The Importance of Language Quality in Information Systems Development Processes

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48. THE IMPORTANCE OF LANGUAGE QUALITY IN INFORMATION SYSTEMS DEVELOPMENT PROCESSES

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Abstract
Focusing on information quality (IQ) in information systems development (ISD), the analysis of language use forms the core of interest, as it is the venue for the system’s conceptualization process. On the one side, language unambiguosness is understood as an ideal basis for the success of ISD. In contrast, a fundamental postulation of language theories is the inherent ambiguity of natural language. Therefore, the analysis of how language consensus can be reached effectively is of particular interest for achieving IQ. We claim that the effectiveness of ISD depends on the ability to manage the question of how people deal with language in practice and reach consensus in the concrete ISD process. Hence, we analyzed the language interaction in an ISD project and identified different language interaction levels, which serve as orientation for specific interventions enabling an improvement of language use and language quality in the ISD process.

Keywords:

1. Introduction
A central challenge in information systems development (ISD) is the question, how the model of the real world as perceived by the stakeholders can be represented properly by the information system (Kent 1978). The inherent complexity of ISD (Hansen & Rennecker 2006) implies the consolidation of different requirements and perspectives in the enterprise into a coherent and meaningful set of information. As we understand ISD as a language development and formalization process (Lyytinen 1985), the analysis of the consolidation process 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 an information system (IS) in the ISD setting, we can obtain helpful hints that enable us to enhance effectiveness and information quality (IQ) in the emergence process of language consensus. Our main questions are: how can language consensus and IQ in ISD processes be reached and how can we influence this process effectively? These questions lead us to the micro-level of ISD, the point where language consensus emerge.

The relevance of the improvement of communication issues in ISD is obvious 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 for these failures are e. g. the insufficient understanding of the integration in practice (Suchman 1995), information asymmetries, and goal incongruence (Keil et al. 2000). We propose: by improving the communication basis for the different stakeholders involved in the ISD process, we can achieve a better alignment of the IS with the business model of the organisation.

Along with the categorization by Gregor (2006), the contribution of this article can be seen in the development of a theory which helps to explain and predict language interaction in ISD. Therefore, we emphasize on the role of language interaction by matching social interaction and communication theories with language theories. Using the results of prior research (Corvera 2009) we apply different language interaction levels, which serve as orientation for specific interventions in an interaction setting, enabling an intensification of consensus negotiation and thereby a higher IQ in the ISD process.

We proceed as follows: In the next section, we order the position of this article within the theoretical background of its field and introduce theoretical assumptions relevant to the contribution of this article. Then, we outline our fundamental theoretical propositions based on social interaction, communication and language theories for the particular ISD setting. After drafting the research case, we present the used language interaction levels. Part 5 and 6 show the embeddedness of the language interaction levels in exemplary observation cases and its impact on IQ and consensus building. Part 7 provides the outlook and limitations of this article.

2. State of the Art and Propositions

Coming from a functional tradition, the IS research has been challenged by new alternative approaches since the 1980s (Lucas 1975). By the consideration of the contribution of those involved in and affected by the system, the understanding of IS as human activity systems gained significant attention (Clarke & Lehaney 2000; Robey & Markus 1984). A further focus addresses communication-related questions about the processes of social interaction in IS and ISD (Hirschheim et al. 1995a) and the existence of a practice fraught with volatility, exceptions, unstructured data and unpredictable requirements (Truex et al. 2000).

As far as language is concerned, although its relevance seems not fully established, the IS research has introduced different approaches and methods focusing on language processes (Hellmuth 1997; Holten 1999; Lyytinen 1985; Winograd 1988). The main focus on natural language has been set by the Language Action Perspective (LAP) (Goldkuhl & Lyytinen 1982; Winograd 1988), which focuses on linguistic communication as the basis for understanding of ISs as well as on the impact of language action on a system (Winograd 2006). However, the focus on action through language was adopted for the analysis of ISs and less for the improvement of language use in ISD.

Yet, the importance of language for ISD can be discerned as dual constituted:
- Language is an instrument for communication in ISD (Pohl 2007)
- Language is deeply involved in the development and formalization process representing coherent elements and functions of the future IS (Hirschheim et al. 1995a; Lyytinen 1985)
This is the point where the ISD setting defers from many other interaction and communication settings: language is an instrument and a result at the same time. Therefore, a main assumption of this article is that the ISD setting is a language based setting (Hirschheim et al. 1995b; Holten 2007; Lyytinen 1985).

Regarding ISD as a language development and formalization process (Lyytinen 1985), a main goal in ISD is the development of a coherent and sound IS model (Holten 2007; McDavid 1996; Thomas & Carroll 1981). The resulting models have to be successfully legitimized on a language and knowledge level (Boland 1979) and consolidated by social action 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 are involved (Alvarez & Urla 2002; Kavakli & Loucopoulos 2003). Translating this assumption to the language perspective implies a somehow performed negotiation about and concretization of language as a sine qua non during the ISD process. Several contributions have been made discussing the role of fixing the requirements elicitation in natural language (Rupp & Sophisten 2002; Ryan 1993). And even if the requirements are fixed in a formal language, we have to acknowledge the use of natural language because it is the most probable common communication media between the different stakeholders, and the most used communication instrument in practice (Pohl 2007). 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). Nevertheless, there are significant disadvantages of natural language. Its inherent ambiguity (Pohl 2007) – e.g. lexical, syntactical, semantical, referential ambiguity and vagueness – provide space for different interpretations of the same requirements (Berry & Kamsties 2003), leading to a rising of negotiation costs and of the risk of misunderstanding in requirements engineering. Holten (2007) applied the language critique of the “Erlangen School” (Kamlah & Lorenzen 1984) in ISs and assume that the reduction of the immanent ambiguity of language and the construction of language consensus between the ISD stakeholders is reached by the creation of a language community as a group of stakeholders with a consensual understanding of relevant language representations. Consequently, the stakeholders of an ISD project ought to reach a shared understanding of and an agreement on the same concepts about the system’s elements and functions. As we assume, this leads to a higher level of IQ (Wand & Wang 1996). Hence, our definition of IQ goes along with the data quality dimensions proposed by Wand and Wang (1996):

- **Unambiguous Information** is the ability of information to map each state of the real world into well-defined concrete states of the IS.
- **Correct Information** refers to the correctness of the linkages between states of the IS and states of the real world system.
- **Complete Information** is understood as the ability of information system specifications to represent every meaningful state of the represented real world system.
- **Meaningful Information** means that no state of the developed IS is meaningless or garbled concerning the real world system.
3. The Communication, Social Action, and Language View on the ISD Setting

The analysis of communication is usually discussed in the sense of the classical code model (Shannon & Weaver 1949) and refers to the act of transmitting codified knowledge from sender to receiver. Yet, as already outlined, the successful development of an IS model means more than a transmission of requirements, but its social, action-driven consolidation. Consequently, a more adequate focus on communication is taken by circular communication concepts, assuming that communication success is related to the right interpretation of the utterance by the receiver and including his or her reaction (Sperber & Wilson 1995). Furthermore, Watzlawick (1990) sees communication as a reciprocal sequence of utterances between individuals in a action/reaction setting. As communication is “carried out by an ensemble of people acting in coordination with each other” (Clark 1996), we use the term interaction, that refers to reciprocal social action. Therefore, every stakeholder in the interaction encompasses his or her own actions with the actions of others. The perspective underlying this analysis is based on the social action theory of Max Weber (Weber 1921/1967): people perform instrumental-rational interaction which defines a social interaction form aiming for the achievement of goals by the use of an artefact. In this setting the goal is the development of an IS, and the artefact is language. As a result, we introduce the concept of language interaction.

The linguistic perspective is endorsed by basic semiotic concepts. Saussure (1974) introduced the term 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 signifier as its psychological imprint (sound pattern or term). That means: in language interaction we deal with subjective concepts by using terms as its representations. As the communication takes place over the use of terms, we also need a similar understanding of terms, that is, the used terms should relate to the same concepts. Yet, the existence of same terms is not a sine qua non, but as Kamlah and Lorenzen (Kamlah & Lorenzen 1984) argue, it can make the communication process more effective. The collaborative challenge in this field is thus the design of the language interaction process in an effective way (Thomas & Carroll 1981). Therefore, stakeholders are expected to adjust their language interaction in order to achieve language consensus and thereby IQ in ISD.

4. Research Case

The performed research was developed against the background of the ontological assumption of the existence of a real world but the epistemological assumption that social action always arise out of a subjective cognition of it (Burrell & Morgan 1979). In this research a combination of interpretive and positivist research according with Lee (1991) was applied.

The first step consisted of an interpretive observation of the language interaction in the ISD project. The goal of this observation was to analyze the point of emergence of language outcomes, which can be interpreted as useful for the development of the system. Therefore we observed the process by which language consensus related to the structure of the IS in the different face-to-face project meetings was achieved. As part-involved researchers, the observation was at all times performed in a two-person team, so that one researcher could concentrate on the observation and the other performed the required tasks. On the second step, we developed hypothesis about possible language interaction forms, referred as language interaction levels, and
its impact on the consensus building by analyzing the interpretive results and testing them against relevant literature in the areas of communication, social action and language theories. The third step consisted of a positivist re-observation and interpretation of different communication strategies on the ISD setting to confirm the impact of these strategies on the achievement of IQ in ISD.

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 work was divided in two main tasks to be fulfilled: the knowledge reproduction task, where the content of the system should be identified and collected and the development of the IS, including the election of required system elements and functions. The research began on December 2006 until September 2008. The development of the structure of the IS model comprised its acceptance and the adoption of used concepts and terms by the involved stakeholders. The meetings took place in different project member configurations. By the drafting of this article, the requirements were successfully realized. The researchers had a project-inside role, as they were responsible for requirements engineering. This research position was convenient because although the other project stakeholders were informed about the documentation of interaction for research purposes, the reaction toward the researcher’s role was overlapped with the role as stakeholders in the project.

Table 1 shows an overview over the involved stakeholders. The abbreviations are parenthesised and the research team is underlined.

<table>
<thead>
<tr>
<th>ISD related Knowledge</th>
<th>Business Knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Management Team (PMT)</td>
<td>Business and organizational knowledge (2 Persons)</td>
</tr>
<tr>
<td>Enterprise Team (ET)</td>
<td>Business knowledge (6 P.)</td>
</tr>
<tr>
<td>Consultor Team (CT)</td>
<td>Knowledge in Business Consulting (2 P.)</td>
</tr>
<tr>
<td>Requirements Engineering Team (RET)</td>
<td>Academic and practical Knowledge in IS (2 P.)</td>
</tr>
<tr>
<td>Developer Team (DT)</td>
<td>Academic and practical Knowledge in IS (2 P.)</td>
</tr>
</tbody>
</table>

Table 1. Involved Teams in the Analyzed ISD Project.

After the first interpretive observations it could be asserted that the stakeholders – using language as an artefact – changed the manner how to deal with language many times. Through their interaction they were able to build a common meaning and IQ. We refer to this mentioned change of manner as to a change of language interaction level. Changes seemed to occur motivated by the necessity to reach an interaction goal. In this article, we focus on selected language interaction levels, which seem to have an impact on the achievement of consensus and of IQ. In the following paragraphs we describe the identified language interaction levels. These levels are not sharply defined and they can influence each other. Furthermore, they may be not exhaustive. Nevertheless they show how people use language as an artefact to communicate and build meaning.
Symmetrical vs. complementary interaction level

Observing the language interaction we could discern phases where the language interaction between the stakeholders strove for a common understanding of terms and concepts and, on the other side, phases where the interaction was built on mutual complementation using already reached consensus on terms and concepts. In prior literature there are different descriptions of the phenomenon (Dennis & Valacich 1999; Holten 2007). We apply Watzlawicks (1990) concept of symmetry and complementarity. Symmetry means an interaction which aims for the building of the same understanding basis, complementarity means that one stakeholder's knowledge complement the knowledge of the other. In the case of language, the stakeholders are acting in a symmetrical sense as long as they negotiate about language. The complementary language interaction means that the language basis is already reached and they use language communication for the development of knowledge.

Explicit vs. implicit language interaction level

Our observations suggest that language negotiation, in most of the cases, was not performed on the language interaction surface, but implicitly present in the background of the discussions. Then again, in few cases, the negotiation about language occurred explicitly, in the sense of: “what do you mean with the word XY?”. Concerning this observation, there are different approaches referring the manner how language is constantly being negotiated in everyday life. As colloquial language is learned empirically in the socialization process (Bourdieu 1990) it has a self evident role on its use (Kamlah & Lorenzen 1984; Pohl 2007; Rupp & Sophisten 2002). We use language more than we talk about it. The process how we connect signs with specific concepts is involved in its use in an existing environment of social interaction, and is therefore coined empirically, that is, by its practical use (Bühler 1990; Kamlah & Lorenzen 1984). Although an explicit language negotiation may be not usual, it sometimes seems inevitable, as for example in academic fields (Kamlah & Lorenzen 1984).

Colloquial vs. technical language interaction level

In addition we could discern a different use of natural language referring the elaboration of utterances. There were on the one hand phases were technical language was on the foreground; on the other hand we could observe a high use of colloquial language and narrative elements. The questions raised here refers to the level of abstraction of the context: the use of technical language is usually associated with a differentiated and less context dependent vocabulary (Cummins 1979) whereas the use of colloquial language is fraught with narrative contents, less concrete use of terms and context-rich utterances (Cummins 1979). These observations are similar with the results of an ISD research performed by Alvarez et al. (2002), where people tend to use narratives and colloquial language to better explain the requirements on an IS.

Level of language interaction volatileness vs. language interaction codification

Finally, we differentiate between the use of oral language, written language and other codification forms during the face-to-face language interaction. It seemed to have different purposes, on the one hand, it was used for documentation and in other cases it allowed the visualization of meaning. The differentiation between oral and written language use is of particular interest in communication theory. One important aspect is the question whether the results of language interaction remain fleeting or are perseverant as in the case of written language (codification). The construction of enduring utterances, e.g. in the form of reports and documentations are understood as language actions on time distance (Clark 1996). This implies a
further reflection about the expression chosen, which ensures stability and uniformity of what has been written (Hellmuth 1997). Therefore, the change between oral and written language can be classified as more than a change between communication medium but as a language interaction modus. A further observation is the use of written specifications, e.g. in form of conceptual models. The ISD has a long tradition of the use of conceptual models as instruments of the visualization of concepts (Karimi 1988; Kottemann & Konsynski 1984). Therefore, this issue is considered as important as well.

Table 2 summarizes the language interaction levels.

<table>
<thead>
<tr>
<th>Language Interaction Levels</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symmetrical vs. Complementary Language Interaction</td>
<td>Complementary: both stakeholders have the same language basis. The interaction goal is the building of new knowledge. Symmetrical: The first interaction goal is the building of the same language basis.</td>
</tr>
<tr>
<td>Colloquial vs. Technical Language Interaction</td>
<td>Colloquial language: Easy structured, common everyday language Technical language: Clearly defined, more standardized an not broadly diffused language</td>
</tr>
<tr>
<td>Language Interaction Volatileness vs. Language Interaction Codification</td>
<td>Volatileness: Language perception is fugacious and concatenated. Codification: Language action occurs over time. Language perception is enduring and can be synthesized.</td>
</tr>
</tbody>
</table>

Table 2. Language Interaction Levels.

5. Impact of Language Interaction Levels on Information Quality

Along with the data quality dimensions proposed by Wand and Wang (1996), we can evaluate the contribution of the use of language interaction levels regarding the achievement of IQ. The following observation cases offer a helpful insight on the impact of the change between language interaction levels and IQ.

**Impact on Information Unambiguity and Correctness**

This observation case emerged in the first meeting between the teams PMT, the RET and the DT. This meeting was held in order to bring the different perspectives of the stakeholders together and develop a first concept of the IS structure. During the 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 seemed to have different technical perspectives on the question of “how to deal with content”. By using the term “content”, the PMT referred to the data display whereas the RET and the DT meant the data structure on an abstract level. This can be ascribed to an incorrect representation, as the stakeholders used the same term referring to different states of the system to be implemented. At the same time, it is ambiguous as the functions of the IS are not well-defined. This situation led to confusion for the further work.

In the first phase of the meeting, the language interaction level of all stakeholders can be classified as an intended complementary interaction, as all three stakeholders were trying to build new meaning without realizing that the symmetric interaction could be more appropriate. Later on, the negotiation seemed to stay in the level of implicit language interaction, as the concept was embedded into further explanations, but not defined as such. In this phase, the stakeholders
interchanged between interaction volatileness and interaction codification, and colloquial and technical language interaction, without visible impact on the consensus building process and IQ. After a while, the possibility of being using ambiguous or incorrect information was explicitly mentioned by one of the stakeholders. Then, the other stakeholders agreed on receiving an exemplary content document from the PMT to have a look at the meant “content”, thereby the stakeholders achieved a common understanding.

The change into explicit language negotiation resulted to better suit the requirements of the language interaction and the solution for ambiguous and incorrect information. Even if the change between implicit and explicit language interaction as well as symmetric and complementary interaction seemed to be decisive, we suppose that the changes between interaction volatileness and codification and casual and elaborated language interaction were not unimportant as they brought the situation to escalate and enabled the change into an explicit language negotiation as a last chance of understanding and achieving unambiguity and correctness.

**Impact on Information Meaning and Completeness**

After having elaborated some notions about the structure and functions of the IS in the prior meetings, there still was vagueness about how these notions should be articulated and referred. In the specification process there were many confusing situations in language use as, although the stakeholders had developed notions about the relevant concepts, they were not able to refer to foregoing interaction results, as the concrete specifications were incomplete, that is, important requirements of the real world could not be referred to as there was no concrete representation in the requirements of the IS.

During the subsequent language interaction, the search for a language representation was so obvious that the point arrived where one of the participants explicitly asked for a time-out to order the different concepts behind the terms. By doing so, he changed the current language interaction from the implicit into explicit language interaction. In the course of the conversation following, a negotiation about meaning emerged: the stakeholder discussed about which terms should be connected with which concepts and which concept is meaningful enough to be represented. In this negotiation, meaningful 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 a complete structure of the needed concepts as a conceptual model.

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, underpinning their meaning and asking for completeness in further specifications.

**6. Discussion and Results**

Both cases showed that the estimation about the adequate point when to negotiate about language is not self-evident and that the adequate point to negotiate explicitly about language seemed to be missed. As a consequence, the language interaction at the beginning remained ineffective and the IQ achievement low.
Moreover, the observation cases suggest, that the explicit language negotiation can involve important solutions for ISD problems as:

- the concretization of the meaningful, complete and correct concept/term relationship,
- the development of unambiguous conceptual model consisting of sign structure and its relationships and
- the necessity of referring to concrete shared results as a basis for further communication.

Regarding the goal of consensus building, the change from language volatileness to language codification can be assumed as being important. The conceptual model served as a codification ground independent of time and place. Moreover, it was adapted as the basis for further unambiguous conceptualizations, e.g. of relationships between the terms.

By analyzing the observation cases through the use of language interaction levels, helpful hints for the consensus negotiation and IQ could be derived. We could observe that the categorisation of language interaction in language interaction levels can provide a helpful perspective to understand the consensus building process and the achievement of IQ. The awareness of language interaction levels could give stakeholders simple strategies to influence the interaction course significantly by changing the interaction level purposely and providing thereby a different basis for communication.

7. Limitations and Outlook

The observed interaction levels make the structure of bottlenecks in language interaction visible. This analysis may contribute to a better language consensus building and IQ in ISD by providing orientation for specific interventions in the interaction and enabling an intensification of language interaction. Thereby we can gain a deeper understanding about the emergence of language consensus and IQ.

Although the interpretive approach and the process of finding the different language interaction levels seems to be a sensitive link in the chain, we need to go over this step as language as well as IQ emerge in the interaction. By analyzing the language interaction in ISD settings, we obtained important references about how consensus and IQ are reached. Using the developed interaction levels proved to be a helpful tool for the analysis of single observations cases in the field of language interaction in the ISD setting.

Further research, besides the in-depth analysis of language interaction situations, could focus on stakeholder interviews, in order to get more detailed information about the user interpretation of the strategies to reach consensus. Another alternative could be action research, trying to change the current interaction levels intentional and observing its impact on the development of coherent entities in ISD.

Acknowledgments

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