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"We want to establish an order in our knowledge of the use of language: an order with a particular end in view; one out of many possible orders; not the order."

Ludwig Wittgenstein

Abstract

In this paper we argue that conceptual modeling is well suited to define a convincing profile for the information systems discipline. Different from empirical research, conceptual modeling should not only represent existing domains. To fully exploit the potential offered by information technology, conceptual models should also represent *constructions* of future reality. While such an approach is promising substantial benefits, it is accompanied by severe epistemological challenges. Rational discourses are about the only chance to deal with these challenges - although they do not offer a convincing solution. However, without facing this problem, the field of conceptual modeling is nothing more than a playground for inventing artifacts.

Introduction

The information systems discipline is still characterized by a remarkable diversity. Among other things, it includes research topics such as the economic evaluation of information systems, the prerequisites of creativity in information systems organizations (Couger 1994), and even the investigation of sexual harassment via e-mail (Sipior&Ward 1997). This diversity is accompanied by a number of different research methods. This "so-called free-for-all situation" (Banville&Landry 1992, p. 87) has caused various authors to emphasize the need for a coherent profile of the discipline (Hirschheim 1992). In a recent book, Weber argues that conceptual modeling is a well suited subject to constitute the "core" of the information systems discipline (Weber 1997, pp. 72). In order to serve as a profile for the discipline, a research subject should be essential in the sense that it promises fundamental insights for the design and successful introduction of efficient information systems. In addition to that, a coherent profile requires a specific research competence that is not covered by neighbor disciplines. Based on the assumption that information systems often require cross-disciplinary approaches, it is also important that the profile of the disciplines includes appropriate interfaces to foster the communication with related disciplines, like management science, organization science or computer science.

Against this background, we will show that conceptual modeling is well suited to serve as a profile for the information systems discipline. However, we will not agree with Weber on the essential research goals. Instead, we emphasize the need for a so called "constructivist" approach.

Conceptual Modelling: Research Goals and Benefits

It is widely accepted that conceptual models are a prerequisite for successfully planning and designing complex systems: They are a medium to foster communication with prospective users and they (should) provide a sound basis for system implementation. Usually, conceptual models are designed by system analysts or other professionals for particular domains. In case conceptual modeling is to serve as a profile of the information systems discipline, there is need for scientific research goals. At first sight, there are two areas that could be targeted by information systems research. In order to support the design of conceptual models, general heuristics or principles would be helpful. There are a few approaches that aim in this direction - like process models within modeling methods, heuristics to identify concepts or design patterns. The second, more promising strategy aims at the development of generic reference models. A generic reference model represents a class of domains (for instance: a generic data model for insurance companies). The long term vision of generic reference models has been popular within the German information systems research ("Wirtschaftsinformatik") for a few year. There is no doubt that the task of developing generic reference models satisfies common ideas of scientific research. It is not restricted to particular instances. Instead it is motivated by the search for general structures that can be applied to numerous instances. At the same time it is promising substantial benefits. Firstly, it contributes to the economics of information systems by promoting the reuse of complex - and hopefully well designed - artifacts. Secondly, the domain level concepts that are defined within reference models allow for a high level of integration between those information systems that are based on a common reference model. Integration implies communication which in turn requires concepts that can be referenced as a common interpretation. The higher the semantic content of those concepts, the better the integration they allow for: If two systems exchange data based on a common concept of "Byte", we would speak of an integration that is poorer than that which results from common concepts like "Customer" or "Invoice". With respect to the diversity of concepts found in reality, it may seem impossible to find general concepts which are meaningful at the same time. However, instead of searching for common features of factual information use, a different approach makes more sense anyway. We call the corresponding research strategy "constructive". Different from an inductive approach, it does not take actual ways of using and producing information for granted. Instead, a constructivist strategy is based on the assumption that the effective exploitation of the potential provided by modern information technology recommends to redesign traditional means of communication and cooperation. In other words: It recommends to *construct* reality by introducing new ways of coordinating cooperative work. Where an inductivist approach assumes that the variance in using information and expressing it through languages is a necessary reflection of the variety of tasks to be taken into account, the constructivist approach relies on the presumption that variance in actual information use and related coordination mechanisms is the result of an - at least partially - arbitrary process (for a comprehensive description see Frank 98a and Frank 98c). For this reason, reducing variance by introducing new common concepts to handle information would not necessarily cause dysfunctional effects. Moreover, if the processes they are to be used in were thoroughly designed, they would contribute to more efficiency. There are numerous examples where concepts/artifacts were constructed to exploit the potential of computerised information systems rather than merely mapping existing concepts. For instance, languages and architectures to describe electronic documents, such as ODA, SGML, HTML or generic enterprise models which were introduced in a prescriptive way by software vendors like SAP.

Different from organization theories, the construction of conceptual models requires formal rigor to support system implementation. At the same time, it recommends a deep understanding of the organization of work and the potentials offered by information technology. Therefore the construction of domain level reference models requires a specific competence that is neither covered by software engineering nor by organization science. At the same time, input from those disciplines is essential. Cross-disciplinary cooperation, however, is hard to accomplish. Conceptual models as subject and result of such a cooperation promise to offer abstractions that are - at least in part - comprehensive for researchers from different disciplines.

Epistemological Challenges

The notion of scientific research is based on the idea of progress – in terms of growing knowledge and improving technologies. Progress, however, implies the existence of criteria that allow to discriminate between competing options – be it explanations of reality or artifacts that help to cope with it. A research discipline that does not seriously care about such criteria risks to sacrifice its identity. If conceptual models and modeling languages are considered as research results, there is need to evaluate them. The quality of conceptual models depends on a number of aspects, some of which can hardly be evaluated using objective measures. In recent years there has been growing awareness of this problem. There are a few publications that suggest criteria/measures for evaluating the quality of conceptual models (for instance: Krogstie et al. 1995). Weber (1997, pp. 72) suggests to focus on the question how well a model represents a user's conception of the real world. While this important question is difficult to answer - unless you favor a naive realism, it is not sufficient in the light of a constructivist strategy. Since the constructivist strategy aims at models of future worlds (for instance: models of information systems that are well integrated with a (re-) organized business), those models cannot be evaluated against a user's perception of reality only. Furthermore, it also requires to investigate which constructions are desirable for which group of future users. Many users will not be capable to fully understand the impact of a particular reference model. Additionally, their preferences may vary over time.

Moreover, developing conceptual models imposes the challenge to evaluate modelling *languages*, since a modelling language (its semantics, abstract syntax and graphical notation) has a pivotal impact on the quality of models. Although we are able to reflect upon language, for instance by distinguishing between object and meta level language, our ability to speak and understand a language is commonly regarded as a competence that we cannot entirely comprehend. Therefore any research that aims at inventing new "language games" (i.e. artificial languages and actions built upon them), has to face a subtle challenge: Every researcher is trapped in a network of language, patterns of thought and action he cannot completely transcend - leading to a paradox that can hardly be resolved: Understanding a language is not possible without using a language. At the same time, any language we use for this purpose will bias our perception and judgement – or, as the early Wittgenstein put it: "The limit of my language means the limit of my world." (Wittgenstein 1981, §5.6). Such considerations may seem to be of philosophical nature only. However, they characterize precisely one problem of research in conceptual modeling: It is almost common practice that artifacts (models, modeling languages etc.) are presented at IS conferences without being thoroughly discussed and evaluated by members of the corresponding scientific community. This is similar with standard modeling languages like the UML (Rational 1997). In other words: There is no common idea of quality and progress in the field.

Some Consequences

With respect to the criteria the profile of a discipline should fulfil, it makes sense to regard conceptual modeling as the or at least one core of the information systems discipline. Combined with a constructivist research strategy, it implies the challenge to evaluate competing artifacts. We do not think that it is acceptable to leave the evaluation to evolution: Those alternatives are most suitable that survive/dominate in the end. Although this "best practice" approach to evaluation is rather common in the information systems domain, it is no satisfactory option. First, it does not allow for an ex ante evaluation which is desirable because the realization of a particular design only for the purpose of testing it will usually be no option. Second, and more important, best practice means to sacrifice scientific standards for criteria which are common (and maybe appropriate) for markets.

A comparison against "objective" features of reality - as it would be recommended by a behavioristic approach, is not sufficient. While frameworks for evaluation, like (Krogstie et al. 1995, Frank 1998b) are helpful with structuring the problem, they are not sufficient either. There is only one chance left: discoursive evaluation. The idea of a rational discourse is based on the assumption that the exchange of thoughts is the only chance to overcome subjective perspectives. In order for a discourse to allow for that, it should fulfil a number of requirements (Habermas 1982). The partipicants should, for instance, have sufficient knowledge about the subject of the discourse. They should also try to transcend their subjective preferences and attitudes. There is not doubt that such an approach is not completely satisfactory after all. Although the requests seem to make sense, they are hard to check. Therefore the main problem that accompanies those recommendations is related to the selection of those who participate in a discourse. In other words: Who is going to decide which group of people is best suited to fulfil the requirements? In our case, one possible answer would be: Everybody who is directly affected by the artifact under consideration should be entitled to participate in those discourses. While this is still a rather idealistic request, we think that there is hardly any other option – unless you are satisfied with “oracles” provided by single experts.

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