ECIS 2007 Proceedings

European Conference on Information Systems (ECIS)

2007

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ON THE ROLE OF CONCEPTUAL MODELS IN INFORMATION SYSTEMS RESEARCH – FROM ENGINEERING TO RESEARCH

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Abstract

Conceptual modelling deals with the process of building or interpreting a conceptual model. Stakeholders use the resulting model to reason and communicate about a domain in order to improve their common understanding of it. From this perspective, conceptual modelling and conceptual models are subjects for information systems research. In this paper, we argue that this engineering-driven view on conceptual models is only one possible perspective for information systems research. Based on language critique, we show how conceptual models can be used not as a subject of but as an important and useful instrument for information systems research. Conceptual models help to structure and formalize the interpretation of a subjective understanding in a domain of focus. We propose a research approach which is based on three roles that the researcher adopts and show how conceptual models are a useful source of knowledge and an instrument for interpretation respectively. We combine our view with an existing framework for information systems research and reinterpret existing research as matching to our approach.

Keywords: Research Methodology, Theory, Conceptual Models, Language Critique.

1 INTRODUCTION

Information systems (IS) research offers a broad body of knowledge and ideas for supporting the methodological structuring and specification of problem domains during the IS development process (Hirschheim et al. 1995). This is especially true if design science approaches are considered (Hevner et al. 2004). Software engineering, requirements engineering and systems engineering all emphasize methods featuring a strong engineering foundation for analyzing and designing IS. In this regard, conceptual models are an important element of methods for the development of IS (Kottemann & Konsynski 1984, Karimi 1988). In practice, they are often used for several purposes, e. g. to support the development, acquisition, adoption, standardisation and integration of IS (Maier 1999).

In order to develop and to control high quality IS, business requirements need to be identified and modelled from a business perspective. Afterwards, an IS can subsequently be implemented according to these specifications. Mere understanding of the syntax or even the specific semantics of a specialised modelling language or grammar is not the most crucial factor in IS development. Of far greater significance are the unstated assumptions that reflect the shared ("common sense") knowledge of people familiar with the social, business and technical contexts within which the proposed system will operate (Ryan 1993, p. 240). A shared domain knowledge between business and IT staff positively influences an improved alignment of business and IT objectives, and thus enhances the quality of IS (Franke et al. 2005, Reich & Benbasat 2000). If the stakeholders involved from both business and IT staff can work collaboratively on IS specifications using the same conceptual modelling method for communication, it is a reasonable assumption that the requirements engineering of IS can be simplified (Gemino & Wand 2004, Ribbert et al. 2004).

This traditional understanding of conceptual modelling focuses on what we call the *engineering-driven view of conceptual models*. From this perspective, conceptual models are part of a method, a planned and systematic engineering approach (Braun et al. 2005) which deals with the process of building or interpreting a conceptual model whereby the stakeholders reason and communicate about a domain in order to improve their common understanding of it (Gemino & Wand 2004, p. 80). The engineering-driven view has a long tradition in the IS research community, especially regarding the construction and application of conceptual modelling languages and grammars for the specification of business requirements. Conceptual modelling and reference modelling are considered to be important instruments for analyzing and solving several technical and organizational design issues on an application level, enterprise level or industry level (Moody 2005, p. 244). Although conceptual modelling and the construction of modelling languages tailored to specific problem domains are well understood, open questions remain, e. g. regarding the construction of conceptual models (Wand & Weber 2002, Weber 2003), the ontological foundations of conceptual modelling (Wyssusek 2006, Wand & Weber 2006), the evaluation of conceptual models (Shanks et al. 2003, Gemino & Wand 2004) or the quality of conceptual models (Moody 2005). From this perspective, conceptual models are a *subject* for IS research.

In contrast, we focus on the part that conceptual models can play in IS research approaches (*research-driven view of conceptual models*). First, conceptual models provide an opportunity for the researcher to jointly develop a formalized common understanding of a problem domain together with experts and practitioners (Ribbert et al. 2004). This results in a presentation of facts about the system in focus in such a way that all stakeholders can understand it and relate it to their objectives. As in IS development, a shared common sense knowledge of the domain in focus (a subjective understanding) is crucial for the development of an interpretive understanding in IS research as well (Lee 1991, p. 351). Second, as Silverman argues, IS researchers would do well to think a long time before rushing into yet another interview-based study, for decontextualized accounts of 'meanings' are very limited guides to the complexities of human-computer interaction (Silverman 1998, p. 19). Instead of focusing on how people 'see things', we have to focus on how people 'do things' (Silverman 1998, p. 3). We propose that conceptual models help to facilitate this way of thinking in IS research. From this point of view, conceptual models become an *instrument* for IS research. We argue that by using conceptual models in IS research and combining them with theories, relevant practical problems can be addressed more rigorously

In this paper, we proceed as follows. First, we discuss a language-based approach to conceptual models and argue that conceptual models as linguistic marks are an integral part of IS and organizations. From this understanding follows that conceptual models are essentially an instrument for empirical IS research in order to develop an interpretive understanding. We propose that this transition from an engineering-driven view to a research-driven view of conceptual models adds to a role-based understanding which fits with an integrative framework for IS research (Lee 1991, Lee 2004). Finally, we provide examples of recent research that match to our understanding.

2 A LANGUAGE-BASED VIEW ON CONCEPTUAL MODELS

Language is an every-day phenomenon and therefore seems to be unimportant at first glance. But this is not the case, several fields like linguistics, philosophy, psychology or neurology inquire about the nature of language. Following this, Lyytinen adequately demonstrated the importance of language and linguistic understanding for IS research (Lyytinen 1985). Nevertheless, there is no consensual answer to the question as to how meaning is given to language. Wittgenstein argued that every perception of the world is language-bound, so that language becomes the mediator between reality and an individual (Wittgenstein et al. 1953, § 2). Nothing is an object "inherently"; it only becomes an object as we talk about it. For this reason we use language to represent some meaning that we conceive (Bühler 1934, p. 254).

In linguistics, de Saussure's seminal work conceptualized a linguistic sign as a union of a *concept* – the signified (signifié) – and a *sound image* – the signifier (significant) (de Saussure 1974, p. 66). According to de Saussure, the combination of concept and sound image is arbitrary. Therefore, a language consisting of linguistic signs is based on *conventions* (de Saussure 1974, p. 67). Following de Saussure, Morris proposed that a language consists of a set of interrelated signs, or *symbols* (Morris 1971, p. 24). Both de Saussure's and Morris' approaches are based on conventions as a precondition for meaningful language-based communication, and both separate a concept from its representation. By symbols, Morris addresses only what de Saussure termed the signifier. As the "lore of symbols", semiotics consists of three subordinate branches: syntactics, semantics and pragmatics (Morris 1971, pp. 22-43). Syntactics (or syntax) deals with relations of symbols to one-another. People who want to communicate by language need syntactical conventions in order to create a common understanding of interrelated symbols. Semantics deals with the relation of symbols to concepts. These conventions are necessary for language-based communication in order to address one object with the same symbol. Pragmatics deals with the relation of symbols to their interpreters, and addresses the understanding of symbols to language users.

In accordance with Ågerfalk and Eriksson, we argue that traditional conceptual modelling research has focused too much on the syntactic and semantic aspects of language and too little on the pragmatics (Ågerfalk & Eriksson 2004). But where Ågerfalk and Eriksson use speech act theory as a theoretical foundation for conceptual modelling in the spirit of the engineering-driven view, we focus on language critique in order to explain the importance of conceptual models as instruments for IS research. Language critique, a branch of constructive philosophy known as the "Erlangen School" provides useful insights and backup for this understanding of conceptual models. Language critique has been successfully applied to IS research in the context of conceptual modelling before (e. g. Wedekind 1981, Holten et al. 2005).

By separating *language* (as a schema which one knows how to speak) and *discourse* (as linguistic action and activities), Kamlah and Lorenzen separate concepts from their linguistic usage (Kamlah & Lorenzen 1984, p. 41). Discourse means the repeatedly actualized usage of concepts in changing combination and variation. Thus, discourse is an actualized activity, whereas language comprises potential activities, or activity-schema (Kamlah & Lorenzen 1984, p. 45). The transition from an actualized activity to its activity-schema is called an *abstraction*. Terms are syntactical representations used in discourse with fixed conventions (*first abstraction*), whereas in order to get concepts, we abstract from the phonetic form of terms (*second abstraction*) (see Figure 1). To put it simply, we can mean the same thing with different words (Lorenzen 1987, pp. 115-118).

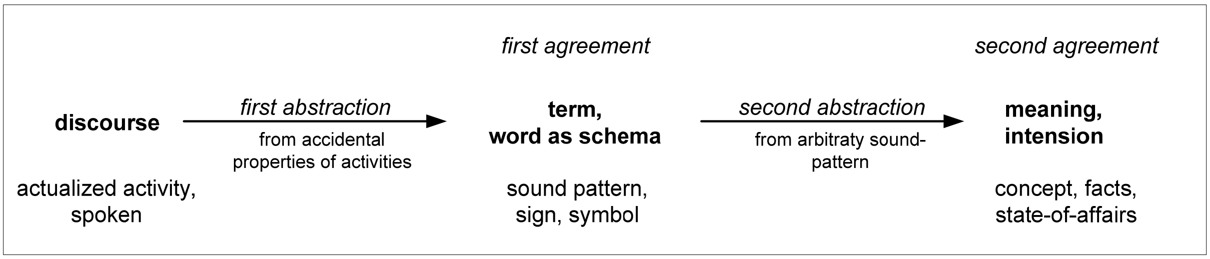

Figure 1. Agreements and abstractions in language critique (Holten 2003a, Holten et al. 2005)

The question of how the conventions that align syntax, semantics, and pragmatics of symbols are formed can be answered using the construct of a *language community*. Kamlah and Lorenzen argue that language as a system of signs promotes mutual understanding as "a 'know-how' held in common, the possession of a 'language community'." (Kamlah & Lorenzen 1984, p. 47). A new term is introduced by *explicit agreement* between language users with respect to its usage (*first agreement*) and meaning (*second agreement*) (Kamlah & Lorenzen 1984, p. 57). This agreement leads to a relation of concept and term, and is shared by a language community as the knowledge of using this term. Accordingly, if members of a group of people communicate, and each has an aligned semantic and pragmatic dimension of a symbol (or term) in mind, then this group of people forms a language community. The implications for our work are that the semantic and pragmatic dimensions of symbols need to be introduced together. If a language community has been created, based on a language (re)construction of a domain, the members of this language community share the pragmatic dimension of a symbol. All members have the same concept in mind if they are confronted with a symbol of the language and vice versa. According to our understanding, conceptual models play a significant role in making language communities explicit: conceptual models are designed through linguistic actions of a language community, and therefore are a written expression of a shared language understanding, so-called *marks* (Kamlah & Lorenzen 1984, p. 46, Holten 2003a, p. 91). Marks are written-down or printed writing-signs (Kamlah & Lorenzen 1984, p. 51). They are actualized as activities by the one who produces the marks in *writing* them, and again actualized by the one who *reads* them (Kamlah & Lorenzen 1984, p. 46, Gemino & Wand 2004). Models as marks create persistent things: solidified activities which stay put, are produced and can be read. Accordingly, conceptual models as marks have persistence just as words do (Kamlah & Lorenzen 1984, p. 46, Holten 2003a, p. 91). In this manner, conceptual models can be used as a formalized way of stating the intersubjective consensus of a language community (Ribbert et al. 2004). Conceptual models provide a starting point for communication as the written expression of the shared understanding of the language community that is part of every IS as a socio-technical system (e. g. business users, experts, managers, IT experts, programmers et cetera). New concepts and problems that every changing organization constantly encounters need to be introduced and explicitly agreed upon by this language community At the moment, it is of no interest for us how this consensus has been achieved, e. g by a enforcing a dominant power position, or by argument in a reasonable discourse. All that matters is that a mutual understanding of concepts and terms has been created. Of course, the idea of complete consensus and mutual understanding is very idealistic and simplified at best. But nonetheless, even if a member of a language community does not fully understand the meaning of a term, or does not concede to the meaning ascribed to it by others, she or he is able to relate to this term her or his interpretation of the understanding of others. Then, in accordance with Kamlah and Lorenzen, truth or correctness of statements depends on the consensus of the group of people that constructed the conceptual models (Kamlah & Lorenzen 1984, pp. 101-111, Ribbert et al. 2004).

3 A FRAMEWORK FOR INFORMATION SYSTEMS RESEARCH

Every research approach is based on fundamental philosophical assumptions (Myers 1997, Lee 2004). Based on these assumptions, IS researchers have debated competing philosophical paradigms for research, mostly represented by the two labels positivism (Jenkins 1985) and interpretivism (Walsham 1995a). There are other related distinctions which are commonly made. For example, research methods have variously been classified as objective versus subjective (Burrell & Morgan 1979), or as critical versus uncritical (Alvesson & Deetz 2000). Although the differences and boundaries between research positions have ever been a cause for discussion and argument among IS researchers, recent contributions argue for a conciliation and the acceptance of each others principle philosophical arguments as ontological and epistemological paradigms (Weber 2004). As Lee shows, supposedly adverse positions can even be methodologically combined and integrated (Lee 1991).

Different positions not withstanding, given the richness and complexity of the real world, a research approach best suited to the problem under consideration as well as the objectives of the researcher should be chosen. The over-riding concern of our approach is that the research should be both relevant to practical problems and rigorous in its operationalization. Due to our understanding of language, we believe that a *constructive philosophy* (Lorenzen 1987) which allows to solve conflicts between interpretive and positivist approaches is required for this purpose. Consequently, we assume that an objective world exists (*ontological realism*), but that our cognition of this world is subjective or private (*epistemological subjectivism*) (Holten et al. 2005, p. 177). We argue that due to this subjectivity, cognition relies upon the (re)construction of reality through (linguistic) action. In order to acquire an understanding of how people in IS development and management situations behave, we must participate in the development and decision processes belonging to IS development and management. To do these things without being involved would be impossible. Following the discussion of language critique and our philosophical assumptions, we argue that the creation of a language community between the researcher and the subjects and the following interpretation of thus subjective understanding are the weakest links in the chain. The creation of a mutual common sense understanding of the research domain essentially creates a boundary for IS research: only by using the detour of forming a language community and creating an interpretive understanding, we are able to investigate the phenomena of socio-technical systems as IS. We propose that conceptual models help to generate a sound interpretation of the subjective understanding of a research domain.

As a consequence, our research approach is characterized by three roles that the researcher adopts during her or his investigation. In accordance with a framework for the development of scientific theories as proposed by Lee (Lee 1991, Lee 2004), this approach allows us to relate interpretive and positivist positions. After having created a subjective understanding of everyday meanings and common sense within the observed organization, which provides the basis for the interpretive understanding, the researcher creates a positivist understanding in order to explain the empirical reality – the explanation being a scientific theory which can be tested against the subjective meaning as recorded in the interpretive understanding (Lee 1991, pp. 351-354). This leads to an integrated framework for an interpretive and positivist understanding (see Figure 2). The three roles can be applied and embodied during known research methods, e. g. action research (Baskerville & Wood-Harper 1996, Baskerville & Myers 2004), field or case study research (Yin 2003, Walsham 1995b, Barrett & Walsham 1999) or action case studies (Hughes & Wood-Harper 1999). We argue that engaging into the three roles allows the researcher to collect rich and meaningful data for answering her or his research questions.

1) First Role: Construction of Data

As Popper acknowledges, the framing of any scientific question assumes some foreknowledge of what it is we want to know (Popper 1959). We exist "all along" within a subjective understanding of the world which is linguistically articulated (Kamlah & Lorenzen 1984, p. 5). Therefore, the first role refers to the *construction of data*, wherein the researcher acts as a participant and engages in observation of the world, for example by conducting practical projects within an organization as an active partner in problem solving. In order to generate a mutual common sense understanding, researchers and other participants actively create a language community during the project. They align their language constructs in the specialised language or terminology of the domain in focus. Thus, an intersubjective understanding of the research domain is created. In doing so, the researcher gains access to observations in the research domain. Based on the observations, she or he is enabled to collect and construct data.

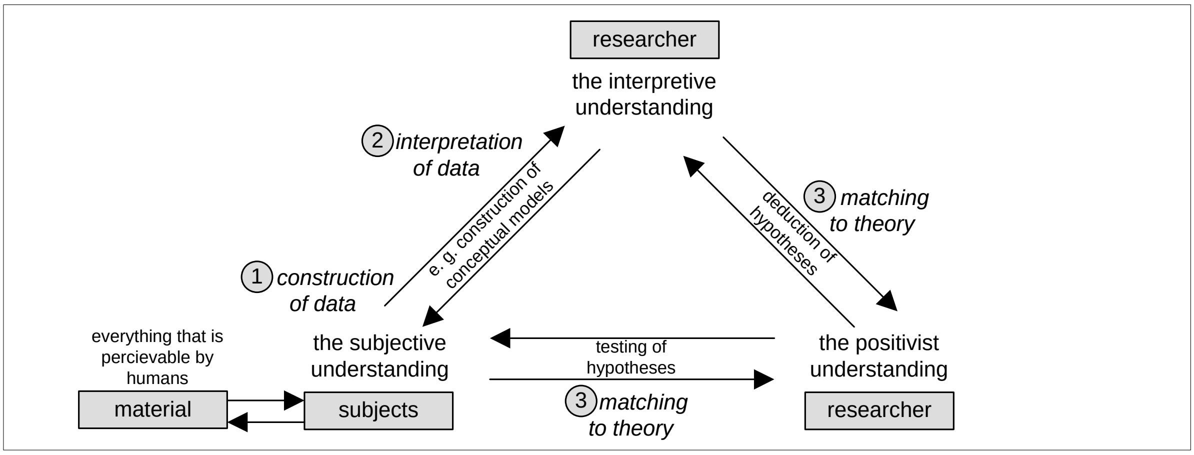

Figure 2. Framework for research adapted from (Lee 1991)

Consequently, participation in actual activities and in a language community becomes a prerequisite for any observation. Adopting a strategy akin to Langley, the researcher chooses to plunge deeply into the operational processes themselves, collecting fine grained qualitative data and attempting to extract theory from the ground up (Langley 1999, p. 691). She or he secures empirical material for the construction of data and interpretation, e. g. by collecting documentation, forms and print-outs, by observing operational processes and IS and by taking of field notes. As Eisenhardt argues, one key to useful field notes is to write down whatever impressions occur, that is, to react rather than to sift out what may seem important, because it is often difficult to know what will and will not be useful in the future (Eisenhardt 1989, p. 539). With regard to specific requirements, research questions and her or his level of knowledge, the researcher uses this material to construct new data.

In this context, existing conceptual models serve as marks of the shared understanding within an organization. Consequently, the researcher should collect existing conceptual models of IS, standard operating procedures, business processes et cetera (*conceptual models as material*). But these to-be conceptual models which exist as documentation must not necessarily mirror operational processes and activities as actually lived within the organization. That is why it is so important for the researcher to engage into practical work and gain first-hand observations of actual operations, adopting the natural attitude of everyday life (Mårtensson & Lee 2004, p. 513). Like an ethnographer, the researcher should begin by using and participating in everyday interactions and focus on how participants do things (Maynard 1989, p. 144). This is a common characteristic of field studies which take place in the natural environment of the phenomenon and where the researcher uses systematic techniques for the collection and recording of data (Cavaye 1996). The construction of data serves to create a subjective understanding of the terminology of a specific situation and domain in focus.

2) Second Role: Interpretation of Data

The second role concerns the *interpretation of data*. The researcher needs to analyze and interpret the extracted data and observations. She or he makes statements about the research domain, which are based on her or his interpretation of the subjective understanding. Consequently, the researcher interprets the mutual agreement and the statements in the specialised language or terminology of the domain in focus. This is in line with Lee's and Baskerville's generalizing from empirical statements to other empirical statements (Type EE generalizability) (Lee & Baskerville 2003). A researcher must therefore repeatedly go from his own interpretive understanding to the subjective understanding and then back again to his own interpretive understanding, using the hermeneutic cycle (Butler 1998, Klein & Myers 1999). The resulting understanding is the researcher's reading or interpretation of the first-level, common sense understanding (Lee 1991, pp. 351-353). Following our argument in section 2, the researcher constructs additional conceptual models of the IS or organization in focus and uses them for her or his interpretation of the subjective understanding and a preceding critical language (re)construction (*conceptual models as interpretations*). The specialised language or terminology of the domain in focus is usually expressed in natural language, thus ambiguities and misunderstandings are more the rule than the exception. The formal description of the interpretive understanding in the symbolic language of a conceptual modelling approach formalizes and clarifies the interpretive understanding of statements made in the specialised language or terminology of the domain in focus. This helps to address critical questions regarding the interpretation.

To test the validity of the resulting interpretive understanding, the researcher refers back to the subjective understanding, accomplishing this e. g. by discussing the conceptual models with other participants to verify the sensibility of "apparent absurdities" (Lee 1991, p. 352). Misunderstandings or misinterpretations of the subjective understanding can be more easily recognized by jointly discussing the conceptual models. Then, conceptual models serve as an instrument for the researcher to engage into a dialogue with practitioners (Mårtensson & Lee 2004). If conceptual models are discussed and refined together with practitioners, they help the researcher to understand how people actually 'do things' in the research domain. Consequently, the language community consisting of all project participants (researchers and practitioners) creates and discusses these descriptions. Afterwards, the researcher understands the situation properly in terms of the observed human subjects because she or he does not misunderstand it (Lee 1991, p. 351).

While it is important that researchers get a good understanding of the practices, the burden lies on the researchers and not on the practitioners. It is not acceptable to force a modelling language on the subjects so that there is a common language. Therefore, the use of conceptual modelling languages which meet the requirements of both researchers and participants is of utmost importance (Ribbert et al. 2004). Additionally, a modelling language suitable to the phenomenon under examination should be chosen. It is unlikely that a single modelling language is able to express all phenomena as efficient as using different modelling languages with different scopes (Kittredge 1982).

3) Third Role: Matching to Theory

In the third role, a matching to theory takes place. Generally, we understand theory as a means for describing, explaining and predicting and as a means for design and action as well (Gregor 2006, pp. 626-630). The researcher confronts a theory with her or his interpreted observations in order to deduct meaningful hypotheses. This positivist understanding is one that the researcher creates and tests in order to explain the empirical reality that she or he is investigating, the explanation being a scientific theory consisting of formal propositions (Lee 1991, p. 351). Consequently, the researcher generalizes from the interpreted observations to a theory (Type ET generalizability) (Lee & Baskerville 2003). From this generalizability concept stems the idea that one case may yield as many information as many cases. Science operates with conjectures and jumps to conclusions, even after one single observation, as long as the rules of hypothetico-deductive logic do apply and the emerging theory remains falsifiable and testable (Popper 1959).

In IS research, this means the deduction of hypotheses about the IS or organization in focus, based on the researcher's interpretive understanding, in order to match the findings with a theory. Conceptual modelling helps to unravel the pragmatics of a given situation by aiding in the process of creating a language community and in the interpretation of the subjective understanding. The researcher does not create a theory *about* conceptual models but uses the conceptual models to make statements in a structured and well-ordered manner. This helps the researcher to deduce hypotheses with respect to a theory. These hypotheses can then be tested based on the interpretive understanding as recorded in the conceptual models.

4 MATCHING OF EXISTING RESEARCH TO FRAMEWORK

We conducted an internet-based literature search (Schwartz & Russo 2004) for research matching to our description, covering both academic and practitioner sources. We used a keyword-based search strategy with prominent literature search engines (Ingenta, Proquest, Google Scholar and Citeseer). Following our literature review, we present five suitable examples of IS research that can be reinterpreted as matching to our approach in general (Table 1). This paper's rationale for selecting the presented works is that they are all settled within a practical problem context, make use of conceptual models for data construction and interpretation and test or improve theories to some degree.

Authors	Research Methodology	Conceptual Modelling Approaches in Use	Roles in Use	Theory in Use and Contribution to Theory
(Grant & Ngwenyama 2003)	Action research study	"ISD methodology" (Grant 1991)	1) explicit, 2) implicit, 3) explicit testing of theory for design and action	Evaluation of ISD methodology (Grant 1991)
(Gasson 2006)	Ethnographic field study	Several methodologies used by team for "business process redesign and IT system definition"	1) explicit, 2) implicit and mixed with 1) (no concept-ual models), 3) implicit	Actor-network theory (Callon 1986, Latour 1987), tested; application to IS design processes
(Vaast & Walsham 2005)	Qualitative case study / field study	None (none explicitly stated)	1) explicit (no conceptual models), 2) implicit and mixed with 1) (no concept-ual models), 3) implicit	Change theories for agents (Bourdieu 1977, Giddens 1984), tested; complement of existing theories
(Tillquist 2002)	Naturalistic inquiry / field study	"workflow diagrams", "requirements specifications"	1) explicit, 2) implicit and mixed with 1) (no concept-ual models), 3) explicit	Social Rule System theory (Burns & Flam 1987), not tested but improved
(Rosenkranz & Holten 2007)	Action case study	MetaMIS approach for specification of manage-ment views (Holten 2003b)	1) explicit, 2) explicit, 3) explicit	Law of Requisite Variety (Ashby 1964), tested

Table 1. Examples of information systems research matching to framework

Using an action research study, Grant and Ngwenyama evaluate the usefulness of a manufacturing IS development methodology at a manufacturing technology company (Grant & Ngwenyama 2003). They used a function of the company as a test case for evaluating an existing IS development methodology proposed by Grant (Grant 1991). During the action research study, conceptual models were used extensively (Grant & Ngwenyama 2003, pp. 26-31). Grant and Ngwenyama did not apply or test a specific theory as described in section 3 of this paper but were interested in the universality of their approach for evaluating future IS development methodologies. In this sense, their understanding of theory is more related to a theory for design and action (Gregor 2006, p. 620).

Gasson presents a field study dealing with the design of business-aligned IS within a mid-sized engineering firm in the United Kingdom (Gasson 2006). In her study, she followed the team activities of business process redesign and IT system definition over a period of 18 months, where design documents, models, work-procedures and information-flow diagrams were all part of the collected data (Gasson 2006, pp. 29, 32). Gasson attended and documented design group meetings, but was not an active participant. She draws upon theories of situated action and actor-network theory (Callon 1986, Latour 1987) to analyze the design process as the evolution of situated learning to address how differing perspectives on the nature of the problem-situation and the scope of design inquiry and analysis do affect the trajectory of IS design. This explains the situated rationalities underlying IS design as the co-design of business and IT systems.

In a qualitative case study set in an autonomous department of a French insurance company, Vaast and Walsham address the question how exactly work practices change with IT use, complementing theories of change (e. g. Bourdieu 1977, Giddens 1984) with findings that propose practice changes with IT use if agents perceive a dissonance between their context, actions and prevalent representations and practices (Vaast & Walsham 2005). Their work is a good example of how multiple sources of qualitative data can be combined to grasp empirically what constitutes the practice in a problem domain. Although they do not explicitly mention conceptual models as a source of data (the term “official documentation” might have included to-be conceptual models of standard operating procedures, IS et cetera) their participant observation (Vaast & Walsham 2005, pp. 72-74) could have easily incorporated existing conceptual models within the organization and newly constructed conceptual models for testing their interpretation of the subjective understanding with the participants.

How norms develop and influence the planning of technological and organizational change is the subject of a naturalistic case study conducted by Tillquist at a large multinational pharmaceutical and medical supply company (Tillquist 2002). Tillquist does explicitly mention that no consultative device was provided, but the direct observation and interviews he describes fit to our first role. As a result of the study, Social Rule System theory (Burns & Flam 1987) was expanded. Norms are actively constructed, rather than passively emergent, from actor interactions. The collected data included “documentation of computerized applications and organizational processes”, e. g. process guidelines, workflow diagrams and requirements specifications (Tillquist 2002, pp. 44-47). This directly matches our understanding of conceptual models as a source of data.

Applying the Law of Requisite Variety (Ashby 1964, p. 207) from cybernetics, Rosenkranz and Holten use an action case study to examine the variety of an IT controlling and reporting system in an European bank (Rosenkranz & Holten 2007). With the aim of making the variety of the controlling system visible, they apply a conceptual modelling language for the specification of management views on business processes (Holten 2003b, Holten et al. 2005). They use the conceptual models in order to create an interpretive understanding of their collected data from observation, documentation and interviews. The consequences as predicted by Ashby’s Law are successfully tested against the observations in the bank by conducting a set of unstructured interviews.

5 SUMMARY AND OUTLOOK

By introducing language critique, we proposed conceptual models as a means to specify the consensus of a language community in a formalized way. Thus we explained the value of conceptual models as an instrument for creating an interpretive understanding for relevant problems if used in combination with a rigorous theory. We applied our understanding to a framework for research introduced by (Lee 1991). Following this, we recognized and introduced in detail three roles that the researcher adopts during her or his investigation. We elaborated the part that existing conceptual models play as data, and how conceptual models designed by the researcher can be used to formalize and test an interpretive understanding. Afterwards, we provided research examples that match to our approach and delivered empirical evidence for the statements made in this paper. One of our chief intentions was to encourage other authors to see conceptual models not only as a subject of IS research but as a useful source of data and a reasonable instrument for the interpretation of a subjective understanding. Our future work aims at applying the introduced approach, refining our understanding of it and defining guidelines for the use of methods in each of the three identified roles, and putting the approach into practice. In particular, we plan to conduct case studies and action research studies which will give useful insight in the applicability of our approach. Additionally, we will try to match our approach with competing methodologies, e. g. Soft Systems Methodology (Checkland & Scholes 1990), and incorporate principles for validating rigour (e. g. Klein & Myers 1999, Yin 2003).

References

Ågerfalk, P. J. and Eriksson, O. (2004) Action-oriented conceptual modelling. *European Journal of Information Systems* 13 (1), 80-92.

Alvesson, M. and Deetz, S. (2000) *Doing Critical Management Research.* Sage, London, UK et al.

Ashby, W. R. (1964) *An Introduction to Cybernetics.* University Paperbacks, London, UK.

Barrett, M. and Walsham, G. (1999) Electronic trading and work transformation in the London Insurance Market. *Information Systems Research* 10 (1), 1-22.

Baskerville, R. L. and Myers, M. D. (2004) Special Issue on Action research in Information Systems: Making IS Research Relevant to Practice-Foreword. *MIS Quarterly* 28 (3), 329-335.

Baskerville, R. L. and Wood-Harper, A. T. (1996) A critical perspective on action research as a method for information systems research. *Journal of Information Technology* 11 (3), 235-246.

Bourdieu, P. (1977) *Outline of a theory of practice.* Cambridge University Press, Cambridge, New York, USA.

Braun, C., Wortmann, F., Hafner, M. and Winter, R. (2005) Method Construction - A Core Approach to Organizational Engineering. In *20th ACM Symposium on Applied Computing (SAC 2005)*, pp 1295-1299, Santa Fe, New Mexico, USA.

Bühler, K. (1934) *Sprachtheorie. Die Darstellungsfunktion der Sprache.* G. Fischer, Jena, Germany.

Burns, T. R. and Flam, H. (1987) *The shaping of social organization: social rule system theory with applications.* Sage.

Burrell, G. and Morgan, G. (1979) *Sociological Paradigms and Organisational Analysis.* Ashgate Publishing, Aldershot, UK et al.

Butler, T. (1998) Towards a hermeneutic method for interpretive research in information systems. *Journal of Information Technology* 13 (4), 285-300.

Callon, M. (1986) The Sociology of an Actor-Network: The Case of the Electric Vehicle. In *Mapping the Dynamics of Science and Technology.* (Callon, M. and Law, J. and Rip, A., Eds), pp 19-34, Macmillan Press, London, UK.

Cavaye, A. L. M. (1996) Case study research: a multi-facetted research approach for IS. *Information Systems Journal* 6 (3), 227-242.

Checkland, P. and Scholes, J. (1990) *Soft systems methodology in action.* John Wiley & Sons, Inc., New York, NY, USA.

De Saussure, F. (1974) *Course in General Linguistics.* Peter Owen Ltd., London, UK.

Eisenhardt, K. M. (1989) Building Theories from Case Study Research. *Academy of Management Review* 14 (4), 532-550.

Franke, J., Wagner, H.-T. and Weitzel, T. (2005) The Role of Information Technology Business Alignment in Value Creation: A Multiple Case Study among German Banks. In *26th International Conference in Information Systems (ICIS'05)*, pp 11-24, Las Vegas, USA.

Gasson, S. (2006) A genealogical study of boundary-spanning IS design. *European Journal of Information Systems* 15 (1), 26-41.

Gemino, A. and Wand, Y. (2004) A framework for empirical evaluation of conceptual modeling techniques. *Requirements Engineering* 9 (4), 248-260.

Giddens, A. (1984) *The Constitution of Society: Outline of Theory of Structuration.* University of California Press, Berkley, CA, USA.

Grant, D. (1991) Towards an information engineering approach for designing computer integrated manufacturing information systems. *DAI* 52 (4), 2235-B.

Grant, D. and Ngwenyama, O. (2003) A report on the use of action research to evaluate a manufacturing information systems development methodology in a company. *Information Systems Journal* 13 (1), 21-35.

Gregor, S. (2006) The Nature of Theory in Information Systems. *MIS Quarterly* 30 (3), 611-642.

Hevner, A., March, S., Park, J. and Ram, S. (2004) Design Science in Information Systems Research. *MIS Quarterly* 28 (1), 75-105.

Hirschheim, R., Klein, H. and Lyytinen, K. (1995) *Information Systems Development and Data Modeling. Conceptual and Philosophical Foundations.* Cambridge University Press, Cambridge, New York, USA.

Holten, R. (2003a) Integration von Informationssystemen. Theorie und Anwendung im Supply Chain Management. Universität Münster, Münster, pp 133-216.

Holten, R. (2003b) Specification of Management Views in Information Warehouse Projects. *Information Systems* 28 (7), 709-751.

Holten, R., Dreiling, A. and Becker, J. (2005) Ontology-Driven Method Engineering for Information Systems Development. In *Business Systems Analysis with Ontologies* (Green, P. and Rosemann, M., Eds), pp 174-215, IDEA Group, Hershey, PA, USA et al.

Hughes, J. and Wood-Harper, A. T. (1999) Systems development as a research act. *Journal of Information Technology* 14 (1), 83-94.

Jenkins, A. M. (1985) Research Methodologies and MIS Research. In *Research Methods in Information Systems* (Mumford, E. and Hirschheim, R. and Fitzgerald, G. and Wood-Harper, A. T., Eds), pp 103-117, North-Holland Publishing Co, Amsterdam, The Netherlands.

Kamlah, W. and Lorenzen, P. (1984) *Logical Propaedeutic. Pre-School of Reasonable Discourse.* University Press of America, Lanham, MD, USA.

Karimi, J. (1988) Strategy planning for information systems: requirements and information engineering methods. *Journal of Management Information Systems* 4 (4), 5-24.

Kittredge, R. (1982) Variation and homogeneity of sublanguages. In *Sublanguage: Studies of Language in Restricted Semantic Domains* (Kittredge, R. and Lehrberger, J., Eds), pp 107-137, de Gruyter, Berlin, Germany.

Klein, H. K. and Myers, M. D. (1999) A Set of Principles for Conducting and Evaluating Interpretive Field Studies in Information Systems. *MIS Quarterly* 23 (1), 67-94.

Kottemann, J. E. and Konsynski, B. R. (1984) Information systems planning and development: strategic postures and methodologies. *Journal of Management Information Systems* 1 (2), 45-63.

Langley, A. (1999) Strategies for Theorizing from Process Data. *Academy of Management Review* 24 (4), 691-710.

Latour, B. (1987) *Science in Action: How to Follow Engineers and Scientists Through Society.* Open University Press, Milton Keynes, UK.

Lee, A. S. (1991) Integrating Positivist and Interpretive Approaches to Organizational Research. *Organization Science* 2 (4), 342-365.

Lee, A. S. (2004) Thinking about Social Theory and Philosophy for Information Systems. In *Social Theory and Philosophy for Information Systems* (Willcocks, L. and Mingers, J., Eds), pp 1-26, John Wiley & Sons, Chichester, UK et al.

Lee, A. S. and Baskerville, R. L. (2003) Gerneralizing Generalizability in Information Systems Research. *Information Systems Research* 14 (3), 221-243.

Lorenzen, P. (1987) *Constructive Philosophy.* The University of Massachusetts Press, Amherst, MD, USA.

Lyytinen, K. J. (1985) Implications of Theories of Language for Information Systems. *MIS Quarterly* 9 (1), 61-76.

Maier, R. (1999) Evaluation of Data Modeling. In *Advances in Databases and Information Systems: Third East European Conference, ADBIS'99, Maribor, Slovenia, September 1999* (Eder, J. and Rozman, I. and Welzer, T., Eds), pp 232-246, Springer Verlag, Heidelberg, Germany.

Mårtensson, P. and Lee, A. S. (2004) Dialogical Action Research at Omega Corporation. *MIS Quarterly* 28 (3), 507-536.
Maynard, D. W. (1989) On the ethnography and analysis of discourse in institutional settings. In *Perspectives on Social Problems* (Holstein, J. A. and Miller, G., Eds), pp 127-146, JAI Press, Greenwich, Connecticut, USA.
Moody, D. L. (2005) Theoretical and practical issues in evaluating the quality of conceptual models: current state and future directions. *Data & Knowledge Engineering* 55, 243-276.
Morris, C. (1971) *Writings on the general theory of signs.* Mouton, The Hague, Netherlands.
Myers, M. D. (1997) Qualitative Research in Information Systems. *MIS Quarterly* 21 (2), 241-242.
Popper, K. R. (1959) *The Logic of Scientific Discovery*. Hutchinson, London, UK.
Reich, B. H. and Benbasat, I. (2000) Factors that influence the social dimension of alignment between business and information technology objectives. *MIS Quarterly* 24 (1), 81-113.
Ribbert, M., Niehaves, B., Dreiling, A. and Holten, R. (2004) An Epistemological Foundation of Conceptual Modeling. In *12th European Conference on Information Systems (ECIS 2004)* (Leino, T. and Saarinen, T. and Klein, S., Eds), Turku School of Economics and Business Administration, Turku, Finland.
Rosenkranz, C. and Holten, R. (2007) Combining Cybernetics and Conceptual Modeling – The Concept of Variety in Organizational Engineering. In *22nd Annual ACM Symposium on Applied Computing (SAC 2007),* Seoul, Korea.
Ryan, K. (1993) The Role of Natural Language in Requirements Engineering. In *IEEE International Symposium on Requirements Engineering 1993*, pp 240-242, San Diego, CA, USA.
Schwartz, R. B. and Russo, M. C. (2004) How to quickly find articles in the top IS journals. *Communications of the ACM* 47 (2), 98-101.
Shanks, G., Tansley, E. and Weber, R. (2003) Using Ontology to validate Conceptual Models. *Communications of the ACM* 46 (10), 85-89.
Silverman, D. (1998) Qualitative research: meanings or practices. *Information Systems Journal* 8 (1), 3-20.
Tillquist, J. (2002) Rules of the game: constructing norms of influence, subordination and constraint in IT planning. *Information and Organization* 12 (1), 39-70.
Vaast, E. and Walsham, G. (2005) Representations and actions: the transformation of work practices with IT use. *Information and Organization* 15 (1), 65-89.
Walsham, G. (1995a) The Emergence of Interpretivism in IS Research. *Information Systems Research* 6 (4), 376-394.
Walsham, G. (1995b) Interpretive case studies in IS research: nature and method. *European Journal of Information Systems* 4 (1), 74-81.
Wand, Y. and Weber, R. (2002) Research Commentary: Information Systems and Conceptual Modeling - A Research Agenda. *Information Systems Research* 13 (4), 363-376.
Wand, Y. and Weber, R. (2006) On Ontological Foundations of Conceptual Modelling: A Response to Wyssusek. *Scandinavian Journal of Information Systems* 18 (1), 127-138.
Weber, R. (2003) Conceptual Modelling and Ontology: Possibilities and Pitfalls. *Journal of Database Management* 14 (3), 1-20.
Weber, R. (2004) Editor's Comments. The Rhetoric of Positivism Versus Interpretivism: A Personal View. *MIS Quarterly* 28 (1), iii-xii.
Wedekind, H. (1981) *Datenbanksysteme I. Eine konstruktive Einführung in die Datenverarbeitung in Wirtschaft und Verwaltung.* Mannheim, Germany et al.
Wittgenstein, L., Anscombe, G. E. M. and Rhees, R. (Eds.) (1953) *Philosophische Untersuchungen / Philosophical Investigations (bilingual edition, German, English).* Basil Blackwell, Oxford, UK.
Wyssusek, B. (2006) On Ontological Foundations of Conceptual Modelling. *Scandinavian Journal of Information Systems* 18 (1), 63-80.
Yin, R. K. (2003) *Case Study Research: Design and Methods.* SAGE Publications, Thousand Oaks, CA, USA et al.