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Epistemological Perspectives on Design Science in IS Research

Björn Niehaves
European Research Center

Jörg Becker
European Research Center

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Björn Niehaves
European Research Center
for Information Systems (ERCIS)
Leonardo-Campus 3, 48149 Muenster, Germany
bjni@wi.uni-muenster.de

Jörg Becker
European Research Center
for Information Systems (ERCIS)
Leonardo-Campus 3, 48149 Muenster, Germany
becker@ercis.de

ABSTRACT

Design science is an established approach in IS research and the literature provides us with a fruitful discussion on its basic concepts, for instance, the IS research cycle (Hevner, March, Park and Sudha 2004), IT artifacts (Orlikowski and Iacono 2001; Weber 2003), or design theories (Markus, Majchrzak and Gasser 2002; Walls, Widmeyer and El Sawy 1992). However, many authors advocating the stance of design science often neglect the influence of basic philosophical and epistemological issues on design science. "The major emphasis of such debates [on positivism and interpretivism] lies in the epistemologies of research, the underlying assumption being that of natural sciences[, not of design science]." (Hevner et al. 2004, p. 98) Here, design science is often, to our understanding incorrectly, advocated as a third paradigm that adds up to positivism and interpretivism (Hevner et al. 2004; Vaishnavi and Kuechler 2006). However, also design scientists seek to conduct *research* and to evaluate their research results. At this juncture, we argue that the understanding of such concepts as 'research rigour', 'research validity' and also 'research quality' heavily depends on the underlying epistemological understanding, also in design science! In order to demonstrate and operationalize our argument, we will analyse Hevner et al.'s guidelines for design science in IS research (2004) taking an interpretivist perspective informed by Klein & Myers's set of principles for conducting and evaluating interpretive field studies (1999). As a result, we will epistemologically reformulate the existing design science research guidelines and provide a basic outline for an interpretivist perspective on them.

Keywords

Epistemology, Philosophy, Design Science, Research Evaluation.

A PROBLEM-ORIENTED INTRODUCTION

An integrated analysis of philosophy, especially epistemology, and design science is vital to IS research and can contribute to solving crucial problems that the IS discipline is facing. In information systems (IS) research, major problems are discussed in the literature, often regarded as crucial for the identity and existence of the IS discipline itself (Benbasat and Zmud 2003). For example, Lee (2000) summarises and describes major dilemmas that the IS discipline is confronted with as follows:

- *Rigour vs. relevance*. The rigour vs. relevance debate had strong impact on the discourse in the discipline and is a long way from being solved (see Applegate and King 1999; Beachboard 2002; Benbasat and Zmud 1999; Benbasat et al. 2003; Darke, Shanks and Broadbent 1998; Jani 2001; Khazanchi and Munkvold 2003; Lyytinen 1999; Markus and Davenport 1999; Zmud 1997) The angles of the dilemma can be simplified as: a) 'Rigorous research has not produced relevant outputs' versus b) 'Relevant research has not been carried out in a rigorous way' (Lee 2000). This means that, on the one hand, some researchers claim to conduct relevant research, while others argue that it lacks scientific rigour in terms of, for instance, generalisability or traceability. On the other hand, some researchers claim to conduct rigorous research, while others argue, for instance, that this research would address trivialities and the knowledge gained would be too marginal to have an impact, especially on IS practice.
- *Reference discipline vs. independent discipline.* A major issue affecting the field is the discussion, whether the IS discipline is an independent discipline or not (see, for instance, Banville and Landry 1989; Benbasat et al. 2003; Galliers 1997; Keen 1980). While referring to other disciplines as reference discipline would undercut the IS identity, however, a clear set of expectations and blueprints which would be a prerequisite for being an independent discipline is not available yet (Lee 2000). In consequence, an ongoing effort on defining the core properties of the IS discipline can be observed (Benbasat et al. 2003).

- *Technology vs. behaviour.* The discussion of technology vs. behaviour is closely connected to the discussion of IS being an independent discipline. Lee (2000) argues about the dilemma as follows: If a just technology-oriented approach would be taken, IS would be not different from the engineering or computer science discipline, a solely behavioural approach would make IS not different from other behavioural fields, such as sociology or psychology (Hevner et al. 2004; Lee 2000).

These dilemmas have strongly affected the discussion in the IS discipline. In accordance to Lee (2000) we will, however, argue that particular concepts which are already known to the IS field can very well address the problems discussed in the literature and mentioned above: ***Philosophy and socio-technical systems thinking***, on the one hand, and ***design science research***, on the other hand. Both concepts have been heavily discussed in the IS literature and are vital to the IS discipline. However, an integrated view, especially a philosophical reflection of design science research, is not yet to be found to a sufficient extent (McKay and Marshall 2005; Schön 1983). Though several efforts were made in order to theorise design science (Hevner et al. 2004; Lee 2000; March and Smith 1995; Nunamaker, Chen and Purdin 1991; Walls et al. 1992) an explicit epistemological stance has not yet been taken. At this point, there exist multiple ways of approaching the epistemological discussion of design science. One option would be to ground the argumentation deep in a particular philosophy of design (science), for instance, Churchman's (1971) inquiring systems. Another option would be to analyse the philosophical discussion, on the one hand, and the design science discussion, on the other hand, at the current state within the IS literature/discipline. Here, we will opt for the second possibility, first, in order to make one potential step of tying together some loose strings in the current IS discussion – epistemology and design science – and, second, in order to elaborate how an integrated view of these two concepts can contribute to solving crucial problems that the IS discipline faces. For that reason, we seek to address the following research question within this paper:

> *How do different epistemologies, for instance, positivism or interpretivism, shape the understanding of design science research (evaluation)?*

Consequently, we seek to answer the following sub-questions in the course of the argumentation:

- What are the basic features of major epistemologies in IS research, for instance, positivism and interpretivism, and why is an epistemological discussion compulsory when it comes to socio-technical systems thinking? (Section 2)
- What are the basic characteristics of design science research (evaluation)? (Section 3)
- Why is the discussion of epistemology relevant in design science research and how do these two concepts basically relate to each other? (Section 4)
- What are the consequences of different epistemologies, here positivism and interpretivism, for understanding and evaluation design science research? (Section 5)

Addressing our research objective, the research method chosen is that of conceptual/philosophical research, in particular that of critique (in the Kantian understanding). This research method is dedicated to identifying, scrutinizing, and questioning the presuppositions of research approaches in order to determine their scope, applicability, possibilities, and limits towards a given research objective. We will hence provide philosophical-logical arguments rather than empirical ones. However, our arguments will (where applicable) also refer to empirical research results, here, a focussed literature review (see Section 4).

SOCIO-TECHNICAL SYSTEMS THINKING AND ITS PHILOSOPHICAL DISCUSSION

System theory has long been known and applied to IS studies (see, for instance, Beer 1985; Checkland 1981; Checkland and Scholes 1990; Churchman 1971; Churchman 1979). Systems thinking foremost provides the means to identify, to render, to analyse, and (preferably) to change a phenomenon of interest, i. e., a system. The systems perspective, furthermore, allows to define systems and sub-systems as well as to analyse interrelationships between them. Here, especially the socio-technical approach emphasises that information systems comprise behavioural sub-systems, for instance, people or culture, as well as technological sub-systems, for instance, hardware or software (see Bostrom and Heinen 1977; Heller 1997; Kling 1980; Markus 1983; Mumford, Hirschheim, Fitzgerald and Wood-Harper 1985; Mumford and Weir 1979; Walls et al. 1992). Thus, focussing on socio-technical systems can very well render the IS discipline independent from related disciplines which focus on either one of the sub-systems (cf. reference vs. independent discipline). Socio-technical system thinking also suggests that a prerequisite for successfully studying IS is to address behaviour and technology in unison (cf. technology vs. behaviour). While Lee (2000) argues that the systems approach itself is rigorous and relevant, we emphasise that focussing on the relevant system – the social and the technical sub-system – is a necessary precondition for conducting relevant research (cf. rigour vs. relevance). Hence, socio-technical system thinking provides a valuable perception of the phenomenon of interest, information systems, also with regard to the major problems the IS discipline is facing. Also due to this strong social perspec-

tive, research on these systems necessitates a philosophy- and especially epistemology-based foundation which recognises the social aspects of knowledge creation and use (see, for instance, Brown and Duguid 2000).

In recent IS literature an extensive discussion positivist and interpretivist epistemologies can be found (see, for instance, Burrell and Morgan 1979; Chen and Hirschheim 2004; Fitzgerald and Howcroft 1998; Hirschheim and Klein 1989; Iivari, Hirschheim and Klein 1998; Lee 1991; Monod 2003; Weber 2004, Niehaves 2005). Epistemological assumptions were considered alongside ontological and methodological ones, those mainly taken into account in order to identify and to describe distinct (IS) research paradigms, most often positivism and interpretivism, as well as to differentiate them from each other (see Figure 1).

Author	Criteria	IS research paradigms
G. Burrell & G. Morgan (1979)	*a. Ontology, b. Epistemology, and c. Methodology*	*Functionalism, interpretivism, radical humanism, and radical structuralism*
J. Iivari (1991)	*a. Ontology, b. Epistemology, and c. Methodology*	*Functionalism, interpretivism, radical humanism, and radical structuralism*
B. Fitzgerald & D. Howcroft (1998)	*a. Ontology, b. Epistemology, and c. Truth*	*Positivism, interpretivism*
E. Monod (2003)	*a. Epistemology I: Object of knowledge, b. Epistemology II: Origin of knowledge*	*Multiple IS research paradigms and philosophical trends, e. g. functionalism, constructivism, critical realism*
R. Weber (2004)	*Multiple. Amongst others ontology, epistemology, research object, method, theory of truth etc.*	*Positivism, interpretivism*

Figure 1. Analyzing Epistemological Assumptions of Distinct IS Research Paradigms

In the IS research literature, two basic divergent streams of thought can be found regarding the definition of positivism and interpretivism (see also Becker and Niehaves 2006).

Standpoint I: positivism and interpretivism feature distinct epistemological[1] assumptions, but share the ontological[2] assumption: for instance, Weber (2004) argues that both positivism and interpretivism share the assumption that a 'real world' exists beyond the realms of human cognition. However, epistemologically, positivism on the one hand assumes that there exists in principle the possibility that objective knowledge about this real world can be achieved. On the other hand, interpretivism epistemologically emphasizes that knowledge is always determined by the subject and, thus, no such thing as objective knowledge exists (see Figure 2 and cf., for instance, Weber 2004).

Standpoint II: positivism and interpretivism neither share the epistemological nor the ontological assumption. According to this understanding, positivism is based on the doctrine of ontological realism, which holds that reality is independent of the observer, whereas interpretivism relies on the hermeneutic and phenomenological tradition, where such observer-independence of reality is not usually accepted (Moran 2000; Varey, Wood-Harper and Wood 2002). Ontologically, interpretivism thus seems to be close to the position that is usually called constructivism (see again Figure 2).

[1] Epistemology is concerned with the question of how humans can achieve "true knowledge". It specifically addresses the question of what is the relation between the object of knowledge and the knowledge achieved and, at this point, elaborates the influence of the subject on the process of achieving knowledge: Is knowledge potentially objective or subjectively influenced?

[2] Ontology is concerned with the question of a 'real world' existence: Does a reality exist beyond human speech and cognition processes? The question of epistemology is dependent on the question of ontology in the sense that an ontological statement is the basis for (epistemologically) discussing to which ('real world') object human knowledge can possibly refer to.

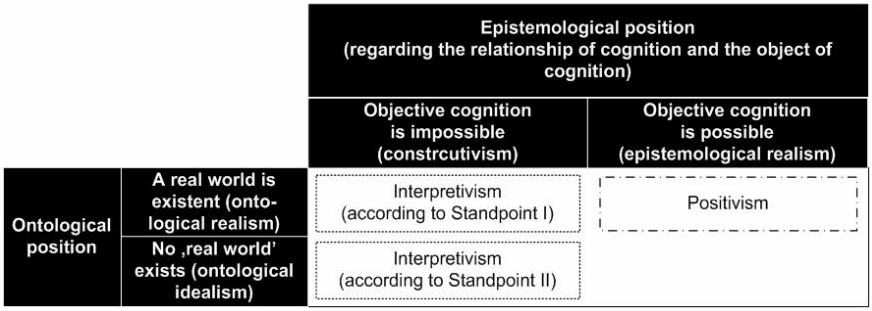

Figure 2. Analyzing Epistemological Assumptions of Distinct IS Research Paradigms

In the course of this paper, we will follow standpoint I due to numerous reasons. First, our primary research objective is to analyse the consequences of different epistemologies for design science research (evaluation). Here, one can logically derive that, once the impact of the finer distinction between positivism and interpretivism (only epistemological differences) on the understanding of design science has been proven, to prove the impact of the greater difference (also ontological ones) would be an easier task. Second, paper length restrictions necessitate to focus the analysis on the most relevant aspects, epistemology in this case. As a consequence, we understand positivism as a paradigm that assumes the existence of a 'real world' and which assumes that one can, in principle, achieve objective knowledge about reality. On the other hand, interpretivism is understood as assuming the existence of a 'real world' but neglecting the possibility of achieving objective knowledge of it. Here, knowledge (more specific: the relationship between the object of knowledge and the knowledge achieved) is always influenced by the subject/individual.[3]

DESIGN SCIENCE RESEARCH

At present, several research endeavours have already been undertaken in order to conceptualise design science: general design science (Simon 1981), design science in IS research (cf. Boland 1989; Hevner et al. 2004; Lee 2000; March et al. 1995; Nunamaker et al. 1991; Rossi and Sein 2003; Walls et al. 1992). While a research process can comprise diverse stages (Mingers 2001; Tashakkori and Teddlie 1998), understanding and acting being major categories, design science focuses on the latter being a "problem solving paradigm" (Hevner et al. 2004). The complementing "problem understanding paradigm" (Hevner et al. 2004) is often referred to as natural science or behavioural science research (Hevner et al. 2004; March et al. 1995; Simon 1981) (see Table 1).

	Behavioural Science Research (BSR)	Design Science Research (DSR)
Origin	natural science	engineering, sciences of the artificial
Paradigm	„problem understanding paradigm"	„problem solving paradigm"
Objective	to develop and justify theories which explain or predict organizational human phenomena surrounding the analysis, design, implementation, management, and use of information systems	to create innovations that define ideas, practices, technical capabilities, and product through the analysis, design, implementation, management, and use of information systems
Object	Human-Computer-Interaction	IT artefact design

Table 1. Behavioural vs. Design Science Research (see Hevner et al. 2004; March & Smith 1995)

Behavioural science research and design science research are seen as two complementary parts of the IS research cycle (Hevner et al. 2004; March et al. 1995). Acquiring knowledge about information systems employed in an organizational con-

[3] Within this paper, we will not attempt to analyse the question of paradigmatic (in)commensurability between positivism and interpretivism, but will give reference to the extensive discussion in the IS literature (see, for instance, Kuhn 1962; Lee 1991; Lee 1989; Trauth and Jessup 2000; Weber 2004).

text requires the application of both research paradigms: Starting from pre-scientific observation of IS and information technology (IT) usage in practice, theories about IS-related issues are developed. These theories are supposed to primarily explain and predict human behaviour, information system function, and issues interrelated with both of these aspects. By the process of justification, these theories are considered to be true or valid. Thus, they provide a basic understanding of the (real world) problem situation described in the first instance. This understanding presents the basis for designing IT artefacts that address a given problem situation. These IT artefacts are supposed to become useful in terms of problem solving and to change present IS usage in practice. For that reason, they provide new impulse for theory development. Hence, behavioural and design science can be considered as two complementary perspectives on IS research (Hevner et al. 2004; March et al. 1995), rather than as two "paradigms" in Kuhn's (1962) understanding. This interconnection between and the duality of behavioural and design science provides an angle for differentiating the IS discipline from either only behavioural or only design oriented disciplines (cf. reference vs. independent discipline) (Lee 2000). Design science focuses on problem solving which undoubtedly is a shared perspective with IS practice (cf. relevance). However, literature provides us with '*design science research guidelines*' (Hevner et al. 2004) how to conduct and to evaluate design science in IS research (cf. rigour). Thus, also design science provides a valuable perspective for solving the IS discipline's major problems (Lee 2000).

The guidelines suggested by Hevner et al. (2004) are specifically developed for the IS discipline, however, they could also be interpreted in a more general way, so that they would be applicable to related design disciplines. Some general categories are addressed: solving a relevant problem, making a significant contribution, designing an effective artefact, evaluating this artefact, doing this in a rigorous way, and communicating the research result in an appropriate manner (see Table 2). By applying these guidelines, a design researcher is supposed to be able to contribute to the body of design science knowledge (in a rigorous way). At this juncture, Hevner et al. (2004) advocate that this contribution to an existing body of knowledge is what separates *design science research* from *design practice*. Subsequently, the design science research guidelines aim at producing and evaluating a certain type of knowledge – design knowledge, for instance, design theories (Markus et al. 2002; Walls et al. 1992), models, methods, processes, or implementations – in a standardized way.

Guideline	Description
Guideline 1: Design as an Artifact	Design-science research must produce a viable artifact in the form of a construct, a model, a method, or an instantiation.
Guideline 2: Problem Relevance	The objective of design-science research is to develop technology-based solutions to important and relevant business problems.
Guideline 3: Design Evaluation	The utility, quality, and efficacy of a design artifact must be rigorously demonstrated via well-executed evaluation methods.
Guideline 4: Research Contributions	Effective design-science research must provide clear and verifiable contributions in the areas of the design artifact, design foundations, and/or design methodologies.
Guideline 5: Research Rigor	Design-science research relies upon the application of rigorous methods in both the construction and evaluation of the design artifact.
Guideline 6: Design as a Search Process	The search for an effective artifact requires utilizing available means to reach desired ends while satisfying laws in the problem environment.
Guideline 7: Communication of Research	Design-science research must be presented effectively both to technology-oriented as well as management-oriented audiences.

Table 2. Design Science Research Guideline according to Hevner et al. (2004)

EPISTEMOLOGICAL PERSPECTIVES ON DESIGN SCIENCE RESEARCH

The question of epistemology is not separate from, but inherent to design science research (evaluation)! Epistemology is concerned with the question of how to achieve "true knowledge". While Hevner et al. (2004) and other authors argue that design science research is a third paradigm that adds up to interpretivism and positivism (see, for instance, Vaishnavi et al. 2006), we will argue that epistemological assumptions are also underlying to design science research and that they heavily impact on how such design science research can be conducted and evaluated. One major argument for understanding design science as a

"third paradigm" is that design science is concerned with designing artefacts while only behavioural science would seek to produce "true knowledge" in terms of certain justified theories (Hevner et al. 2004). At this juncture, we will refer to the discussion of what separates design science from design practice: it is a contribution to the body of design knowledge. Design practice is rather concerned with applying existing knowledge, while design science research seeks to add new knowledge to the existing body of knowledge, for instance, in terms of design theories (Markus et al. 2002; Walls et al. 1992). In order to be able to assess the quality of such potential contribution to the body of design knowledge and in order to evaluate the (research) process which led to this knowledge, Hevner et al. (2004) suggest design science research guidelines. These guidelines seek to aid achieving and evaluating design knowledge! At this point, it should become obvious that the question of epistemology, which is the question of how to achieve "true knowledge", is not separate from design science research, but that both concepts are inevitably intertwined. While at some points, it is argued that design knowledge would not necessarily have to be "true" in order to be "good", March and Smith (1995) state: „Well-informed actions (i.e., those based on true beliefs) are more likely to achieve desired ends. Information is valuable insofar as it helps individuals form true beliefs which, in turn, promote effective, goal achieving action" (p. 251). In consequence, an epistemological viewpoint on assessing design science research would suggest analysing the question of how different (epistemological) assumptions about how humans can achieve knowledge influence the way that design scientists research new knowledge and the way that such knowledge can be evaluated.

Further arguments for the inherence of epistemology to design science research can be found. Epistemology is concerned with the question of how humans can achieve "true knowledge". At this juncture, one can ask, at which points of the scientific process humans are involved. Here, we argue, first, in the observation field, second, on the researcher level. First, socio-technical system thinking is inherent to IS research (see Section 2). Also due to this strong social perspective, research on these systems necessitates a philosophy- and especially epistemology-based foundation which recognises the social aspects of knowledge creation and use (see, for instance, Brown et al. 2000). Second, also on the researcher level the question of how humans can achieve "true knowledge" comes into play, even if one only observes technical systems, rather than socio-technical systems. Here, epistemology would scrutinise the possibility of "objective" research knowledge, no matter if the research subject is eventually a solely technical one (see also Niehaves and Stahl 2006).

	Behavioural Science Research	Design Science Research
Positivist Research	(Westland 2004)	(Hevner et al. 2004; March et al. 1995)
Interpretivist Research	(Miranda and Saunders 2003; Schultze and Leidner 2002)	(Boland 1989)

Table 3. Examples for Cross-Paradigmatic Research

Hence, we sought to provide arguments against the seemingly common knowledge that design science would be a "third paradigm" adding up to positivism and interpretivism (among other epistemologies). We also provided arguments that the question of epistemology and the question of design science research (evaluation) are inseparably intertwined (see also, for instance, McKay et al. 2005; Schön 1983, Niehaves and Stahl 2006). An empirical observation in the IS literature supports this line of argumentation: a focussed literature overview made available several IS research pieces, both in behavioural as well as in design science research, that entail different epistemologies, positivism and interpretivism in these example (see Table 3). As Hevner et al. (2004) suggested the design science research guidelines and as they have a positivist epistemological assumption (see again Table 3; a similar assessment can be found in McKay et al. 2005), an epistemological reflection of these guidelines is compulsory.

EPISTEMOLOGICAL REFLECTION OF DESIGN SCIENCE RESEARCH GUIDELINES

At present, the discussion of design science research (evaluation) follows a rather implicit positivist epistemology. Literature provides us with a comprehensive discussion of design science research evaluation in terms of design science research guidelines (see again Table 2). Here, we argued that the question of epistemology cannot be separated from this discussion. However, at the current state, one can observe a (rather implicit) positivist epistemology (see Section 2) in the notion of design science (McKay et al. 2005). Regarding, for instance, research papers by Hevner et al. (2004) and March and Smith (1995), one can observe significant evidence of such argument. For example, the authors promote a positivist approach to the evaluation of design artefacts through mathematical formalisms or experimentation (reliance on subject groups using design artefacts within semi-controlled environments) (McKay et al. 2005). Furthermore, the authors presume a positivist understanding of the relationship between research and practice: the major task for design science research is to produce objective knowl-

edge which afterwards should be applied by design practice (Hevner et al. 2004). Implicit is, here, the assumption that – in principle – the possibility of achieving "objective" knowledge exists (see Schön 1983).[4]

Hevner et al.'s (2004) Guidelines	Interpretivist Reflection and Core Questions (based on Klein and Myers 1999)
Guideline 2: Problem relevance "The objective […] is to develop […] solutions to important and relevant business problems".	§ **Principle of multiple interpretations**: How do the different subjects that are involved in the situation interpret the problem situation? § **Principle of suspicion**: Are different problem perceptions and definitions guided by biases or systematic distortions in the narratives of the participants? § **Principle of interaction between the researchers and the subjects**: In how far is the (research) problem situation socially constructed through the interaction between researchers and participants? § **Principle of contextualisation**: In how far is the problem grounded in the social and historical setting of the research case and in how far are certain insights (not) generalisable?
Guideline 3: Design evaluation "The utility, quality, and efficacy of a design artifact must be rigorously demonstrated […]".	§ **Principle of hermeneutic circle**: As human understanding is considered to be depending on continuous iteration (hermeneutic circle), what are the criteria to 'complete' a design evaluation? § **Principle of contextualisation**: In how far are the evaluation findings attached to the social and historical setting of the research and evaluation environment? Are the evaluation findings in some way applicable to other situations, and by which criteria?
Guideline 4: Research contribution "[DSR …] must provide a clear and verifiable contribution […]".	§ **Principle of dialogical reasoning**: In how far did the particular piece of design research show certain sensitivity to possible contradictions between the theoretical preconceptions guiding the research and actual findings with subsequent cycles of revision? § **Principle of contextualisation**: In how far is the problem grounded in the social and historical setting of the research case and in how far can specific insights be considered as a 'generalisable' contribution?
Guideline 5: Research rigour DSR "relies on the application of rigorous methods […]"	§ **General**: Which methods should be used in order to conduct and to evaluate design science research? What are the assumptions of these methods? Do certain evaluation methods have an inherent positivist background, for instance, the Bunge-Wand-Weber-Ontology (Wand and Weber 1990) or "mathematical formalisms or experimentation" (as advocated by McKay et al. 2005)?
Guideline 7: Communication of research "Design-science research must be presented effectively […]".	§ **Principle of multiple interpretations**: On the researchers' level (see again Section 4): In how far does the research communication pay attention to possible different interpretations by different researchers (which are the communication addressees)? § **Principle of interaction between the researchers and the subjects**: How does the research communication explicate a possible social construction of research processes and outputs? In how far is the researchers influence critically reflected?

Table 4. Interpretivist Views on Selected Hevner et al.'s Design Science Research Guidelines

[4] Simon's (1981) work on design science, or as he called it, science of the artificial, is the foundation of March and Smith's (1995) as well as of Hevner et al.'s (2004) recent works. Schön (1983) in detail elaborated the positivist assumption of the relationship between design research and design practice in Simon's work. Due to the fact that the recent authors in IS heavily draw from Simon, similar arguments can be applied here, too.

Design science research is not a positivist domain, but it is also open to alternative epistemologies, for instance, interpretivism. Schön (1983), for instance, challenged the positivist assumption in design science. Especially referring to Simon's works, he criticised the assumption of well-formed problems that design science seems to be able to address. Here, he argues that relevant problems would be 'messy problematic situations' that require 'an epistemology of practice implicit in the artistic, intuitive processes which some practitioners do bring to situations of uncertainty, instability, uniqueness, and value conflict' (Schön 1983; see also Cross 2001). As a consequence, Schön (1983) offers a constructivist approach to design science. At this juncture, the question arises of why, having a non-positivist assumption, design science is a significant field of interest. As McKay and Marshall (2005) elaborate, also interpretivist researchers could engage in rigorous research in order to better understand the impacts of design artefacts in real world context. Also critical research might be interested in analysing how changes in a socio-technical system, due to an introduced design artefact, have an impact on the power relation in the given situation (see Markus 1983; McKay et al. 2005). For the case of interpretivist research, Klein and Myers (1999) provide us with a set of principles for interpretive field studies in information systems. Although these guidelines do not explicitly address design science research issues, they very well formulate interpretivist principles in research evaluation. Therefore, in the following, we will draw from these interpretive principles[5] suggested by Klein and Myers (1999) in order to reflect Hevner et al.'s (2004) design science research guidelines. We will formulate core questions from an interpretive stance that may arise when discussing selected Hevner et al.'s guidelines. By doing so, we do not attempt to fully solve the question of interpretivist design science research guidelines, but rather give a brief outline of how the perception of design science research guidelines varies according to an assumed epistemology, interpretivism in this case (see Table 4).

CONCLUSION

The IS discipline is confronted with major problems: The dilemma of rigour vs. relevance, the dilemma of IS being an independent or a reference discipline, and the dilemma of researching on behaviour or technology (Lee 2000). However, there are certain concepts already developed in the IS discipline that provide great potential to contribute to solving these major problems: Socio-technical systems thinking and philosophy on the one hand, and design science on the other hand. Nonetheless, a comprehensive integrated view of these concepts can not be found yet, though several calls can be heard (for instance, Cross 2001; McKay et al. 2005). Instead, the discussion of design science research and its evaluation is often dominated by an implicit assumption of a positivist epistemology. However, design science research is not a positivist domain, but it is also open to alternative epistemologies, for instance, interpretivism (see, for instance, Klein et al. 1999). We provided arguments that taking an alternative epistemology has great impact on understanding design science research and on evaluation design science research results. At this juncture, we explicated such impact, though we did not intend to give any preference to a particular epistemological assumption. We consider it to be compulsory for the scientific discussion to analyse relevant implications, epistemological ones in this case, so that research evaluation can be conducted taking into account different (epistemological) worldviews.

Arguments were provided that, at the current state, design science research guidelines suggested by Hevner et al. (2004) are based on an implicit positivist assumption. In order to prove the impact of alternative epistemologies on design science research evaluation, we reflected a selection of Hevner et al.'s guidelines against the work of Klein and Myers (1999) on interpretive field studies in IS. As shown, the interpretation of certain design science research guidelines heavily shifts emphasis when taking an interpretive stance. At this point, we could only provide a brief outlook on how such interpretive reflection of design science research guidelines could look like. Also other guidelines which could not be further analysed within this paper are affected by the particular epistemological stance. Moreover, we could only discuss a selection of 'interpretivist principles' suggested by Klein and Myers (1999) and their impact on design science research. Therefore, we would suggest as further research to more comprehensively investigate the impact of alternative epistemologies on design science research (evaluation). A pluralist environment in conducting design science research offers, to our opinion, great potential for solving relevant real world problems as well as the 'internal' problems that the IS discipline faces.

[5] Briefly, these principles are: The fundamental principle of the hermeneutic circle, the principle of contextualisation, the principle of interaction between the researcher and the subjects, the principle of abstraction and generalisation, the principle of dialogical reasoning, the principle of multiple interpretations, and the principle of suspicions (see Klein et al. 1999, especially p. 72)

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