Building Language Consensus in Information Systems Development - An Interdisciplinary Approach

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ABSTRACT

A central challenge in information systems development (ISD) refers to the ability to fit the different requirements as perceived by the stakeholders into shared accurate and complete models of the desired system. Focusing on ISD as a language development and formalization process, we claim that its effectiveness depends on the ability to manage the question how people deal with language in practice and build consensus in the concrete ISD process. By applying social interaction, communication and language theories we assert that the role of language in ISD is of particular relevance as it is a communication medium and an interaction goal at the same time. Moreover, the analysis of a concrete ISD project from this interdisciplinary perspective provides helpful insights in the development of language consensus and gives advice on how an efficient language interaction can be targeted by the moderation of the consensus building processes.

Keywords

INTRODUCTION

One of the most crucial stages in information systems development (ISD) is the determination of meaningful and coherent requirements out of the different perspectives of the stakeholders (Kent, 1978). From the perspective of ISD as a language development and formalization process (Lyytinen, 1985), the analysis of the consolidation of requirements on a language level can provide an important contribution to this challenge. We argue that by characterizing and analyzing the use of language as an instrument for communication and for consolidation of requirements in the development process, we can improve its communication basis and obtain helpful hints that enable us to enhance effectiveness in the emergence process of shared accurate and complete requirements.

The improvement of the consolidation process in ISD is of particular relevance due to its impact on the ISD profitability. Alarming results of different requirements engineering surveys give an account of the failure arising in a significant percentage of software projects (Keil et al., 2000; Standish Group International, 2001). Some major reasons are e. g. the insufficient understanding of the integration in practice (Suchman, 1995), information asymmetries or the lack of specific and correct information requirements (Davis, 1982; Marakas and Elam, 1998).

In this research we analyze how people use language to build meaningful and coherent requirements specifications and how the process of consensus building is shaped. Although in prior research consensus building is described as an important issue in ISD (Weltz et al., 1992), it is addressed rather abstractly as a goal than methodically as a process. In contrast, our perspective targets the micro-level of ISD, the point where language consolidation emerges.

Along with the categorization by Gregor (2006), the contribution of this article is the development of a theory which helps to explain and predict language interaction in ISD.

We proceed as follows: In the next section, we locate the position of this article within the theoretical background of its field and introduce the basic premises in this research. Then, we outline our fundamental theoretical propositions based on social interaction, communication and language theories for the particular ISD setting. To accomplish the empirical analysis of this setting, our research is led by the triangulation of positivist and interpretive research approaches (Lee, 1991). At the end, helpful insights in how people achieve consensus from a language perspective is provided as a basis for the assessment of language interaction situations.
STATE OF THE ART AND BASIC PREMISES

Since the 1980s, the functional tradition in IS-Research has been challenged by new alternative approaches (Lucas, 1975). The consideration of those involved in the system (Clarke and Lehaney, 2000; Robey and Markus, 1984) as well as the focus on communication-related questions and the processes of social interaction in IS and ISD (Hirschheim et al., 1995) gained significant attention.

These approaches make an important contribution to one of the central challenges in ISD, specifically the analysis of how meaningful and coherent IS models can be developed (McDavid, 1996; Thomas and Carroll, 1981). This question implies that the resulting models have to be successfully legitimized on a language and knowledge level (Boland, 1979) and consolidated by social interaction and communication (Hirschheim et al., 1991) in a collaborative setting, where multiple stakeholders representing the different fields of the organization and of the system development section are involved (Alvarez and Urala, 2002; Kavakli and Loucopoulos, 2003). In the core of these contributions is the assumption that the enhancement of the ability to communicate and interact in the ISD process leads to shared accurate and complete models of the desired system (Figure 1). In this work we approach this assumption from the perspective of ISD as a language development and formalization process (Lyttinen, 1985), which implies a somehow performed negotiation about and concretization of language as a sine qua non during the ISD process.

A main focus on language in ISD has been adopted by IS-researchers aiming to provide more insight in the development of meaningful, correct and sound system models (Holten, 2007; Niehaves, 2007). They assert that to build semantic and syntactic well-defined model statements we need to define their model element structure and terminological structure (Pfeiffer and Niehaves, 2005). We address the semantical terminological structure, that is, the structure that gives the semantic relationship between terms and concepts of the domain language (Becker et al., 2008). The domain language provides terms and concepts relating to the particular domain of the real world to be represented. In IS literature, the relationship between the domain of the real world and the domain language is referred by the “fragean core view” (Lyttinen, 1985). According to this view, terms of language have the function of denoting entities of the real world. Thereby an IS-model has the capacity to represent the domain of interest and is able to be the basis for ISD. This assumption is one of our basic premises and represents the precondition for our research.

Furthermore we emphasize that natural language is the most probable common communication medium between stakeholders with heterogeneous backgrounds and the most used communication instrument in practice, even if the requirements are later on fixed in a formal language (Pohl, 2007). Several contributions have been made discussing the role of natural language in ISD (Rupp and Sophisten, 2002; Ryan, 1993). The advantages of natural language are its universal use in different knowledge areas, its flexibility regarding abstraction grades and its simple use (Kamsties, 2001; Pohl, 2007), whereas the disadvantages underline its inherent lexical, syntactical or semantical ambiguity (Pohl, 2007). By allowing space for different interpretations of the same requirements (Berry and Kamsties, 2003) it may lead to an increase in negotiation costs and the risk of misunderstanding. To highlight this issue, Holten (2007) applies the language critique of the “Erlangen School” (Kamlah and Lorenzen, 1984) in ISs and assumes that the immanent ambiguity of language is affronted by the construction of a similar language basis (see details later). For this research we infer that by the analysis of how people use language to communicate in this setting, we can derive helpful insights in how to enhance the mutual understanding. This is the second basic premise in our research.

Figure 1. Importance of Communication and Interaction in the ISD Process (Guinan and Bostrom, 1986)
Finally we analyze language use in an interaction setting. Such an analysis in the field of IS has been performed by researchers using the Language Action Perspective (LAP) (Goldkuhl and Lyytinen, 1982; Winograd, 1988), which focuses on linguistic communication as the basis for understanding of ISs and on the impact of language action on a system. However, the focus on action through language was adopted for the analysis of the IS use process and less for the improvement of language use in the ISD process. Only a small number of researchers have focused on language use in the ISD-Interaction (e.g. Alvarez and Urla, 2002; Hansen and Rennecker, 2006; Marakas and Elam, 1998). This view on language corresponds to the “ordinary speaking view” and rests on the assumption that the use of natural language can be observed as a social act, in which the stakeholders mediate their intentions (Lyytinen, 1985). The use of natural language is observed as a reciprocal social action mediated through language as an instrument. This is the third basic premise for our research.

**COMMUNICATION, SOCIAL INTERACTION AND LANGUAGE THEORIES: ANALYZING THE ISD SETTING**

The successful development of an IS model implies on the one side the transmission of requirements in the sense of the classical code model (Shannon and Weaver, 1949). On the other side it is a process of social, action-driven consolidation, where every stakeholder encompasses his or her own actions with the actions of others. This perspective is additionally given by circular communication concepts (Sperber and Wilson, 1995). From this perspective, communication is a reciprocal sequence of utterances between individuals performed over action and reaction (Watzlawick, 1990). It is “carried out by an ensemble of people acting in coordination with each other” (Clark, 1996). To underline the reciprocal character we define communication as communicative interaction, whereas the interaction medium used is language. Therefore, we adapt the concept of language interaction.

According with the social action theory of Weber (1921/1967), people perform instrumental-rational interaction, defined as a social interaction form aiming for the achievement of goals through the use of an artefact. For the ISD setting, the goal is the development of the IS, mediated by the development of a coherent and meaningful model on a language level. The artefact used there is language, as natural language and additionally as formal languages. Then we can assert that language is a communication instrument for ISD. Additionally, we can also state that language is – at the same time – a result of ISD, as the goal is the creation of a meaningful and coherent model. The importance of language for the development of conceptual models in ISD can then be discerned as dually constituted:

- Language is an instrument for communication in ISD (Hansen and Rennecker, 2006; Marakas and Elam, 1998; Pohl, 2007)
- Language is deeply involved in the development and formalization results, representing coherent elements and functions of the future IS (Hirschheim et al., 1995; Lyytinen, 1985)

This raises a fundamental difference between the ISD setting and other interaction and communication settings: in many interaction cases, language is used as a means for the development of meaning (Bühler, 1990). Rather, in ISD, language is an instrument and part of the result at the same time because meaning is fixed over language elements. This conclusion supports the understanding of the ISD setting as a language based setting (Hirschheim et al., 1995; Holten, 2007; Lyytinen, 1985) whose implications have to be particularly analyzed. To meet to this exigency in our research, we set a broad focus on language theories.

Along with the linguistic perspective we adapt the semiotic concept of a sign. Saussure (1974) introduced the understanding of a “sign” as a two-sided psychological entity. It consists of the relationship between the signified as a mental fact related to objects in the real world (concept) and the signer as its psychological imprint (term). Consequently, a language basis in interaction is reached when the term-concept combinations are the same.

Yet, the existence of the same signs in a language interaction setting is not a sine qua non, but as Kamlah and Lorenzen (1984) argue, it can make the communication process more effective. Stakeholders are expected to adjust their language in order to achieve language consensus. According to Holten (2007), people who are interacting with each other over a long time automatically adjust often-used signs and create thereby a language community defined as a group of stakeholders with a consensual understanding of relevant language terms. This leads to an enhancement of language interaction. Hence, we define language consensus as the agreement about a same term-concept combination as part of a shared language or semantical background. The interactional challenge in this field is the question how we design the process of consensus building more effectively (Thomas and Carroll, 1981) by assessing the language interaction. Figure 2 shows the role of language interaction in the ISD setting.
An important facet of natural language is that it is primarily an everyday life tool (Kamlah and Lorenzen, 1984), which is learned in the socialization process (Bourdieu, 1990). We use language more than we talk about it; therefore language consensus runs the risk of being taken for granted. The process of connecting signs with specific concepts is involved in its use in an existing environment of social interaction, and is therefore coined empractically, that is, by its practical use (Bühler, 1990; Kamlah and Lorenzen, 1984). To better analyze how language consensus is actually reached we apply Clark’s audience design (1996). According to Clark, the language interaction progress is influenced by assumptions about previous language interaction or a given semantical background, e.g., already used language elements (Clark, 1996). Weber (1921/1967) talks about evidences of understanding given by the stakeholders to carry on the interaction process. In the following we include these considerations in our analysis.

**RESEARCH METHOD AND RESEARCH FIELD**

As the analysis of language interaction ought to be performed on a micro level of ISD, we resort to qualitative methods. Moreover, to better analyze the interaction, preserve rigour and include prior results from the research on social interaction, communication and language use, we apply Lee’s (1991) combination of interpretive and positivist research.

According to Figure 3, the first step, the interpretive understanding (1), consists of an interpretive observation (Lee, 1991) of the language interaction in the ISD project. The procedure used by the researcher includes the use of the hermeneutical circle to develop the resulting interpretive understanding according with the research principles proposed by Klein and Myers (1999). In the second step, the theory-driven development of the positivist understanding (2), we develop hypotheses about how people develop consensus over language by analyzing the interpretive results and testing them against relevant literature in the areas of communication, social interaction and language theories. Based on Schutz (1962), it is important to develop assumptions in terms of rationality along theoretical propositions (Lee, 1991). The third step, the positivist analysis (3), consists of a positivist re-observation of the results to confirm the relevance and the impact of the attained propositions in a qualitative way.
The observed ISD project aimed at the development of an IS for analysis, storage and retrieval of market-specific and user customized information with an expected user group of > 500. The development of the IS included the election of required system elements and functions. Here an overview of the stakeholders involved in the research, the research team is underlined:

- Project Management Team (PMT) - Business and organizational knowledge (2-3 Stakeholders)
- Enterprise Team (ET) - Business knowledge (6 Stakeholders)
- Requirements Engineering Team (RET) - Academic and practical Knowledge in IS (2 Stakeholders)
- Developer Team (DT) - Academic and practical Knowledge in IS (2 Stakeholders)

The research was performed from December 2006 until December 2008. The meetings took place in different project member configurations. By the drafting of this article, the requirements were accomplished.

BUILDING CONSENSUS OVER LANGUAGE INTERACTION

Interpretive and Positivist Understanding

After the first interpretive observations it could be asserted that the stakeholders were able to build shared concepts, terms and signs by the modification of their language use during the interaction. These changes seemed to occur motivated by the necessity to build a common basis of knowledge, represented in many cases by conceptual models, protocols etc.

Our observations indicate a difference between processes where the interaction between stakeholders was built on mutual understanding given by a shared language basis, and processes where stakeholders strove for a common understanding of terms, concepts and signs. The latter process type was referred by Dennis and Valacich (1999) for the field of communication as a process of convergence, in which stakeholders reach a common understanding and an agreement. We apply this perspective on language interaction and concentrate on convergent language interaction processes, which aim to build consensus by the agreement on terms-concepts combinations. On this note, we discern two important issues, which had influence on the convergence process.

On the one hand, referring the use of language as a communication instrument, we perceived that the negotiation about term-concept combinations was mostly not performed on the language interaction surface, but implicitly present in the background of many discussions. Then again, in few cases the negotiation about language occurred explicitly, in the sense of: “what do you mean with the word XY?”. These observations show that, contrary to explicit language negotiation, implicit language use has a self-evident role (Kamlah and Lorenzen, 1984), which seemed to have an impact on the language consensus process.

On the other hand, observing the development of consensus against the background of language theories and the understanding of a sign (de Saussure, 1974), we could discern different convergence process types:

- **Concept Convergence**: is given where stakeholders share a well-defined concept of an object, but they do not have one common term to address it.
- **Term Convergence**: refers to the use of the same term, but bound with (part-) different concepts.
- **Sign Convergence – Language Consensus**: is given when stakeholders use common terms and have well defined shared concepts of them, that is, the term-concept convergence is high. This corresponds to the model of language consensus.

We understand sign convergence as the goal of convergent processes, whereas concept and term convergence refer to a consensus only on one side of the sign due to a gap in language understanding. In the following exemplary cases (EC) (Table 1.) we show the impact of a one-sided concept or term convergence on consensus building and sketch the influence of an implicit or explicit language interaction on consensus building.
EC-1 The IS to be developed is expected to retrieve data dependent on personal needs, made possible by a prior personalization of the user’s profile. In a project meeting the RET referred to this issue as “personalization”, embedding the word in utterances describing the corresponding features. Later on, the PMT referred back to this concept by saying “in that case we could apply that what you called personalization”. The adoption of the term “personalization” in this particular situation was motivated by the prior use of this term by the RET and did not seem to imply a fully understanding of the concept behind.

EC-2 The first meeting between PMT, RET and DT was held in order to bring the different perspectives of the stakeholders together and develop first conceptions for the IS. During this meeting, the discussion on the term “content” seemed to be held in an atmosphere of confusion. Although the stakeholders referred to the same term, they had different technical perspectives on its concept: the PMT referred to the data display whereas the RET and the DT meant the data structure on an abstract level.

In the further language interaction the concept was not defined as such, but embedded into further explanations, without visible impact on conveyance. Not until after a while, the possibility of everyone talking about different concepts was explicitly mentioned by one of the stakeholders. By this means they were able to understand their different concepts.

EC-3 During the concretization of relevant project entity-types, there were some discrepancies between the terms “case study” and “field report”. Both terms referred to the same concept within the IS model. Nevertheless the choice of the term seemed to bring confusion between the stakeholders (PMT, ET, RET, DT). We observed some utterances beginning with one and ending with the other term, or correcting themselves in the same sentence: “case study, I mean… field report… whatever”. Although the evident confusion in the utterances claimed for the definition of a unique term to be referred in further language interaction, nobody asked explicitly for it.

EC-4 After having elaborated some notions about the structure and functions of the IS in prior meetings, there still was ambiguity about how these notions should be articulated and referred. This led to confusing situations in language use, as the stakeholders (PMT, RET) were not able to refer back to foregoing interaction results. During the subsequent language interaction, the search for a language anchor was so obvious that the point arrived where one of the participants explicitly asked for a time-out to order the different concepts and terms. In the course of the conversation following, a negotiation about which terms should be connected with which concept emerged. In this negotiation, the relevant concepts were solidified and linked to terms. To better concretize the negotiation results, the stakeholders were also engaged in writing the produced terms and the relationships between them down, building thereby conceptual models.

In the next meeting, where the consolidation of the systems structure had to be accomplished, the PMT presented the negotiated terms and its relationships, indicating the importance of the specified terms for a better understanding within the project.

Table 1. Exemplary Cases for the Consensus Building Process
Figure 4. Concept-Term Convergence of the Exemplary Cases

Figure 4 shows the position and the development of every EC according with its concept-term convergence. EC-1 depicts a situation of high term convergence as a previous used term was adopted by other stakeholders. In this case the adoption was performed having a notion about the concept behind the term, but with no well-defined definition of it. At first glance this seems to be a sufficient requisite for communication progress as it serves as evidence of understanding and the further language interaction is built over a somehow given language base. Nevertheless, a consensus gap remains, as it is not fully clear whether the term is understood as meant.

EC-2 shows another situation of term convergence, whereas here the language interaction in the beginning proceeds ineffectively as people have different concepts of the term being used. Finally, the situation of misunderstanding could be managed by explicit language negotiation. In this case, the change into explicit language negotiation and the achievement of language consensus better suited the requirements of the language interaction.

Referring to language negotiation, whilst EC-3 suggests that people are not always committed to finding a term consensus because they assume that they all have the same concept in mind, EC-4 recommends that sometimes the investment of time to talk explicitly about shared terms and its concepts is essential. In this situation the explicit thematicization of language served as an enabler of:

- the concretization of the concept/term relationship,
- the development of a conceptual model consisting of sign structure and its relationships and
- the development of common and accessible definitions of the concepts and terms used, which can serve as anchor for referring to already reached consensus.

Besides, EC-2, EC-3 and EC-4 show that the estimation about the adequate point when the negotiation about language should occur is not self-evident and the critical point of change into explicit language negotiation seems sometimes to be missed. As a consequence, the language interaction remains ineffective.

Below the line, we could observe that the conceptualization of consensus from a language interaction perspective can provide helpful advice to understand the consensus building process in ISD. On the one side, the analysis of which kind of convergence in language is driving the language interaction can give stakeholders advice over possible misunderstandings. On the other side, stakeholders should be aware on the situations were actually a clear definition of terms and concepts is necessary and accordingly react making this request explicit.
FUTURE RESEARCH PERSPECTIVES

By analyzing the language interaction in ISD settings we obtained important references about how consensus is reached. Far from the suggestion, that every single word in an interaction setting has to be explicitly defined, we believe that the analysis of how we use language in order to build consensus is of particular relevance for the ISD setting as it gives advice of possible misunderstandings and inefficiency in language use and offers strategies to influence the interaction course significantly. The results of this research provide qualitative evidence and analytical generalization by the triangulation of research methods and the inclusion of relevant theoretical positions. Therefore we hope to provide a useful approach for future fields in IS-research. Our further research focuses are the in-depth analysis of language interaction situations and the impact of communications media on consensus building from a language perspective.

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