1989: 393). *California* was a different object for different parties (Social Worlds) within the Arena. For Grinnell it was a biotope for research, a resource for academic interests, and a symbol of homeland. By shaping identity with California, it was a symbol like concept for Alexander, too, as well as for the hobby collectors and for the public. This geographical concept was not working by shaping just one identity. Each social world had a different view on California, Alexander closely referred to the preserved animals; the public had a fairly abstract sense of regionalism, so did the hobby collectors which added the desire for an intact landscape during their leisure time. Curiously enough, no such meaning worked with the trappers; they did not care about all these ideas and had to be paid for doing their job. California, for them, was no observable symbol but the mere geographical base of being a professional; it was their workplace where they could perform their profession.

### 3.3 Translation

Bringing in expertises from many perspectives into organisational endeavours is exactly what makes boundary objects interesting for knowledge management. These expertises are manifold. Hence, it is not useful to state that each participant involved into the knowledge production process must have insight into everything that is going on during the production work. In the afore-mentioned California museum example, the biological theory has been evolved by the contribution of many different parties. Grinnell, later on, became indeed a scientific authority. But not just this happened. The museum also became an integral part of the development of public cultural life in the American West, which had been rather rudimentary in those days; from the perspective of organisational learning, for trappers, and probably much more for the hobby-collectors it was a learning process about the flora and fauna of California. We do not know whether for any good but we may imagine that it might have had consequences of some sort – in another Social Arena.

*Science and Technology Studies* (Latour 1987; Star and Griesemer 1989; Fujimura 1992; Knorr Cetina 1999) speak of ‘translation’ when referring to this kind of organisa-

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<sup>16</sup> Star and Griesemer do not say anything about it but we can imagine that her own alignment to the process of collecting (she was a hobby collector) was shifting when she got aware that *careful* collecting would contribute to science. Her own mode of collecting might have been changing toward even more reliability. This would be another phase of the dynamics of the network (Social Arena respectively).

tional transformation of knowledge and skills. Besides the object *California*, many more entities were involved in this process. The authors differentiate between four types of boundary objects. *California* is an example for a so called ‘coincident boundary’: “These are common objects which have the same boundaries but different internal contents” (Star and Griesemer 1989: 410). There are also ‘repositories’ in which different parties may acquire resources which are different each time (e.g. the museum and library for getting information), ‘ideal types’ being abstractions of things that play a role in every day tasks (maps about the area, diagrams, but also the notion of ‘species’ which is an abstraction for analytical means), and ‘standardized forms’. In order to highlight the role of division of labour, I want point out the latter, standardised forms, or as Fujimura (1992) calls it: ‘standardized packages’.

Standardised forms are “methods of communication across dispersed work groups” (Star and Griesemer 1989: 411). The task of collecting animals was quite complicated because it had to be done with regard to evolutionary scientific analysis. It required “collecting, preserving, labelling and taking field notes” (Star and Griesemer 1989: 406); and it was decisive that these tasks were fulfilled precisely. So Grinnell established highly standardised methods in order that all collectors could meet the requirements of this scientific endeavour. This strategy helped by establishing a routinised action. Its utilisation may resemble Nonaka’s (1994) notion of transfer from explicit to implicit knowledge (Nonaka 1994). But as Cook and Brown (1999) show, what happens during this process is far more complex. It is a process of learning anew; this counts for each actor; everybody acquires new knowledge for his own sake (e.g. that the trappers learn writing and fast counting) as well as for the sake of the whole endeavour (efficient counting may lead to a high amount of classified species). It is worth noting that the collecting method itself became a standard in the biological sciences (Star and Griesemer 1989: 393) – it is an innovative outcome of itself even if not intended.

Joan Fujimura’s (1992) concept of standardised methods (‘packages’) refers even closer to the notion of ‘work’. Activities towards the boundary object *California* may be called ‘articulation work’ whereas the use of standardised methods (the collecting method) is straight forward ‘production work’ (Strübing 2005: 267). Participants from different Social Worlds are able to refer to those standardisations, learn actions toward them by continual usage, and make their contribution by using them (consider rules and routines with Nelson and Winter 1982). But something is different to boundary objects. Standardised packages are able to change the habits of the members of Social Worlds; they may even change the whole core activity. This happens when technological developments are used as strategic means.<sup>17</sup> Hence, Fujimura (1992) extends the model of standardisation to entire theories and even scientific schools. These do not only refer to problems of incommensurability of theoretical assumptions but also to those of using different technologies,

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<sup>17</sup> Fujimura (1992) showed this with the development of a routine in cancer research that made economically attractive research possible. It was then used strategically for more than only scientific needs.

having access to different resources, being in different organised fields and geographically displaced, etc.<sup>18</sup> This perspective of including everyday conditions of knowledge production offers an alternative to the Kuhnian theory about paradigm shift (cf. Strübing 2005) in that it includes those circumstances, which are not ostensibly concerning with the main issues. Systems theoretically inspired management approaches (Ulrich and Probst 2001; Senge 1993; Probst et al. 1999) tell us how important it is to regard those circumstances. In the context of this paper we should be aware that it may shift expertise where it is undesired, or even destroy existing expertise.

## 4 Implications for Strategic Knowledge Management

*“Error I: Not Developing a Working Definition of Knowledge”*

(Fahey and Prusak 1998: 265)

The benefit of pragmatist Science and Technology Studies to KM research may be seen in their successful efforts towards deconstructing the concept *knowledge* to observables. By referring to organisational knowledge and its manifestation, organisational strategists are not at all committed to think of one timeless single entity which is named *knowledge*. Even if knowledge of the organisation’s members is decisive, it is not just this kind of knowledge as such that leads to the progress of a firm. If it is not individual knowledge as such, what is it that refers to the knowledge assets of a firm? It is certainly the outcome of action of knowing individuals such as products as well as patents and so forth; but knowledge managers know that it is more than that. Even if not (yet) activated by an economic outcome, knowledge is a resource (Wernerfelt 1984; Barney 1991) which is not easily transferable or imitable. Hence it is a structure of opportunities for future action. This resource is not just *one* epistemic entity (Spender 1996). There is expertise of a very heterogeneous level. Furthermore, it is not just an entity at all. It comes along with organisational practices (Brown and Duguid 1991; Tsoukas 1996; Cook and Brown 1999; Orlikowski 2002). As *boundary objects* these practices result in intermediate manifestations. Such a structure enhances further individual knowledge for the advantage of organisational action. It is the task of knowledge managers to set up this structure – be it organisational knowledge maps, yellow pages, interaction space, motivations for communication, points on which similar as well as different identities can adopt.

### 4.1 Research towards Boundary Objects

As we have seen in the Museum of Vertebrate Zoology example, activation structures exist and occur even if they are not easily observable – and not induced strategically. They are not obvious because they do not directly refer to knowledge acquisition. However, they may still be easier to observe than organisational practices as mere activity, because they

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<sup>18</sup> Consider the example about the deep sea, which I mentioned on p. 6.

may serve as somewhat like a reference point, a target for (managerial as well as academic) search strategies, etc. *Science and Technology Studies*, by drawing from theories about knowledge as a semantic entity towards knowledge as the outcome of organisational practice, showed that those structures are manifestations of some kind that play a crucial role for members of the production site of knowledge.

Turning to analogical issues in knowledge management, we speak of knowledge maps, yellow pages, interaction space and so on. By referring to these obvious tools for knowledge management, do we exhaustively describe the tools at hand? Probably not, there are other means as well, but they seem to be alienated from the field of knowledge production. And it is this alienation in particular which makes them interesting for knowledge management. *Boundary objects* are decisive means that operate in the background of knowledge production and organisational learning. They seem to be yet uncovered resources.

This idea resembles rather the enabling of organisational culture as resource (Schein 1985; Sackman 1991) but does not correspond with it. The frame of this paper focuses on the observable parts of the cultural assets of an organisation, and here only on those assets that are, first, strategically important and, second, observable. For management research it is advisable to focus on segments of cultural assets – and for knowledge management only on those which refer to knowledge production and organisational learning. The corporate culture as such is not describable – approximating at most by ethnographers and social anthropologists in long-term field-studies. Objectivations of learning are those entities that are explicable and, which is decisive, they are those entities that bear consequences to the knowledge assets of the firm for further learning of individuals as well as to strategic management in order to dispose over the direction of learning.

Especially with reference to knowledge, formal organisations break down their formal borders in order to shape alliances, refer to foreign experiences, join the values surrounding them, etc. However, a benefit of the Social World approach is its analytical openness according to the notion of ‘perspective’ (by the observer, i.e. the researcher or manager), and the fact that its very functionality is less attributed with the formulation of abstract theories but with empirical research from which theories emerge (Glaser and Strauss 1967).<sup>19</sup> The Social World perspective allows the creation of a basis for observing action by analytically shaping boundaries due to characteristics of activities of a social aggregation that can be set apart from others. This may, but does not need to, be a formal organisation or a firm. This analytical element is scaleable in a way that the core activity (*going concern*) may happen among several individuals. Core activities are observable on the basis of very large aggregations, too. Here, we may discriminate worlds and subworlds (parts of Social Worlds that share commitment to the overall world but also interpret their own

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<sup>19</sup> The rise of resource-based (Wernerfelt 1984; Barney 1991) and knowledge-based theories (Spender and Grant 1996), claiming that activation of resources within a firm leads to competitive advantage, demands qualitative research approaches, probably more than any formal theory. Hoopes et al. (2003) bring the problem to light: Many theories regard just formal assets like patents etc. or some kind of blurredly described assets like culture. However, formal assets are only the peak of an iceberg and blurred expressions do not really help. Both are signs of lacking thorough qualitative research.

commitment) as well as arenas in which different worlds are negotiating. Particularly when looking at entrepreneurial activity it is not advisable to concentrate only on formal organisations. In many processes of entrepreneurial activity circles of friends or the family may be of greater importance than the firm, especially when the business has just been launched.

Observing *boundary objects* and *standardised packages* may, to certain extent, overcome the obstacle that qualitative research is an expensive endeavour. We may not observe activity as such, but look for ‘entities’ that are products out of the course of knowledge production, may they be epistemological in nature or social or psychological (motivations, social structures, images, etc.). Considering the questions we are posing, we may refer to these entities, i.e. to those actors – incl. ‘actants’ (Latour 1987) – that play a role in the process of knowledge production.<sup>20</sup>

*Boundary objects* and *standardised packages* may also play a crucial role when we will model knowledge production and organisational learning on the basis of empirical data. Most often, abstract models like those in economics are of no use to management studies. Being depended on stochastic averages and a simple idea of man (e.g. homo oeconomicus) could have fatal consequences for management action that would rely on such models.<sup>21</sup> Hence, models that are to be used in management studies must be guided by less abstraction and close to the observable ‘reality’. In order to get some anchor points that serve as generalised entities of a model of knowledge production and organisational learning, empirical research of *boundary objects* and *standardised packages* followed by careful generalisations may be a promising way. There are many theories of knowledge management and organisational learning from which such empirically grounded models may depart, for example, the dynamic knowledge management models by Pawlowsky (1994; 2001) and Probst et al. (1999).

## 4.2 Multi-Perspectivism and the Division of Labour

A careful reconstruction of knowledge production leads us in each case to *boundary objects* and *standardised packages*. Those objects are addressed by many actors of the organisation, or Social World/ Arena respectively, from many different perspectives for many different purposes – in fact from as many perspectives, and for as many purposes as there are actors involved.<sup>22</sup> Each of those actors has got an own frame of experience, skills and motivation (Tsoukas 1996). The knowledge domain of a Social World, however, shows some similarities, because it is somewhat an aggregation of individuals with a common set of orientation, skills, etc. It is the task of management to activate capabilities and incentives towards the overall aim of the organisation; and it is the task of strategic man-

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<sup>20</sup> Boundary objects are, of course, ‘constructions’ by the observers in particular *situations*, cf. Bloor’s postulations of ‘symmetry’ and ‘reflexivity’ towards research in Science Studies (Bloor 1976).

<sup>21</sup> An issue that gets increasing awareness in classic economics, too.

<sup>22</sup> Actor-network theoreticians (e.g. Latour 1987) would insist that the perspectives are as many as there are “actants” involved, which embraces non-human activity, too.

agement to leave boundaries of the Social World existent where important expertises could get lost.<sup>23</sup>

Speaking about a knowing organisation does not mean that everybody needs to know everything. The ability to reflect everything that is going on in the firm may even harm such an organisation. In this respect, we may think of cultural traditions. In many settings deuterio learning (Argyris and Schön 1996) throughout the whole organisation may rather harm the organisational progress than help, because in many settings the cultural background can be seen as an asset; and it is a genuine feature of culture that it is not reflected by its members. One strategic means by using *boundary objects* is to identify when it is necessary to switch to double-loop or deuterio learning, and, more importantly in our context, to identify situations when this is not necessary or even counter productive. Operational tasks within a firm remain in the frame of division of work, even if they happen in a very knowledge intensive business. Even if those reflections of members of an organisation are welcomed or even demanded by management, the crucial factor of time often does not allow for extensive reflections during everyday work. Apart from this issue we just need to think of the distribution costs of a certain kind of information and inducing knowledge acquisition throughout the organisation.

The most decisive counter argument against a firm as a large homogenous community of practice is that once acquired expertise may even vanish. We should remember that division of labour as specialisation and the formation of heterogeneous skills is the prerequisite of industrialisation, modern bureaucracy, and of modern life itself.<sup>24</sup> If we decide that there should exist similar implicit knowledge like skills, tradition, etc. throughout the organisation (and in larger aggregations) we decide that there will be a loss of certain other implicit knowledge (Hedberg 1981). The decision what is to be unlearned is, first, a precarious one and, second, very often not influenceable. Problem solving within organisations is a highly heterogeneous endeavour, grounding on the division of labour. It is probably only the tip of the iceberg to which management refers to in everyday controlling action. All those everyday micro-activities that are not obviously observable and controllable, in sum are crucial for the progress of the organisation. The process of knowledge creation itself is a process by division of labour. Each party involved in this process has got expert skills and ought to use them. Some parties learn during this process, others do not, or do so only marginally (e.g. the Californian voluntary collectors and trappers). However, what would be the benefit of trappers learning something about the funding of a museum, or about Darwinian evolution? Therefore, it is not the aim of a knowledge creation process that each party profits equally from this learning process.

Most often, managing towards multi-perspectivism holds that it is decisive to make the most of the expertises that are on hand. This kind of management concerns rather with the control of the surrounding conditions (Willke 1998). We may speak of implementing inter-

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<sup>23</sup> Of course, most of management's daily tasks do not need following such strategic assumptions. Carlile (2002; 2004) shows how boundary objects can be used in mutual product development.

<sup>24</sup> Cf. the assumptions of evolutionary economics (Nelson and Winter 1982; Nelson 1995).

ests and motivations of very heterogeneous types which can be traced back from experience that is informed by the observed objectivations (boundary objects). We may also speak of being aware that technical and organisational tools and programmes (boundary objects as standardised packages) have very different meanings to different parties and that these tools must serve the needs of multi-perspective usage. Only recently, Yanow (2004) has shown how local knowledge is being neglected or even disparaged in favour of explicit expertise from outside – for the disadvantage of the organisations. Managerial action failed in that management was not able to adapt to the needs of the local working conditions due to reliance to knowledge as “made up of detached, universal, generalizable facts that can be known objectively, absent the context of their origin” (2004: S18).

Hence, being aware of multi-perspectivism means being aware of a *boundary object's* different ontological states for different actors (like *California* as symbol, workplace, resource, etc.). So it is important to be able to reflect some phenomena (within the organisation as well as crossing the organisation's formal border) in many different lights and to develop strategies along these reflections. Strategies may be planned with the involvement of objects into the overall aim of the organisation. Different parties ought to join with the object in a manner that goes along with their own background as well as with the overall aim of the organisation. This means that these parties do not necessarily share the overarching aim but some intermediate structural orientations, e.g. that shared identity does not need to be constructed to the entire organisation but to carefully selected divisions only. It also means that knowledge production extends the boundary of a firm. Boundary work in this respect means “cooperation without consensus” (Strübing 2005: 252). Consequently, *boundary objects* and *standardised packages* do not just exist as a “distributed knowledge system” (Tsoukas 1996) within a firm. Rather, they even may enlarge knowledge as a resource in that they enable external expertise *for the sake of* the firm.

## 5 Conclusion

Competitive advantage of firms in a comparable environment (e.g. a business sector) is one of the big research challenges which have puzzled management scholars for the last two decades. Knowledge plays a crucial role in these theories. This paper suggested looking closely to the *production process* of knowledge in and around organisations. Qualitative research enables deconstructing the notion of collective knowledge.

Collective knowledge does not mean that there must exist a single knowledge base of an organisation. There does not even need to be a single base for cooperation. Rather, there are structures of the organisation that are involved in knowledge producing processes. Collective knowledge in organisations inhere not only epistemic entities but some intermediate manifestations of knowledge production, too.

With thorough reference to *boundary objects* as intermediate manifestations, cooperating without consensus in knowledge production is possible. Many allies in the game have diverse orientations. In fact, these allies do seldom follow the objectives of the organisation.

Nevertheless, these allies cooperate as long as we get an idea about where we can get their basis for collaboration. These are exactly the *boundary objects*. The task of knowledge management lies in the activation of such focal points, and it is the task of qualitative social research to uncover them as they are not obviously observable.

One sort of boundary objects serve as *standardised packages* in that they serve as mediators for ‘translation’ of meaning in the process of knowledge production. The participants of the knowledge production process have got individual skills that derive to a great extent from the surroundings they have been socialising from, and this make them experts of the organisation. Groups of individuals (Social Worlds) possess skills that are fairly similar and make them expert groups. It would be fatal to destroy these expertises for the sake of a homogeneous knowledge base at all costs.

This informs us that division of labour is still a crucial issue, even with knowledge intensive endeavours. We just need to extend this view by referring to worldwide cultural diversity in order to get an idea about the weight of this argument in terms of macroeconomics. If we assume that, first, producing knowledge causes costs in terms of money and time, and, second, newly acquired knowledge bases are to a certain extent substituting existing ones, it would probably be useful to test David Ricardo’s theory about *comparative advantage* with respect to a global division of knowledge assets.

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