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A Model of the Dynamics of Organizational Communication

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We propose a model of the dynamics of organizational communication. Our model specifies the mechanics by which communication impact is fed back to communication inputs and closes the gap between sender and receiver of messages. We draw on language critique, a branch of language philosophy, and derive joint linguistic actions of interlocutors to explain the emergence and adaptation of communication on the group level. The model is framed by Te'eni's cognitive-affective model of organizational communication.

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1 Introduction

Organizations rely on good coordination of activities which requires good information flows (Crowston, 1997, Malone and Crowston, 1994). Therefore, organizations need information flows to function, and strive to create efficient information flows to be effective (Jin and Levitt, 1996, Tushman and Nadler, 1978). Nevertheless, coordination in today's distributed organizations is constrained by mismatches of views, since each unit involved in the cooperation might generate its own values, terms and coding schemes for information processing, which leads to communication boundaries (Tushman, 1977). Unfortunately, most of today's business redesign practices ignore information flows and their integration in

business processes (Kock, 2001, Kock, 2003, Kock and McQueen, 1996). Nevertheless, organization development should focus organizational communication to actively construct better work environments, customer experiences and socio-technical systems (Avital et al., 2009), which leads to the field of Information Systems and Information Systems Development.

Information Systems (IS) are *socio-technical systems*, which include both technical and organizational sub-systems (Bostrom and Heinen, 1977, p. 291) and emerge from complex interdependencies between organization, IT, and other potential factors (Markus and Robey, 1988). An IS is the result of an IT enabling an organization, as much as an IS is the result of an organization enabling an IT (Lee, 2004, pp. 11-12). Information Systems Development (ISD) is characterized by multiple stakeholders and multiple influences, many of which relate to pre-existing IT systems or cultural and social aspects that have evolved in organizations over decades (Chae and Poole, 2005). The creation of “mutual” (Tan, 1994), “common” (Tiwana and McLean, 2003), or “shared” (Hirschheim and Klein, 1989) understanding between stakeholders has been repeatedly identified as a key determinant of successful IS development (Guinan and Bostrom, 1986, Siau et al., 2010).

To understand the relations of human agents and technological objects, we propose to look at the most obvious and natural, but at the same time, the most complex phenomenon of human interaction: language and linguistic communication.

The elaborate cognitive-affective model of organizational communication presented by Te’eni (2001) frames our work. Te’eni’s model structures the communication process as goal driven strategies choosing media and forms of message. The gap between the sender’s and receiver’s interpretations before transmitting a message is defined as cognitive distance which is an attribute of sender-receiver distance (Te’eni, 2001, p. 281) belonging to communication input. Mutual understanding belongs to communication impact. Communication complexity comprises cognitive and dynamic complexity which are of

interest for our further discussion as well as affective complexity. Multiplicity of views and incompatibility between representation and information use are attributes of cognitive complexity. Deficient feedback and changes during the process are attributes of dynamic complexity (Te'eni, 2001, p. 257).

Te'eni's model in principle is unidirectional from sender to receiver. This means that inputs are given and goal oriented senders choose communication strategies, media and message forms. Te'eni identifies as open issue for further research the exploration of the feedback loop from impact of communication to communication inputs, especially the sender-receiver distance (Te'eni, 2001, p. 291). This is where our study intends to make a contribution. We propose a model explaining the adaptation process of language communities in cases of insufficient mutual understanding to reduce the sender-receiver distance.

We first review language focused IS research. We then define theoretical building blocks to be integrated into one model. Finally we discuss how our contribution relates to recent empirical findings in IS and linguistic research.

2 Related Work

Language, or linguistic communication, is “a form of social action constituted by social conventions for achieving social ends, premised on at least some shared understandings and shared purposes among users” (Tomasello, 2008, p. 343). These kinds of social objects are just the continuous possibility of activity (Searle, 1995, p. 36). Language thus provides potential action. Language is a device that people use to coordinate their behavior with one another so as to achieve some purpose (Malone and Crowston, 1994, Pinker and Jackendoff, 2005). Te'eni's review reveals that “mis-communication will be higher when inter-cultural distance is greater, because of different languages, different patterns of using language, different values and beliefs, and different attitudes to communication” (Larkey, 1996, Te'eni, 2001, p. 289).

Earlier other researchers have drawn attention to the importance of language for ISR (Flores et al., 1988, Flores and Ludlow, 1980, Goldkuhl and Lyytinen, 1982, Lyytinen, 1985, Winograd and Flores, 1986). The application of linguistic approaches to organizations has been considered by a number of IS researchers as a necessary advance in IS theory (Clarke, 2001, Land, 1985, Rzevski, 1985, Tully, 1985). Language-based communication is taken as suitable basis for understanding and designing IS (Winograd, 2006) and linguistic studies provide a link between technology and humans/organization (Eco, 1976, p. 8).

There are studies in ISR on the relationship between different languages and IT (Holmqvist, 1989, Holmqvist and Andersen, 1987, Kaasbøll, 1987, Pernille and Ojelanki, 2009, Wynn et al., 2002), and the important role of language in IT-based communication systems is a special concern of the Language-Action Perspective (Auramäki et al., 1992, Auramäki et al., 1988, Flores et al., 1988, Goldkuhl and Lyytinen, 1982, Schoop, 2001, Winograd and Flores, 1986), of Symbolic Interaction studies (Gopal and Prasad, 2000), or Organizational Semiotics (Clarke, 2001).

The Language Action Perspective (e. g., Flores et al., 1988, Winograd, 1988) has made language and communication the cornerstone of IS development (ISD) and modeling as well. A semiotic approach to ISD is presented by (Stamper et al., 2000). The authors build on Peirce's version of the semiotic triangle (1931-1935) and the FRISCO report (Falkenberg et al., 1998) to conceptualize signs and norms in a six layer model starting from physical signals and ending with pragmatic norms specifying the shared meaning of signs for groups of persons.

To understand the yet open problem of how the mechanics of feeding back communication impacts to close the sender-receiver gap might work we propose four theoretical building blocks in the next chapter which will be integrated into one model intended to explain the dynamics of organizational communication in chapter 4.

3 Theoretical Building Blocks of the Model

In the next chapter we present a model to theoretically explain how the feedback from communication impact to communication inputs (Te'eni, 2001, p. 291) works as self-organizing process in realizing the dynamics of organizational communication. We use joint linguistic actions of individuals to explain emergence and adaptation of linguistic communication of a group. In this chapter we introduce and justify the theoretical concepts and building blocks required for our model. For every single building block we present the theoretical background and give empirical evidence for our own conclusions. The building blocks we need are: two modes of operation (Figure 1), structure of adaptation process (Figure 2), awareness of language adaptation (Figure 3), and finally, control of modes of operation (Figure 4).

Two Modes of Operation

We refer to the model developed by (Holten, 2007) and propose as first building block of our model two modes of operation of a group of communicating individuals: Mode of Discourse and Mode of Adaptation. Our model is framed by a broad philosophical approach called Language Critique. Language Critique is a branch of the philosophy of language known as the “Erlangen School” (for reviews see Butts and Brown, 1989, Kamlah and Lorenzen, 1984, Lorenzen, 1987). Language Critique argues that human beings use language to disclose the world (Kamlah and Lorenzen, 1984, p. 33). Every perception of the world is language-bound so that language becomes the mediator between reality and an individual (Wittgenstein, 1953, § 2).

Language Critique offers the concept Language Community to explain why and how a group of people is able to understand each other, and to establish the conventions making the syntax, semantics and pragmatics of signs (Kamlah and Lorenzen, 1984, pp. 45-47): a Language Community is a group of people that shares the relation of concept (meaning of a

thing) and sign in a Term (a sign which has meaning) as the knowledge of how to use this Term.

Terms are agreed-upon predicators (Carnap, 1956, p. 6); we state something about an object to which we point, in that we assert or deny a predicator of the object (Kamlah and Lorenzen, 1984, p. 18). The explicit separation of “sign” and “meaning” helps us to avoid the problem of specifying the much disputed construct “concept” as an abstract cognitive unit of meaning (for a discussion, see Margolis and Laurence, 2006). We are only interested in the combination of sign and concept in a Term.

In the words of Kamlah and Lorenzen (1984), since “discourse as actualized activity pursues the particular end of mutual understanding, we may say of language ... that as a system of signs it promotes mutual understanding. For this very reason it is, in a unique way, a ‘know-how’ held in common, the possession of a ‘language community’” (p. 47). The key notion is that within a language community, people acquire specialized kinds of discourse competence that enable them to participate in specialized groups (Faigley et al., 1985, p. 20). A domain-specific language is called a Terminology. A Terminology is a set of technical Terms in a subject field, practice, or domain; it is the “common knowledge” of a Language Community.

We use this broad philosophical basis to separate the Mode of Discourse from the Mode of Adaptation. In the Mode of Discourse a group of persons uses a domain specific language while in the Mode of Adaptation the group creates or adapts this language. We propose that adaptation of language is a mode of joint action (Garrod and Pickering, 2009, Pickering and Garrod, 2004) which is observable in practice. Evidence for this mode of language adaptation was found, e. g., in the study of (Corvera Charaf and Rosenkranz, 2010). In this study the authors propose a pattern for semantic alignment of stakeholders in development teams in the requirements development phase of ISD. The study was performed in an ISD project developing an application for analysis, storage, and retrieval of market-

specific and user-customized data. In this research, semantic alignment as an interaction purpose in requirements development was observed. A communication pattern was developed based on authentic communication data, collected through qualitative fieldwork.

Communication patterns depict the standardized structures of linguistic interaction; their reconstruction is a unique way to understand the social achievement of interaction purposes (Redder, 2008, Titscher et al., 2000).

Four main categories for achieving semantic alignment and shared understanding were identified: “definition”, “request”, “reassurance”, and “adjustment”. They represent active contributions to the development of a shared language between stakeholders. As semantic alignment is related to the symbol-concept combination of a sign, the focus of research was on investigating which part of the symbol-concept combination is being targeted by every single alignment action.

It was found, for example, that alignment mostly occurs as actions of definition focusing on the alignment of concepts as the meaningful part of language. While these observations seem to be satisfying regarding the emergence of shared understanding, other observations showed the importance of symbols for the maintenance of a shared understanding. Moreover, evidence was found for the negative impact of unspecified alignment actions on the effectiveness of the alignment process.

Following Shannon and Weaver (1949)’s communication model in developing the pattern for semantic alignment, the study departs from two idealized roles of stakeholders (sender and receiver). Nevertheless, Corvera Charaf and Rosenkranz (2010) resolve this unidirectional view and describe an iterative process of joint action: the interaction begins with an action with language-defining character performed by stakeholder A. Stakeholder B then analyzes if an alignment of the utterance is required. If required, s/he has different options to react according to prior knowledge and her/his (fractional) understanding of symbol-concept combinations. After her/his action, stakeholder A again has the same options

of reaction, and the thereupon following reactions lead to an iterative process. At every stage of the process alignment is either achieved and stakeholders proceed with their interaction (which we call Mode of Discourse), or the alignment process is aborted and stakeholders proceed without alignment (which in contrast in our model would mean to remain in the Mode of Adaptation as we will see later).

Corvera Charaf and Rosenkranz (2010) showed that semantic alignment is observable in practice. We combine this finding with two levels of language, namely discourse and construction as proposed in (Holten, 2007) on the broad basis of Language Critique (Kamlah and Lorenzen, 1984), to motivate the first theoretical building block for our model which gives the set of required operating modes to realize the feedback of communication impact to sender-receiver distance (Te'eni, 2001, p. 291). We propose two fundamental modes of operation: Mode of Discourse and Mode of Adaptation. The adaptation process itself is an iterative and permanent change of a group of communicating persons between these two modes (Figure 1).

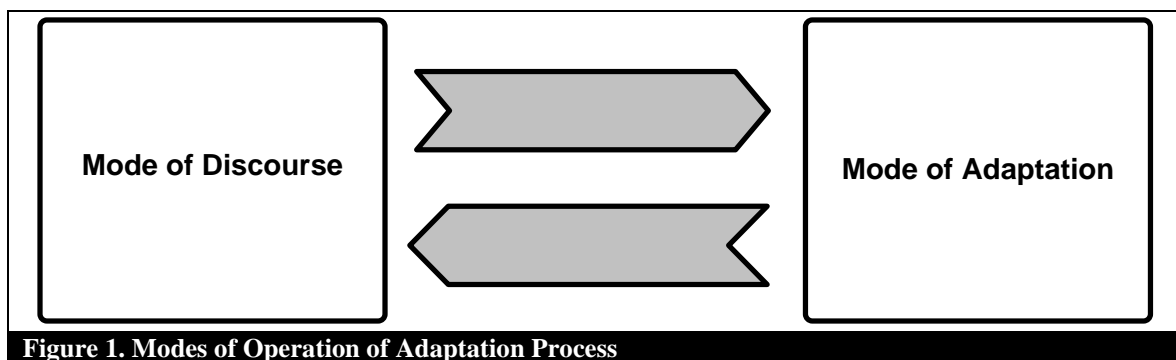


Figure 1. Modes of Operation of Adaptation Process

Structure of Adaptation Process

As second theoretical building block we propose that the process of language adaptation is initiated by changes of environmental conditions. The group of persons then adapts their domain specific language which leads to a changed or augmented Terminology. If

environmental conditions change, there are two cases of relevance for members of a Language Community (Holten, 2007):

1. The situation is known to the group. The group members have a shared understanding, established interpretative schemes, and Terms to describe this situation in domain-specific linguistic statements. These interpretative schemes are “the modes of typification incorporated within actors’ stocks of knowledge, applied reflexively in the sustaining of communication” (Giddens, 1984, p. 29).
2. The situation is unknown to the group. They have no established interpretative schemes and lack the Terms, along with the relevant shared understanding, to describe this situation in domain-specific linguistic statements.

In the first case, the group of persons forms a Language Community and the given Terminology enables them to engage in so-called terminological discourse about situations in the known world. The group remains in the Mode of Discourse. In the second case the group does not form a Language Community for the new situation. The established interpretative schemes do not provide the concepts, and the Terminology-in-use does not provide Terms required for understanding the new situation properly. Consequently, the group has to use words (signs) in pre-terminological, natural language for descriptions, conversations, and communication. The meaning of these words (signs), however, may be ambiguous because of conflicting interpretative schemes. Initially, these words are not agreed-upon Terms.

Yet, new Terms (in new situations) arise through predication from pre-terminological statements by use in specific contexts. Following Kamlah and Lorenzen (1984) this is called Language Construction. Language Construction aligns the meaning of Terms and relies on “the very accomplishment of acting and living together”. In the words of Kamlah and Lorenzen (1984, p. 36), what “ ‘walking’ or ‘eating’ is, ‘sawing’ or ‘plowing’ or ‘roasting’, ‘controlling oneself’, ‘agreeing’, ‘praying’, ‘loving’ and so on: we learn these things linguistically only along with the activities themselves, at the same time.” (p. 36) This is also

called Empractical Learning; persons have to experience what the meaning of a Term in specific situations really is (Bühler, 1990, pp. 176-179). Empractical Learning, acting and living together, has to take place in the case of Language Construction.

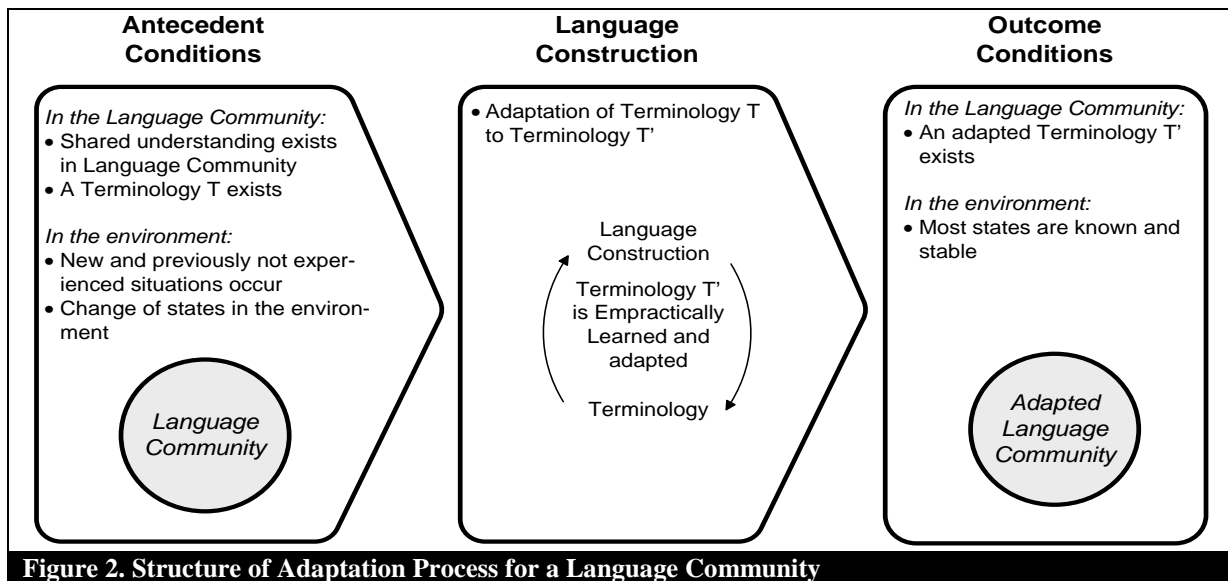
There is empirical evidence that Empractical Learning takes place to enhance mutual understanding in specific situations. In their exploratory study (Vranesic et al., 2011) found that the exchange of persons in data warehouse (DWH) development teams as well as the exchange of boundary objects in use could accelerate the progress of knowledge in the team if these exchanges matched the changing needs and knowledge in the development process.

In modification of the one-sided definition of brokering limited to IT developers who manage coordination and knowledge transfer across the borders of communities (Pawlowski et al., 2000, p. 335), the study of (Vranesic et al., 2011) introduces the concept of a brokering situation as a knowledge exchange situation with at least two boundary spanners from different communities of practice that each adopts the role of a broker. In DWH development, DWH professionals take the role of such brokers in the knowledge exchange on two different borders. On the one hand, eliciting users' requirements means to meet and discuss with business experts, on the other hand, in interaction with operative system professionals who are in charge of source data systems, DWH professionals concentrate on the technical design of extraction, transformation, and loading (ETL) processes (Kimball and Caserta, 2004). Only in close cooperation with knowledgeable operative system professionals can DWH professionals extract and interpret operational data so that it matches the users' requirements.

The study found that each broker independent of background can become familiar with required domain knowledge of another domain and can compensate for missing or inaccurate semantic interpretations of discussed issues during a brokering situation. Chakraborty et al. (2010, p. 235) have already discussed similar types of developer-based and user-based factors acting as enablers/inhibitors of the requirements elicitation process. However, these factors were grouped according to participants' roles in the project. In

contrast, the findings of (Vranesic et al., 2011) show that the line between those participants who possess necessary knowledge due to previous experience and those who do not was dynamically moving in the course of different projects. Vranesic et al. (2011) observed that in cases with apparent gaps in mutual understanding the role of single brokers played a significant role in closing these gaps.

These findings lead to the second theoretical building block for our model intended to explain the dynamics of the feedback of communication impact to sender-receiver distance (Te'eni, 2001, p. 291). Language adaptation closes the sender-receiver gap in changing environments with insufficient mutual understanding (Holten, 2007). Empractical Learning is a suitable theoretical concept to explain how a group reaches alignment of sign and meaning. Empractical Learning therefore is the link between the Mode of Adaptation (right part of Figure 1) and Language Construction (center of Figure 2) explaining the dynamics of the language adaptation process. We propose that the process of adapting a Language Community to environmental changes is structured in three phases (Figure 2): Antecedent Conditions, Language Construction, and Outcome Conditions. The adaptation process is triggered by changes of environmental conditions (Virany et al., 1992). Human agents recognize and act on changes of environmental conditions by altering their established interpretative schemes and adapting their domain-specific language. Language Construction extends and changes Terminologies and leads from a Terminology T to a Terminology T' . An arbitrary sequence of Language Constructions leads from Terminology T_1 to Terminology T_n in $n-1$ steps (Holten, 2007).



Awareness of Language Adaptation

The third building block for our model proposes to stop Empractical Learning in the Mode of Adaptation when Equivocality of Peers' Statements is reduced to an acceptable degree within the group of communicating persons. While Language Critique (Kamlah and Lorenzen, 1984) states that Empractical Learning is required to align Terms it does not answer the question when to change from Mode of Adaptation back to the Mode of Discourse from a practical perspective. Therefore we propose to use clarity of the sign-meaning relationships in peers' utterances as perceived by persons in the group as criterion.

There is empirical evidence for the practicability to use sign-meaning relationships in utterances as criterion to judge language quality. First, (Corvera Charaf et al., 2010) propose the concept of language quality based on the analysis of an ISD project, second (Rosenkranz et al., 2010) propose to enforce clear sign-concept relationships in ISD projects.

The concept of language quality was proposed in the qualitative study of (Corvera Charaf et al., 2010). This study is based on the same ISD project as the study of (Corvera Charaf and Rosenkranz, 2010) already discussed above. (Corvera Charaf et al., 2010) analyzed how effectiveness of ISD depends on the ability to manage how people deal with language in practice and reach a shared understanding. The research was restricted to (natural)

language as communication channel used in ISD and focused on the observable level of language. The study analyzed how shared meaning was constructed during the interaction of stakeholders in an ISD project.

The concept of language quality was defined by (Corvera Charaf et al., 2010) as the degree to which a symbol obtains and retains a relationship to a concept. Language quality thus focuses on the concept-symbol relationship built during the language definition process (which we call Mode of Adaptation). Consequently, it was assumed that the quality of language can be observed as mappings between symbols and concepts given the language definition process as context. To frame their study (Corvera Charaf et al., 2010) drew on the semiotic tetrahedron (Falkenberg et al., 1998), an adaptation of the semiotic triangle (Ogden and Richards, 1923).

Corvera Charaf et al. (2010) conclude from their findings that it might be very useful to strive for an early explicit agreement on representing symbols for relevant concepts in order to avoid the emergence of volatile symbols, long discussions, or insecurity regarding mutual, shared understanding. Language quality therefore requires a constant attention and revision.

The negotiation of symbol-concept relationships is analyzed in the study of (Rosenkranz et al., 2010). In their design science study the authors use a multi case analysis to stepwise design and evaluated their approach of forcing DWH development teams in the financial industry to explicitly specify the meaning of attributes in the ETL phase of DWH development projects. Since data warehousing in the financial industry is confronted with tremendous problems due to the heterogeneity of meanings this setting is ideal to study how mutual understanding emerges. The evaluation is based on a qualitative cross-case analysis and shows that developers and managers judge projects to be more successful if they were based on the strict approach of forcing the development teams in very early phases to explicitly create mutual understanding. This study is framed by theoretical principles about

the communication process proposed by Clark and collaborators (Clark, 1992, Clark, 1996, Clark and Brennan, 1991, Clark and Krych, 2004).

The findings of these two studies lead to the third theoretical building block for our model. To understand the feedback of communication impact to communication inputs (Te'eni, 2001, p. 291) we need to assess sender-receiver distances. We propose to use Equivocality as a basis to decide on the probability of misunderstandings of a group in the Mode of language Adaptation: Language Construction by Empractical Learning proceeds until Equivocality between peers is reduced to an acceptable level (Figure 3). Equivocality, or ambiguity, means the existence of multiple and conflicting interpretations of a situation (Daft and Lengel, 1986, Daft and Macintosh, 1981, Weick, 1979, pp. 4-9). The meaning of a message or statement might not be clear due to greater variety, greater ambiguity, or simple ignorance, and because of differences in sense-making and cognition between individual human agents that construct different interpretative schemes.

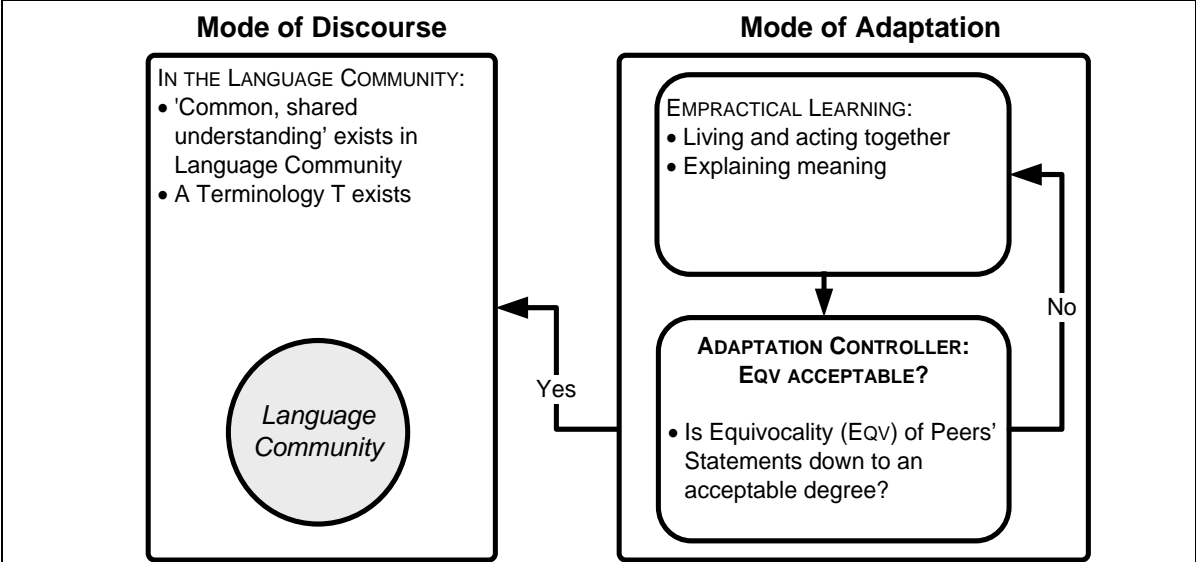


Figure 3. Awareness of Language Adaptation

Control of Modes of Operation

To explain why a Language Community changes from Mode of Discourse to Mode of Adaptation and vice versa we use the theoretical background, typology and terminology of

general systems theory and cybernetics (Ashby, 1964, Boulding, 1956). We regard a group of persons forming a Language Community as a system. Changing environmental conditions may lead to perturbations which are stimulating “irritations” that trigger internal operations in the system (Seidl, 2005, p. 23). They are disturbances that upset the balance of the established stasis of the system (Taylor, 1995, p. 8) and increase environmental variety (V_{EN}). Variety is the number of distinguishable states, elements and connections between the elements differentiated by an observer (Ashby, 1964, p. 126).

The variety of a Language Community (V_{LC}) is determined by the number of Terms of its Terminology. In the Mode of Discourse, human agents as members of the Language Community draw on their established interpretative schemes, using their contextual pre-knowledge and understanding of a situation that is manifested in their Terminology. Following the law of requisite variety (Ashby, 1964, p. 207), which states that only variety can absorb variety, we propose that for the Mode of Discourse the variety of a Language Community (V_{LC}) must at least be on par with their environmental variety (V_{EN}). Understanding a given situation thus depends on the number of Terms. We call this the Stability Condition of a Language Community: ($V_{EN} \leq V_{LC}$).

For the fourth theoretical building block of our model describing the feedback loop from communication impact to sender-receiver distance (Te'eni, 2001, p. 291) we enhance the model of (Holten, 2007) to explain the control of the Modes of Adaptation: given the number of Terms of the Terminology remains unchanged in case of rising environmental variety ($V_{EN} \uparrow$), the members of the Language Community do no longer have the requisite internal variety (V_{LC}) to understand the changed environmental conditions. The Stability Condition is broken ($V_{EN} > V_{LC}$) and the Language Community turns from the Mode of Discourse to the Mode of Adaptation (Figure 4).

In the Mode of Adaptation the members of the Language Community engage in Empractical Learning to create and align new Terms (Figure 2). Doing so, the Language

Community increases their internal variety ($V_{LC}\uparrow$) by transforming Terminology T into Terminology T'. As soon as Equivocality for every new Term is reduced to an acceptable degree (Figure 3) and enough new Terms are created, the Stability Condition is reconstituted ($V_{EN} \leq V_{LC}$) and the Language Community has acquired requisite internal variety to understand the new situation. The group changes back to the Mode of Discourse.

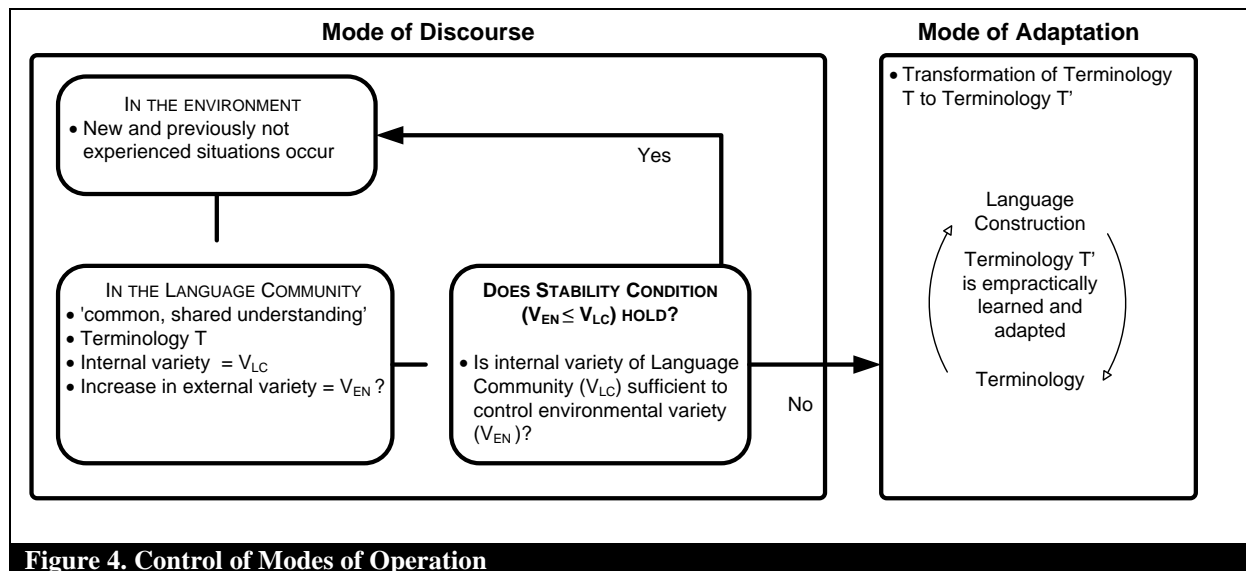


Figure 4. Control of Modes of Operation

We compile the concepts for our model describing the feedback loop from communication impact to sender-receiver distance (Te'eni, 2001, p. 291) introduced as theoretical building blocks in the following two tables. Table 1 summarizes concepts our theoretical argument is based upon; Table 2 lists and defines the concepts directly used to formulate our Propositions 1 and 2 in the following chapter.

Concept (Synonym)	Definition	Fundamental Literature
Term [used to define: Empractical Learning, Language Community, Terminology]	Relation of concept (meaning of a thing) and sign; a sign which has meaning for human agents; these human agents then have the knowledge of how to use this Term.	(Carnap, 1956, p. 6, Kamlah and Lorenzen, 1984, pp. 18, 45-47)
Terminology (Domain Specific Language) [used to define: Language Community, Mode of Discourse, Mode of Adaptation]	A set of technical Terms in a subject field, practice, or domain; it is the "common knowledge" of a Language Community.	(Kamlah and Lorenzen, 1984, p. 47)
Pre-terminological Statement [used to define: Empractical Learning]	Statements in standard or natural language which do not use Terms of a Terminology. Every human agent is able to make pre-terminological statements in any situation.	(Holten, 2007)
Environmental Variety	Variety is the number of distinguishable states, elements	(Ashby, 1964, p.

(V _{EN}) [used to define: Stability Condition, Breach of Stability Condition, Perturbation]	and connections between the elements differentiated by an observer. An observer is an individual human agent who is a member of a Language Community. Environmental variety is the number of distinguishable states, elements and connections between the elements differentiated by this person. Every single person has its own environmental variety.	126)
Variety of Language Community (Variety of Terminology, V _{LC}) [used to define: Stability Condition, Breach of Stability Condition]	The number of Terms of a Terminology.	
Stability Condition [used to define: Breach of Stability Condition]	The stability condition says that the Variety of a Terminology (Variety of Language Community, V _{LC}) must be at least as high as the Environmental Variety (V _{EN}); an individual human agent as member of a given Language Community knows to use V _{LC} Terms for this Language Community, if the number of distinguishable states, elements and connections between the elements differentiated by this human individual (V _{EN}) does not exceed V _{LC} , the stability condition holds; therefore the Stability Condition is: V _{EN} ≤ V _{LC} .	Law of requisite variety (Ashby, 1964, p. 207)
Perturbation	Any interaction between system (Language Community) and environment that increases Environmental Variety (V _{EN}). Stimulating “irritations” that trigger internal operations in the system. Perturbations are influences on the system from the environment that take the form, not of inputs, but of disturbances that upset the balance of the established stasis of the system.	(Seidl, 2005, p. 23, Taylor, 1995, p. 8)

Table 1. Basic concepts of model

Concept (Synonym)	Definition	Fundamental Literature
Language Community [concept in propositions 1&2]	A group of persons sharing the relation of concepts (meaning of a thing) and signs in Terms (signs which have meanings) as the knowledge of how to use these Terms. Persons as members of a Language Community have specialized kinds of discourse competence that enable them to participate in specialized groups. Members of a Language Community share the same Terminology.	(Faigley et al., 1985, p. 20, Kamlah and Lorenzen, 1984, pp. 45-47)
Individual member of Language Community [concept in propositions 1&2]	A person (human agent) who is a member of a Language Community.	
Mode of Discourse [concept in proposition 1]	In the mode of discourse, human agents as members of the Language Community draw on their established interpretative schemes, using their contextual pre-knowledge and understanding of a situation that is manifested in their Terminology. Members of the Language Community speak using the Terminology; they make terminological statements.	(Faigley et al., 1985, p. 20, Holten, 2007)
Mode of Adaptation (Language Construction) [concept in propositions 1&2]	A Language Community extends and changes its Terminology; this leads from a Terminology T to a Terminology T'. Existing Terms might be changed (new meanings are related to existing signs or vice versa) or augmented (new Terms are introduced for new situations, which means that new meanings are created). In the Mode of Adaptation Empractical Learning takes place.	Language Construction: (Carnap, 1956, p. 6, Holten, 2007, Kamlah and Lorenzen, 1984, pp. 18, 45-47)

Empractical Learning [used to define: Mode of Adaptation] [concept in proposition 2]	Acting and living together to experience what the meaning of a Term in specific situations really is. Empractical Learning is the operation driving the Mode of Adaptation. Pre-terminological statements are used while Empractically Learning a new or changing an existing Term.	(Bühler, 1990, pp. 176-179, Kamlah and Lorenzen, 1984, pp. 23-26 and 36-38)
Breach of Stability Condition [concept in proposition 1]	As soon as the number of distinguishable states, elements and connections between the elements differentiated by a human individual agent (V_{EN}) exceeds the Variety (number of Terms) of the Language Community (V_{LC}), the stability condition is broken: $V_{EN} > V_{LC}$.	
Perceived Equivocality of Statements [concept in proposition 2]	For individual human agents multiple and conflicting interpretations of a situation might exist. The meaning of a message or statement might not be clear due to greater variety, greater ambiguity, or simple ignorance, and because of differences in sense-making and cognition between individual human agents that construct different interpretative schemes. Typically pre-terminological statements are equivocal to a high degree while terminological statements are (by definition) unequivocal to the members of the respective Language Community.	(Daft and Lengel, 1986, Daft and Macintosh, 1981, Weick, 1979, pp. 4-9)

Table 2. Central concepts to formulate propositions 1 and 2

4 A Model of the Dynamics of Organizational Communication

We look at groups as organizational entities and we explain the emergence and adaptation of linguistic communication of a group based on joint linguistic actions of their individual members (Garrod and Pickering, 2009, Pickering and Garrod, 2004). We use Language Critique (Kamlah and Lorenzen, 1984) as theoretical framework to explain how linguistic actions of individuals implement coordinated communicative behavior on the group level, which is our intended theoretical contribution. Because of the law of requisite variety (Ashby, 1964, p. 207), a system has to regulate its internal variety as a reaction to variety-increasing events in its environment. Beer (1965) showed that in complex systems such as social systems, the process of adaptation to changing environmental conditions can only be achieved by processes of self-organization. We argue that new stimuli that are deemed important in the enactment and sense-making processes (Weick et al., 2005) by members of the Language Community trigger (re-) actions of these individual members (Figure 5) which explain the emergence and adaption of linguistic communication of the group.

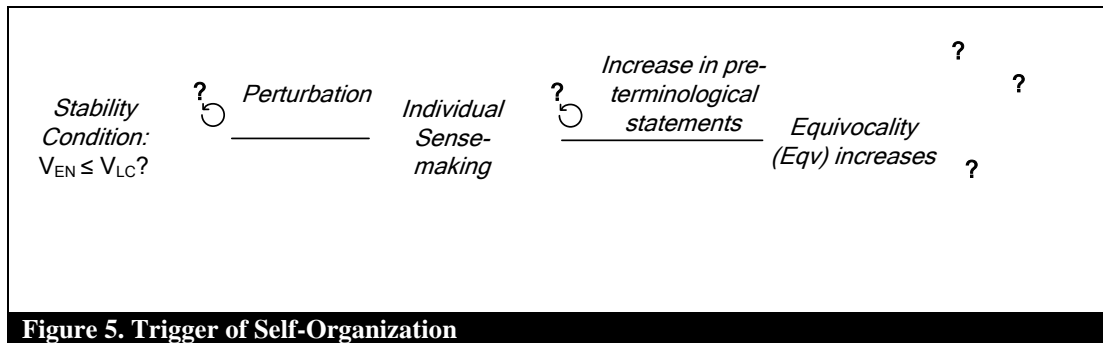


Figure 5. Trigger of Self-Organization

The stability condition ($V_{EN} \leq V_{LC}$, Figure 4 and Figure 5) is controlled by every individual human agent. If the stability condition is broken for any individual agent, this individual agent absorbs the increased environmental variety by individual sense-making processes. The respective individual agent transforms and replaces the complex, unknown world into an individually known world (Luhmann, 2005, p. 99). The group of persons (the system in focus) changes from Mode of Discourse into the Mode of Adaptation (see Figure 4). Agents' engagement in sense-making and enactment are observable in an increasing fraction of pre-terminological statements in natural language (compared to terminological statements), because individuals ascribe different words and signs to different concepts and meanings. A higher degree of pre-terminological statements mirrors an increase in perceived Equivocality (Eqv \uparrow).

There is empirical evidence in the study of (Holten et al., 2010) that persons use pre-terminological statements to a higher degree in new situations compared to known situations. Based on a quasi-experimental design (Campbell and Stanley, 1963, pp. 34-64) it was tested by (Holten et al., 2010) if degrees of shared understanding of an application domain can be empirically observed in linguistic communication. Chat protocols of first-year students were compared with chat protocols of advanced students studying logistics and operations management. Written conversation of randomly composed pairs of test persons were logged while discussing tasks to be solved. To calculate semantic similarity based on cosine distance

latent semantic analyses (LSA) (Deerwester et al., 1990, Landauer et al., 1998, Landauer et al., 2007) was used.

It was shown by (Holten et al., 2010) that both advanced students and first-year students on average are more semantically similar to their peers than to members of the other group. Additionally, semantic similarity is on average higher for experts compared to novices. Another test compared chat protocols with a corpus created based on course materials and revealed that the language used by advanced students is semantically more similar to the language used in the course materials than the first-semester students' language is.

We conclude that persons more familiar with a given situation use a different language compared to persons less familiar with the same situation. In other words, if the environment of a group of persons changes from familiar to unfamiliar and this change has a certain degree of intensity, it should be mirrored by decreasing semantic similarity of linguistic statements made by group members. Heterogeneity of statements will increase. This means that in new situations pre-terminological statements are used to a higher degree compared to known situations.

This process of Empractically Learning and aligning new Terms will go on as long as individual agents in the group feel the degree of Equivocality to be too high for terminological discourse. In fact the degree of Equivocality perceived by individual human agents (right part of Figure 5) is the implementation of the self-organizational controller of the emergence and adaptation of the group's linguistic communication (right part of Figure 3).

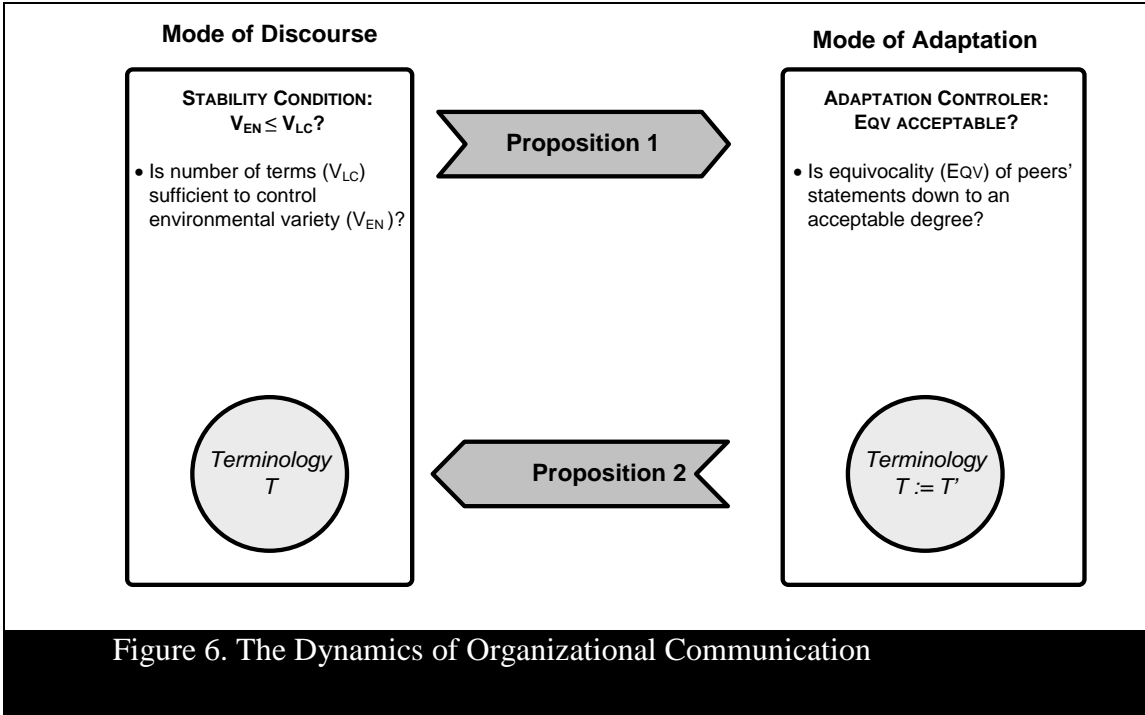
We argue that (re-) actions of individual members of a Language Community to perturbations lead to a series of Terminology modifications that result in new or modified agreements on the meaning of Terms and change the knowledge about the world shared by the Language Community (Holten, 2007). As a result, we suggest the following propositions (see Figure 6) to theoretically explain how the feedback from communication impact to

communication inputs (Te'eni, 2001, p. 291) works as self-organizing process in realizing the dynamics of organizational communication.

In case of changing environmental conditions and resulting sense-making processes of individual human agents, the Terminology of the Language Community may no longer be sufficient to handle this new situation. We propose:

Proposition 1 Any Breach of the Stability Condition for one individual member turns a Language Community from the Mode of Discourse into the Mode of Adaptation.

Proposition 2 In the Mode of Adaptation, members of the Language Community engage in Empractical Learning until perceived Equivocality of peers' statements is reduced to an acceptable degree for every individual member.



5 Discussion

This paper deals with organizational communication. In accordance with (Te'eni, 2001, p. 291) we identified as research gap the feedback loop from impact of communication to communication inputs. We are especially interested in the question how mutual

understanding as communication impact can be fed back to close sender-receiver distances in communicating groups of persons. As Te'eni (2001, p. 291) suggested we elevated his discussion from the level of groups as organizational entities to the level of joint actions of individual human agents as members of groups. We explained how linguistic communication as joint action of individuals (Garrod and Pickering, 2009, Pickering and Garrod, 2004) dynamically enhances mutual understanding of groups as organizational entities and thus reduces cognitive distances of interlocutors. Cognitive distance in fact is due to different views on the world manifested in language (Te'eni, 2001, p. 257).

We proposed a model (Figure 6) to close the required feedback link from communication impact to communication inputs in the cognitive-affective model of organizational communication developed by Te'eni (2001). We showed how mutual understanding feeds back to reduce cognitive complexity (Te'eni, 2001, p. 291). The mechanisms we described relate to and substantiate Te'eni's propositions 9 a & b which aim at the relationship of cognitive distance and contextualization, and frequency of requested information respectively (Te'eni, 2001, p. 287). Our model intends to explain how contextualization is operationalized by Empractical Learning and Language Construction in the Mode of Adaptation (Figure 2 and Figure 3) and how the mechanics of reducing sender-receiver distance are controlled in a self-organizing way by a group of communicating persons (Figure 4 and Figure 5).

Our model of the dynamics of organizational communication draws on Language Critique (Kamlah and Lorenzen, 1984) as philosophical basis to explain how linguistic actions of individuals implement coordinated communicative behavior on the group level. We integrate these actions of individuals with theoretical knowledge from cybernetics and systems theory (especially Ashby's (1964) law of requisite variety and Beer's (1965) explanation of self-organizing behavior) to explain the emergence of communication on the group level, which is our intended theoretical contribution. We propose that our model is a

meaningful extension of Te'eni's (2001) model, since our model explains the dynamics of organizational communication which Te'eni's (2001) model does not. Nevertheless, in contrast to Te'eni's (2001) model, our model is restricted to linguistic communication.

Our model explains the ability of a group to efficiently reduce linguistic distances by constructing a common language. We argue that this ability is a main component of collective intelligence (Williams Woolley et al., 2010). In their empirical study (Williams Woolley et al., 2010) provide evidence for a collective intelligence factor and its independence of personal intelligence of group members. Additionally they show that balanced communication within a group is another important parameter correlated with collective intelligence. This is in line with the study of (He et al., 2007) providing evidence for the importance of communication within development teams. We therefore conclude that our model might contribute to the theoretical explanation of linguistic communication as a factor of group efficiency in solving creative tasks.

We justified our theoretical building blocks with empirical findings concerning groups Empractically Learning linguistic symbols in ISD projects. In contrast to these real world organizational settings (Galantucci, 2005) used virtual settings in his experimental study to provide evidence for the emergence of rudimentary symbolic languages. He showed as well (without using our theoretical concept) that the meaning of symbols is Empractically Learned by human agents. We agree with Galantucci (2005, p. 746) that the same mechanisms as found in his study work in real organizational settings based on natural human languages as well. The concept Empractical Learning is also supported by empirical research on the influences of visual information on linguistic information processing in the brain (Tanenhaus et al., 1995).

Furthermore, we argue that natural languages provide a sufficiently large repertoire of symbols which was empirically found to be critical for the emergence of languages (Selten and Warglien, 2007). Our model is at least from a structural point of view compatible with

these findings. Positive effects of emerged languages and task fulfillment were observed by (Galantucci, 2005) and (Weber and Camerer, 2003). Therefore, we conclude that Empractical Learning and Language Construction as described in our Mode of Adaptation could have a positive effect on groups' task fulfillment, if managed properly.

Finally, our model of the dynamics of organizational communication overcomes the unidirectional effect from sender to receiver as proposed by (Te'eni, 2001) by introducing an iterative dialog-oriented mechanism. This is in line with conceptual (Garrod and Pickering, 2009, Pickering and Garrod, 2004) and empirical (Garrod and Doherty, 1994, p. 214) linguistic research advocating for output-input co-ordination as well. We, thus, argue that Empractical Learning in the Mode of Adaptation is the mechanism to reduce cognitive sender-receiver gaps in communicating groups. Our model is therefore restricted to linguistic communication of groups.

We argue (Figure 6) that individual sense-making of individual agents as members of a Language Community in new situations is the trigger to change from Mode of Discourse into the Mode of Adaptation. Then, in the Mode of Adaptation Empractical Learning goes on as long as Equivocality of statements of peers is reduced to an acceptable degree. Further research can use these concepts to (1) clarify how to estimate and measure levels of Equivocality, (2) to show (e.g., based on experimental settings) if environmental changes lead to individual sense-making and (3) higher degrees of pre-terminological statements and, finally, (4) if a focused management of changes between Mode of Discourse and Mode of Adaptation is positively correlated with group task fulfillment.

6 Conclusions

The question how we can feed back mutual understanding as communication impact to reduce cognitive sender-receiver distances in communicating groups is of relevance for organizational change projects. Since IS are socio-technical systems ISD is directly affected

by this question. The ultimate goal of organizational change projects are better coordinated business processes. A presupposition for coordination is mutual understanding. Therefore, organizational change projects as well as ISD projects should strive for accelerating mutual understanding to be efficient. We proposed a model to explain why mutual understanding in linguistic communication is a main factor to reduce cognitive distances of interlocutors and how mutual understanding can be brought about in groups. Nevertheless, mutual agreement can only be enforced in an indirect manner as language construction is a self-organizing process due to sense making procedures of persons. Consequently, a focused management of changes between the Mode of Discourse and the Mode of Adaptation should help groups to be more efficient in reaching the goal of better coordinated business processes.

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