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Artefact Science vs. Practice Science: Seeking Information Systems Identity

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Abstract
This paper addresses the important paradigmatic issue of how to conceive the science of information systems (IS). It investigates especially the relations between IS science and its empirical fields (development and usage of information systems). One possible view of IS science is reviewed; an artefact science view. With inspiration from and critique of this view another view is articulated: Information systems as a science of the practical. Elements of this IS science view are outlined. This is made through exploring the practice concept. The character of IS practices as complex, multi-facetted phenomena are described. Ten paradigmatic principles for a practice oriented IS science are proposed. Central in the practice view of IS science is its ability to contribute to improvements of IS practices. This is especially clarified through formulating knowledge interests for an IS science of the practical.

Keywords: IS paradigm, practice science, artefact, IS ontology, IS epistemology.

1 Introduction

The search for appropriate meta-scientific grounds for information systems (IS), as a research area, has proceeded for quite some time. The positivistic mainstream IS research has been challenged from many positions. Many different arguments have been espoused for alternative ways of carrying out IS research in order to avoid the constraints of positivism and scientism. Several different perspectives and frameworks have been put forth as alternatives to traditional scientism in IS research[1]. There are alternatives like hermeneutics and interpretivism (e.g. Boland, 1991; Walsham, 1995), phenomenology (e.g. Boland, 1985; Rathswohl, 1991), critical social theory (e.g. Lyytinen & Klein, 1985; Ngwenyama, 1991; Cecez-Kecmanovic, 2001) and ethnography (e.g. Myers, 1997; Schultze, 2001). These claims for non-scientistic paradigms are usually accompanied by claims for qualitative research methods. Important compilations of articles engaged in this kind of criticism of scientistic IS research are Mumford et al (1985), Nissen et al (1991), Lee et al (1997), Trauth (2001) and Myers & Avison (2002) which involve both discussions, concrete proposals and examples of research.

Even if alternatives to scientistic IS research seem to be well established now, there are still many research issues to consider in this kind of paradigm shift (Kuhn, 1970). The basic view upon the science in question is one important issue to reflect upon. Within such a view comes also the question of the relation between the science and its empirical domain. The important queries to raise in this respect are: How shall we view IS as a research area? How shall we view IS as a science? How shall we view IS science in relation to the empirical field of developing and using information systems?

There are suggestions for such a basic view on IS science. The purpose of this paper is to investigate possible IS science views. Two views will be investigated which will be called artefact science and practice science; or science of the artificial vs science of the practical. I

[1] Confer Klein & Lyytinen (1985) for a good description of what a scientistic approach means in general and also for the IS area.

will start the paper with a study of the artefact science view. I will investigate merits and shortcomings of this view as a basis for articulating the view of IS as a practice science. The main part of the paper is an elaboration of the practice view. A science of the practical is proposed as an adequate paradigm for the information systems discipline. A practice science is an articulation of a pragmatic science view (e.g. Dewey, 1938; Argyris et al, 1985; Wicks & Freeman, 1998; Fishman, 1999; Cronen, 2001).

2 Information systems as an artefact science?

In the search for an appropriate basis for IS research, several scholars have suggested IS to be considered an artefact science. Two well-known papers take this position: Orlikowski & Iacono (2001) and Benbasat & Zmud (2003). These papers have given rise to an intensive debate. Many scholars have criticized those positions taken; e.g. Alter (2003) and Galliers (2003). Another scholar arguing for an artefact science position is Dahlbom (2002). He bases his argumentations on the famous book by Herbert Simon (1969); "The sciences of the artificial". Simon (1969) has criticized the natural science assumptions behind many new sciences. In many engineering sciences and social sciences, one does not study a given nature. Rather, one studies an artificially made reality. Simon argues that the interest should be towards the design of artefacts. Such sciences can be labelled design sciences or artificial sciences. In an analysis of Simon's ideas and program for artificial science, Dahlbom (2002) has been both appreciative and critical. The basic view of acknowledging the artificial character of modern society is pointed out by Dahlbom. He does, however, not find the methodological consequences formulated by Simon as radical enough. Dahlbom tries to formulate a program for artificial science, and this program seems valid for both IS and many other sciences (both social sciences and engineering sciences). I will do this investigation because Dahlbom's proposal is challenging and important for IS as science. This investigation will also be a basis for my own proposal for a science of the practical.

2.1 Examining principles for an artefact science

Dahlbom (ibid) has formulated eight foundational characteristics for an artefact science. These are formulated in a rather slogan-like manner, but they have been further explained. I will go through these principles and theses of an artefact science and comment upon them. One main problem with Dahlbom's theses is that it is not always clear whether he speaks about artefact science or the engineering artefact practice. To state this with a philosophical language it is not always clear when he discusses epistemological issues (i.e. knowledge of the artefact science) or ontological issues (i.e. character of the empirical artificial world). Here follow the theses and my comments upon them:

1. Artefacts are designed rather than described

In the formulation of this thesis, Dahlbom makes a contrast between design and description. I have problems agreeing with such a contrast since any god engineering and design practice involves description of the artefact. If we look at IS development, different models are often produced during the design process. Many artefacts (like for example many information systems) are such complex products, that it is necessary for humans to be supported by models during the design process.

In his text, Dahlbom refers to artefact science activities in the following manner[2]: "To say that artificial science is a design science is to say that there we study possibilities rather than restricting ourselves to the already realized, and that it is our ambition to construct rather than describe, understand, or explain" (ibid p 22). I think there is a good point in stating that an

[2] This passage is, to me, an example of the sliding between artefact science and engineering practice.

artefact science (being a design science) has an explicit interest in studying the possibilities and what is not already realized, i.e. a knowledge interest in *what might be*. I do not, however, see the point of ruling out an interest in *what there is*, that is the already made design and the pragmatic consequences of this. In order to improve (i.e. to redesign), it is usually appropriate to first understand (by describing and explaining) what there is.

2. Technology in use rather than design practice
Dahlbom states that in artefact science "it will be important to learn about the technology as it looks from the user's end" (ibid p 23). I fully agree with this. However, the principle is once again formulated as an unnecessary contrast. I conceive it very important in an artefact science to study (and also to influence) the design practice. It is necessary to understand and improve the design practice[3] in order to improve technology in use. I think that the interaction between design and usage shapes the core of IS science. The significance of Dahlbom's thesis is to recognise the quality-in-use perspective as a basis for the improvement of design practice.

3. Artefacts have quality rather than functionality
Dahlbom tries to make a distinction between artefact quality and artefact functionality. He argues for other important qualities besides functionality, as e.g. aesthetics and symbolism. The main functions of an IS to receive, process, store, transfer and present information can, however, according to my opinion, definitely not be neglected. Information systems are built in order to fulfil such functions. I would rather rephrase Dahlbom's thesis in the following way: Functionality is often a main part of artefact quality. If no functionality, then no quality.

4. Artificial science is normative rather than objective
Dahlbom has a strong ontological claim concerning the artificial world that it "is suffused by values" (ibid p 24). If one creates an artefact or if one uses an artefact, this is done in order to create differences. And intentional differences in the world are, by definition, valued differences, so I fully agree with Dahlbom's strong claim. We cannot, in a science of the artificial, escape from values. This does not mean, however, that we as researchers, need to have a strong normative orientation all the time. A good reconstructive understanding of different realized values in the artificial world does not entail that we as researchers must take a normative stance.

5. Artefacts are accidental rather than essential
Dahlbom emphasises the local design solutions of artefacts in contrast to abstract universal principles. He claims that "the sciences of the artificial ought to make a virtue of this lack of generality" (ibid p 26). I think that Dahlbom is too pessimistic and defensive about generality or as I would prefer to state it, *validity beyond the local*. The design and usage of technology is contextually bound. Here I follow Dahlbom. However, there are possibilities of making use of a particular artefact in different contexts, although adapted to varying specific properties of the contexts. In order to *transfer* and make use of *artefact knowledge*, researchers need to strive for abstraction, essentiality and generality. This kind of generality[4], in the social and artificial world, is of another character than the generality described in natural sciences.

[3] It is also hard to see that this second principle (with its downplaying of design practice) really is congruent with the first principle where Dahlbom argues for an "ambition to construct", that is, in my interpretation, a claim for design practice!

[4] Yin (1989) makes an important distinction between statistical generality and analytic generality when discussing the use of case studies in social science studies. The concept of analytic generality is the most

6. Artefacts are constructed rather than documented
This principle of Dahlbom seems to be almost equivalent to his principle 1. Consequently, my comments on that principle are also valid here. Dahlbom writes in relation to the principle 6 that "engineers often take lightly the demand for documentation for the obvious reason that documentation plays a secondary role in engineering, and so can be taken more lightly" (ibid p 27). I do think that Dahlbom is in error here. Engineers (as constructors of artefacts) usually employ sketches, drawings, models and other aids for visualisation in the design process. Documentation is not taken lightly and is not given a secondary role. Signifying artefacts is usually very important, both during design and usage.

7. Artificial science has heuristics rather than methods
Here is another unnecessary contrast by Dahlbom. He states that "heuristic rules of thumb, intuition and tacit knowledge, experience and tinkering, and plain common sense will be more openly accepted in engineering" (ibid). I have no problem in acknowledging the need for and the use of tacit knowledge etc. in both artificial science and engineering practice[5]. This does not, however, rule out the need and possibility to use more systematic methods in certain situations. This counts both for science and engineering activities.
Dahlbom says in connection to this: "The artificial world is haphazard, accident prone, collection of artefacts. The artificial world is not ordered" (ibid p 28). This provocative formulation is to me an exaggeration. An organisation, as an artificial world, will of course have ordered streaks; otherwise it could not be able, in any reliable way, to make any products for its customers. Human work and artefacts must be ordered and coordinated if they are to function together, but this does not mean a totally mechanistic order. To say that an artificial world (of humans and artefacts) is a partially ordered world, does not disregard that misfits, inadequate arrangements and accidents occur now and then. A (design of a) technical artefact must be seen as a limited ordered part of the world. Artefacts must be ordered if they should function in accordance with our intentions and thus if we want to use them with a sufficient degree of reliability for purposive actions. Following the arguments of Collins & Kusch (1998), one could claim that the very idea of a machine artefact (like an IS) is to produce determinate, controlled and reliable behaviour.

8. Artificial science is engaged rather than disinterested
Dahlbom criticizes the common scientific attitude of objective detachment. He says that one of the aims of artificial science is to restore the interactive engagement between man and his artificial and natural environment. Since the artificial world is suffused by values (see principle 4 above), our interest in it cannot be value-free. With inspiration from Dahlbom, I would like to state that the basic attitude of a researcher should be the improvement of the artificial world. There are, however, situations where researchers should keep a distance to the world in order to establish an adequate understanding and critical evaluation.

2.2 Intermediate conclusions

Should we define information systems as an artefact science? Is it a science of the artificial? It is not to be disputed that information systems are artificially made phenomena. They are designed in order to serve different human purposes. In this sense, IS science is a study of artefacts. This does not entail that we should use "artificial science" or "artefact science" as the main characterizing feature of this science. I can see possible limitations with such a

appropriate one to use in artefact sciences. Analytic generality helps to transfer knowledge (through abstraction) between local contexts.
[5] Once more Dahlbom is sliding between artificial science and engineering practice.

characterisation. There might be an unintended delimitation away from the human and social work context, when the artefact is emphasised. The human actions of design and usage of IT artefact are central to IS science and they should be fully acknowledged.
Figure 1 tries to illustrate the action dialectic relationship between humans and IT artefacts as a basic paradigmatic position for IS science. Humans create information systems as IT artefacts through design actions. Humans perform "informational" actions when using these IT artefacts. It is important to recognise that the continual usage of an IS, will change its contents. New information is added to the IS; old information may be changed or even deleted. My claim is that *humans, actions and artefacts* form the field of study for IS science. I would like to claim that this triad is in principle irreducible. Of course it might be possible in a research study to have a restricted focus on one of these parts of the triad, for example the IT artefact. But as researchers we should not forget that these artefacts are designed through humans' actions and that they are continually changed through humans' usage actions. This is a necessary contextual knowledge for a limited focused IT artefact study.

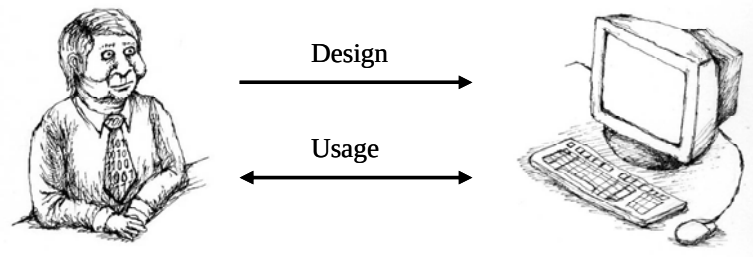

Figure 1 Action relations between humans and IT artefacts

I have posed the question "is IS an artefact science?". My answer is: Yes, it is an artefact science, but not only! There is more to it. Artefacts are parts of a whole, which is what shapes the field of IS science. How shall we denominate and characterize this whole? The rest of this paper should be seen as an answer to this question. I will call this whole "practice", and thus I will call IS a practice science or a science of the practical.

3 The practice notion

Blumer (1969) argues that the action notion should be central to social sciences: "The essence of society lies in an ongoing process of action - not in a posited structure of relations. Without action, any structure of relations between people is meaningless. To be understood, a society must be seen and grasped in terms of the action that comprises it" (ibid p 71).
Action perspectives in social sciences involve often a scepticism towards macro concepts of holistic character. The significance of human action is emphasised. There has been a long battle between micro and macro perspectives in social science (e.g. Cuff & Payne, 1979), where action theorists are usually on the micro side. Macro perspectives emphasize the use of systemic and supraindividual concepts. Micro perspectives emphasize the use of individually related concepts. This long battle can be seen as a struggle between holism and atomism. The micro advocates argue for founding scientific reasoning in "atomic building blocks" of human action. They are accusing macro researchers for using reifying concepts; the human actors and their actions are lost and the used concepts are too abstract and thus unintelligible. The macro advocates argue for a holistic approach with societal forces and functions of systemic character. They accuse the micro researchers for a narrow detailed focus without contextual understanding.
The practice notion can be seen to be a dialectical answer to this micro – macro battle. Practice is a holistic concept, but at the same time a pragmatic concept with clear relations to micro components of human action. A practice is a web of actions that are related and

combined in a meaningful way. There is a growing attention in social science towards the concept of a practice; cf e.g. Giddens (1984), Schatzki (1996), Scollon (2001), Reckwitz (2002). Schatzki et al (2001) speak about a 'practice turn in contemporary theory'. There are IS researchers which have adopted the practice notion in their research (e.g. Wynn, 1991; Suchman & Trigg, 1991; Orlikowski, 2000; Clarke, 2003; Goldkuhl & Röstlinger, 2006). One can also consider the use of the activity notion within the tradition of activity theory (e.g. Nardi, 1996) as a similar conceptual approach. Confer also the work systems approach by Alter (2002).

Schatzki (2001 p 2) defines a practice as "embodied, materially mediated arrays of human activity centrally organized around shared practical understanding". A practice is a wholeness consisting of combined and related actions. Human actions are performed within a practice and determined by the practice which they are part of. This means that a practice determines which actions are adequate within that practice; i.e. what actions count as enactments of the practice. A practice does not only consist of actions. It consists of humans performing actions and different artefacts used or produced within the practice. A practice is thus a meaningful wholeness built up by such different pragmatic constituents. It is based on the irreducible triad (human - action - artefact).

4 The character of information systems practices

Information systems are developed and used. Humans stand in two fundamental relations to the artefacts of information systems: A design relation and a usage relation (figure 1). These relations are constituting the two main typical practices we can talk about as a meaningful empirical field for a IS science:

- IS development practice
- IS usage practice

In this section I will make a characterization of these two practices. This means that I will present some ontological assumptions. This will however not be done without epistemological and methodological considerations. What I mean is that I will make ontological characterisations, having in mind that these features of reality will have impact on what kind of knowledge is possible and on the ways we can obtain such knowledge.

IS practices are *complex* fields of reality. There are *diverse* phenomena in these fields. The phenomena are of technical, human, linguistic, social and organisational character. These *aspects* are often *intertwined* and this is important; I will come back to this later. IS practices show a great *variety*. They are not performed in the same way in their different instances. There are of course similarities, but there are also great differences and variations. There are *continuous innovation and development* within the field, not only dependent on constant *technical changes*. There are also organisational and informational innovations occurring (Mustonen-Ollila & Lyytinen, 2003). There is a high *change speed*. As an inquirer it is hard to keep the pace with what is happening in the practices of IS. These practices are however not independent of what goes on within IS science. There may be *intentional and accidental influences* on IS practice coming *from research*.

IS practices are an *already meaningful field*. The natural scientist imposes an external logic and meaning on the matter he studies. The social and artificial world involves already an *internal logic* with associated meanings. This hermeneutic insight has been expressed by many scholars; e.g. Silverman (1970) makes such a distinction between external and internal logic. This means that an IS researchers does not study plain matter. He inquires into a world full of meanings while studying humans and their interaction with their artificial environment. There are meanings to detect, reconstruct and interpret. This is a challenging task since many social expressions have *ambiguous, subtle and obscure meanings*. Many actions and expressions are also intentionally *multi-functional*. This implies that they carry multiple

meanings. Many of these meanings incorporate values. As Dahlbom (2002) has stated, IS practices are *suffused by values*. Many *values* may be *in conflict* with each other.
The difference between external and internal logic, mentioned above, also entail that an inquirer cannot presuppose the same action rationality among those inquired as he adopts himself. Among the practitioners studied, there may be *varying subjective and inter-subjective rationalities* working.
IS practices include not only humans and their relations. *Material and symbolic objects* (artefacts) play decisive roles. These artefacts are used for action and interaction. The features of these artefacts *afford* different *actions*, which mean that they have both *enabling and constraining powers* (Gibson, 1979; Wertsch, 1998).
One important character of IS practices mentioned above was rapid change. This is however not the whole picture. IS practices work, as nearly all human practices, in a *tension between stability and change*. Certain rules and artefacts are created by humans as a change of practices. These rules and artefacts can then become part of social institutions and structures (Berger & Luckmann, 1967; Giddens, 1984) and thus giving stability and social order. IT artefacts have certain faculties – due to their hardware and software features – to freeze routines and give a high sustainability of communication patterns. IS practices should be understood in terms of *creation, compliance and violation of rules and institutions*.
IS practices are often embedded in organisational contexts. This means that such organisational aspects as *agency* and *division of responsibility and labour* are important characteristics. The use a formalised IT artefact in a partially informal environment is another distinct feature: The meeting between the *formal* and the *informal*.
The two main IS practice types are, as said, IS development and IS usage. The *alternation and dialectics between design and usage* is an important character of the empirical field. It is important to recognize that design implies *intended planned effects*. It is usually not possible to foresee all effects and use-situations during design. There is normally a great element of *uncertainty* in design besides its planning character. There are often *unintended effects* of IT usage and to manage the use of an artefact with a restricted and pre-defined functionality, there may be a need for *tinkering* (Dahlbom, 2002).
The meaningful character of IS practices makes it important with understanding and interpretation. This does, however, not rule out explanations. On the contrary; different types of explanations are necessary elements in a knowledge of IS practices. This is the case since such practices are full of forces, influences and effects. There are things occurring in the IS practices, and researchers and practitioners are often interested in how and why these things come about. There is an interest to explain "cause" and "effect". The original meanings of the cause notion were broad. Aristotle used four different cause concepts (in his "Metaphysics"), designating different preconditions (principles) explaining why an effect comes into existence. The scholastic philosophers expanded the four causes of Aristotle into 13 different types of causes. However, the use of the cause notion since David Hume has often been associated with a restricted and deterministic view of the relation between cause and effect. This is often not considered consistent with the "soft" characters of social practices. To avoid these connotations I will instead talk about conditions and effects, and relations between preconditions and effects I will call influences. It is of course possible to use the cause concept with a broad general meaning in accordance with established definitions as "something that brings about an effect or a result" (Merriam-Webster's Online Dictionary; www.m-w.com). I will however avoid using the cause concept, since I know that many social scientists are very sceptic and hesitant concerning its use in social settings. As said above, I will talk about conditions, influences and effects.
The relation between condition and effect in social settings are often of meaning character. The influence relation is a case of *signification*. There is not a matter of pure material forces.

The relation between condition and effect works through processes of signification. Expression and interpretation of meaning occur as parts of these influences. People act on the basis of meanings they assign to their environment (Mead, 1938; Blumer, 1969). *Social influence is meaning influence.*

The influences in social practices (like IS practices) are *multi-facetted*. Besides, this basic signification character, there are other important features. There may often be *many influencing conditions*. Some of these may be *not apparent*, but rather tacit or concealed during efficacy. A particular collection of conditions may not lead to just one effect, but sometimes to *several effects*, and where some effects are not apparent. The deterministic causality from many natural science studies must be modulated in social settings. It is, in such settings, rather exceptional with deterministic influence relation. Instead there might be a variation in the *modalities of influences*. Besides necessary conditions for obtaining certain effects, there might be conditions with other modalities as enabling, facilitating, obstructing and preventing conditions. The effects obtained can also be associated with modalities. An effect can appear as necessary, possible or impossible (Goldkuhl, 1979).

To complicate the picture of IS practices even more I want to add two more important features: Multi-character of phenomena and multi-existence of phenomena. A screen document (of the user-interface of an IT system) is a typical example of a *multi-character phenomenon* (a multi-faceted phenomenon). Its existence is dependent on the technical-material features of the computer equipment. It is thus obvious to characterize the screen document as a *technical* phenomenon. The contents of the screen document may be a written text and it is thus at the same time a *linguistic* phenomenon. It is the result of a computer formal manipulation of symbols according to its program. Being a result of a computer execution we can consider it being a *formal* object. The screen document is to be interpreted by a user, while it is a representation of some knowledge. We can call it a *cognitive* object, although it is of course not knowledge per se. What is on the screen can, at least partially, be something communicated from one or several persons to the actual person. The message within the screen document is a *social* phenomenon. This communication may be performed in an organisational setting, which makes it appropriate to denote it as an *organisational* phenomenon. The screen document is also a result of a design process, and we can call it a *design* object. To conclude, many phenomena within IS practices can be viewed from multiple perspectives and it might be risky to exclude some perspective when one tries to establish an understanding of it.

Many phenomena within IS practices are examples of *multi-existing phenomena* (Goldkuhl, 2002). For example information systems development (ISD) methods exist at the same time in several realms of the world. In order to be used as support and guidance in the ISD process, methods must exist as *knowledge* of ISD actors. The *intra-subjective* method knowledge of different ISD actors needs to be shared (i.e to be *inter-subjective* to some degree), in order to obtain a convergent and coordinated method use in the development process. Methods exist also, often, in method manuals; i.e. they exist as written prescriptions in a *linguistic* realm. They can also be implemented into CASE tools, and thus they exist in a *technical-material* realm. When practised, methods exist as exerted in *human actions*, and consequences of such actions can be found in documentation and the IT artefact itself. This means that traces of method usage can be found on a *consequential* level.

This principle of multi-existence may be both a source of problem and a source of assistance for an IS researcher. There may be variations between the different instantiations of a multi-existing phenomenon (as e.g. a method). This can be confusing and the phenomenon under scrutiny can be conceived as fluctuating and elusive. There is a need for the researcher to fully recognize this multi-existence of many IS-related phenomena. When doing this, he can accept that there may be differences and tensions within different existence forms of a phenomenon.

He can intentionally adopt a triangulation strategy when inquiring a phenomenon within its different realms.

5 Information systems as a practice science

5.1 Three related practices

IS science is, in this paper, argued to be a science of the practical; i.e. a science concerning the practices of IS. Being a practice science, it is a science concerned with actions and artefacts within such practices. The formulation "a practice science" means that it is a science about a practice and with relations to such practices. The practice view adopted means, however also, that IS science is a practice of its own. We can thus talk about three related practices (figure 2):

- IS development practice
- IS usage practice
- IS research practice

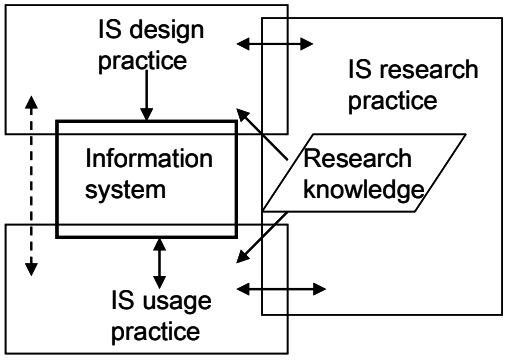

Figure 2 Three related practices

There are bi-directional relations between the research practices and the two empirical practices. The main result from the research practice (scientific knowledge) is generated based on observations (data) of the empirical practices. Sources of research knowledge come thus from development and usage of IS. This research knowledge is however a basis for change in the empirical practices. Knowledge is developed by the research practice in the service of the IS practices of development and usage.

5.2 Proposing principles for a practice science

To make the view of a science of the practical more clear, I will now formulate some principles for such a science based on my analysis of the character of practices (section 3 above) and IS practices (section 4 above). These 10 paradigmatic principles concern ontological, epistemological and methodological issues. To a large degree they are dealing with the relations between IS practices and IS research. To formulate these principles means articulation of a pragmatic and practical science view. There are other steps taken towards articulation of a pragmatic view of IS science; e.g. Goles & Hirschheim (2000), Mathiassen (2002), Baskerville & Myers, (2004), Goldkuhl (2004; 2005; 2007; 2008).

1. Information systems are shaped by alternations between design and usage.
Information systems are produced and used. The basic action repertoire of an IS is created through design. Information systems are changed by continuous usage and by redesign. The quality of an IS arises from the human use of this artefact and is also dependent on what this artefact affords and the competence and interests of the users.

2. Information systems need to be understood as elements of social practices.
Information systems are not isolated phenomena. They are parts of social practices and need to be understood against the background of such practices. IS are "atoms" and practices are wholes. An information system is contextual phenomena, since it is only meaningful in relation to its social and practical context.

3. IS practices are constituted by humans and their purposive, value-driven and institutionalized interaction through communication and artefact usage.
The triad actor-action-artefact is fundamental for constituting a social practice. The social interaction, which takes place within such practices, is governed and coordinated by stabilized and continuously changing institutions (Berger & Luckmann, 1967; Scott, 1995). It is also influenced by breakdowns, learning and innovation (Winograd & Flores, 1986). In such social practices, there is continual tension between 1) a habitual and taken-for-granted existence and 2) a strive for change and betterment.

4. The complexity, multi-character, multi-existence, variety and change of IS practices requires closeness to such practices for inquiries.
The character of IS practices makes it hard to study them at distance. They are complex in many ways which demands disclosure instead of superficial descriptions. To obtain valid knowledge calls for in-depth, qualitative and interpretive studies. Good access to empirical data requires active presence of the researcher in the inquired practice (Gummesson, 1991). Closeness is also a precondition for addressing issues that are relevant to practice (Keen, 1991).

5. Much knowledge about IS practices is not possible to obtain without participating in change.
In many situations one must change the world in order to get knowledge about it. The researcher needs to be active in change situations in order to explore the meaning of a particular class of changes. This calls for a joint practical intervention together with practitioners. Practice research is often, but not always, action research (Mathiassen, 2002; Baskerville & Myers, 2004; Davison et al, 2004; Goldkuhl, 2007; 2008). Knowledge concerning the possible often requires participation in change. One must make real what is thought of as a possibility in order to see if it can be realised and the potential consequences of it.

6. The societal value of IS science lies within its possibilities to improve IS practices.
Why should we bother about having IS research? It gets its legitimacy from being a servant to practice. The ultimate goal of IS science is to contribute to the improvement of IS practices (Goldkuhl, 2007; 2008). It does so through the generation of knowledge and its dissemination to students and practitioners. Science of the practical should make a difference (Dewey, 1931; Cronen, 2001). Being a servant does however not exclude being critical. Critique is a basis for improvement[6] (Argyris et al, 1985).

7. IS practices are artificially shaped worlds, which may be changed by action and knowledge of practitioners and researchers.
IS research may have and should have an impact on IS practices. IS researchers are through their research, both in direct contact with practices in empirical studies and through

[6] Confer also discussion about knowledge interests in section 5.3 below.

presentation of theorized and abstracted knowledge, participating in potential changes of the world. The dialectics of knowledge and action need to be fully considered (Dewey, 1931): Proper action is knowledgeable action. Proper knowledge is actable knowledge (Goldkuhl, 2004).

8. Knowledge about particular IS practices can, through abstraction, be transferred to useful knowledge for other practices
Scientific IS knowledge cannot be pure idiographic, i.e. concerned with single cases, even if exemplary cases can be inspiring for change in other situations. In order to get useful knowledge there is a need to abstract. Abstraction means that we create categories, principles and prescriptions, which go beyond case specific properties. Abstracted knowledge about IS practices need to be translated into actable terms in order to be transferrable and useful for practitioners. The essential role of knowledge from IS science is to be used for IS design and improvement of IS usages. IS theories need to be practical theories (Dewey, 1931; Cronen; 2001; Goldkuhl, 2007; 2008) and sometimes design theories (Walls et al, 1992; Hevner et al, 2004).

9. In order to have an impact on IS practices, researchers need to contribute to the establishment of a practitioner-researcher community of understanding.
Successful communication is always dependent on an adequate inter-subjectivity of used language and a mutual pre-understanding among participants. IS researchers, aiming at influencing IS practices, need to present their knowledge in ways that is understandable to practitioners. This is not only a case of adapting to practitioners. The ideal is rather that researchers and practitioners engage in dialogues not only for transferring knowledge but also to develop their common language (Apel, 1980).

10. A science of the practical must, as other sciences, strive for validity in knowledge based on open, rational and criticisable communication/documentation.
Scientific ideals of knowledge validity are fundamental to a science of the practical. Even if scientistic ideals of reproducibility is hard and often inadequate to fulfil, there is a strong need for making the empirical bases and the theoretical assumptions for the obtained knowledge as transparent as possible. A free and open communication between researchers and between researchers and practitioners is fundamental for a science of the practical (Habermas, 1984).

5.3 Knowledge interests of IS as a practical science

The concept of knowledge interest (Habermas, 1972) seems to be fruitful to use when discussing the relation between a science and its practice field. I will not restrict myself to the three categories introduced by Habermas (ibid), since I doubt that his formulations were made having a social practice involving design and technology use as his paradigm case. I use the concept of knowledge interest in a more free way.
Traditionally, science has a *descriptive and explanatory knowledge interest*. This is valid even in a practice science having a basic interest of improving the practice field. Descriptions and explanations may serve as an indirect basis for action and improvement. In a pre-interventive stage of an action, the actor needs to orient himself about the action environment and what action possibilities it affords (Mead, 1938; Gibson, 1979). Descriptive and explanatory knowledge can guide the actor at this stage. There are however other knowledge interests which are more adequate to talk about in a science of the practical.
A *revealing knowledge interest* is concerned with uncovering what is not apparent. ("*Look what is here!*"). Research can contribute with reconstruction and making explicit what is taken-for granted and tacit. Hidden agendas and values are brought to open reflection and

debate. This knowledge interest relates to and supports a *critical knowledge interest*. Being critical means that you question status quo. Arguments for what is not considered good are expressed. A critical and objecting stance is taken towards some parts of IS practices. ("*That is not good!*"). Research can contribute to practice through a *reflective knowledge interest*. Researchers can suggest alternative ways to view practice, new perspectives and conceptualisations. This knowledge interest may contribute to practitioners' reflection and change of perspective. ("*You can see it like this!*"). A *prescriptive knowledge interest* is even more concrete and action oriented. New strategies, methods, procedures and design solutions may be suggested by researchers. ("*You can do it like this!*"). This can be made on a general level or directed to particular practice settings. Research can also contribute with ideas about new ways to develop or exploit technology; an *innovative knowledge interest* that goes beyond common applications. ("*This is a new possibility!*"). As said above (in principle 10; section 5.2), there is a need for a language community between practitioners and researchers. This can be expressed and addressed through a *dialogical knowledge interest*. Researchers may take part in public dialogues concerning the usage of IT in companies and society. Through such a participation in public dialogues, a knowledge exchange may be established together with improved conditions and ways of communication. ("*Can we talk about this?*").

6 Concluding remarks

How shall we view information systems science? How shall we conceive the relation between IS science and its empirical domain? These are the questions I have addressed in this paper. I started my analysis by investigating one possible view on IS science; an artefact science. This view contributes with important insights, but its focus on partial aspects of the empirical field, made me turn to the holistic concept of practice. Artefact aspects are acknowledged to be fundamental in practices, and they are incorporated in the practice concept.

I have outlined elements of IS as a science of the practical. This was made through exploring

- the practice concept
- the character of IS practices
- principles for a IS science of the practical
- knowledge interests of a IS science of the practical

Defining IS as a practice science has consequences for what and how to research. Basic questions will be raised as: What do people do in the world? What values are people aiming at? Which effects arise from action? What instruments do people utilise for action? How do the properties of these instruments affect human action? How are these instruments designed? Such pragmatic issues are central for a science of the practical. There is a basic interest in knowing how the world can be different; how people can act in different ways to shape a different world. This means that an IS science is one partner in such a pragmatic attitude and approach. IS research can contribute through valid pragmatic knowledge for an informed change and development of the practice world of information systems.

IS as a science of the practical means 1) research about the practical affairs of IS (referential pragmatism) and 2) research creating knowledge in the interest of improving IS practices (functional pragmatism).

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