An Extended Model of Knowledge Communication:
The Situational View of Dealing with Asymmetries

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Abstract In this paper, we examine the consequences of knowledge asymmetries in complex communication scenarios, looking especially at those situations in which professionals – in our cases translators and visual information designers – are required to manage communication for other parties, produce texts and design information. After describing the general knowledge communication setting in information design processes, we will discuss the knowledge asymmetries and diversities which characterize this scenario. We base our arguments on conceptualizations of knowledge as constructive and situative. This constructivist, situational perspective on knowledge confronts us with new challenges for translators and visual information designers. To overcome these challenges, we propose an extended model of knowledge communication and different strategies for addressing the changes in information design and translation practice that result from a situated view on knowledge communication. This novel conceptualization of the knowledge communication setting manifests itself in four changes to the information design process: a changed view on user knowledge as situated, on artefacts as enriched, of target users as innovators, and of information designers as situation designers.

Keywords knowledge asymmetries, information design, knowledge communication, translation, visual information design, situated cognition

1 Introduction[1]

Imagine the following situation: you buy a new smartphone, turn it on, but find you cannot use it (a situation two of the authors found themselves in only recently). You consult the operating instructions, but after a quick look, you become aware that you don't understand them. Why? You might lack the necessary knowledge of the subject matter. Or the author might have used terms you do not understand. Your knowledge and that of the author are not symmetrical. Such knowledge asymmetries often present barriers in communication processes. Overcoming them is the task of those people who mediate between suppliers and their customers: information designers, translators, interpreters, technical communicators, etc.

In this paper, we examine and try to explain the consequences of knowledge asymmetries in complex communication scenarios, looking especially at those situations in which professionals – in our cases translators and visual information designers – are required to manage communication for other parties, produce texts and design information and thus overcome the various communication barriers that confront non-professional communicators.

Information designers use "pictures, symbols, colors, and words to communicate ideas, illustrate information or express relationships visually" (Tactical Technology Collective 2008). Their aim in doing so is to augment cognition. In our cases, translators use mainly verbal means to communicate information, whereas nonverbal, visually designed information is a dominant factor in the work of information designers. Since texts and visual elements can be combined in many ways, we will address both forms of information design in this paper in order to adequately cover the middle ground in enriched artefact design.

After describing the general knowledge communication setting in information design processes, we will discuss the knowledge asymmetries and diversities which characterize this scenario. We base our arguments on conceptualizations of knowledge as constructive, individualistic, and situative. Taking a constructivist, situational view on knowledge influences the way we conceptualize knowledge communication: cognition – and, consequently, also communication – is a context-dependent process in which the interplay of social environment, scaffolding artefacts, the brain, and the body form an extended network of activity (Ziemke/ Frank 2007, Hutchins 1995, 2010). Therefore, knowledge asymmetries arise not only on a cultural, but also on the individual, community and situational levels.

This constructivist, situational perspective on knowledge confronts us with new challenges for translators and visual information designers which have not been previously addressed systematically. To overcome these challenges, we propose a number of different strategies which can be applied in the process of creating mediating artefacts – be they translations, information visualizations, or other designed artefacts.

2 General Setting of Knowledge Communication

Common depictions of knowledge communication usually involve a knowledge source (A), targeted individuals or groups (C), and – in the case of professional knowledge communication – a mediating party (B) who strives to transfer specific content or information from A to C (see Figure 1).
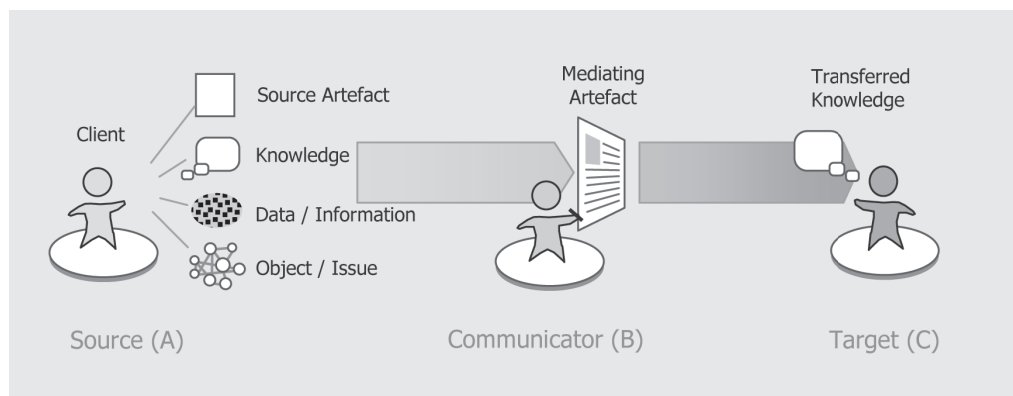

Figure 1: Traditional model of knowledge communication

Classic communication models (Shannon/Weaver 1949, Hollnagel/Woods 2005) only rudimentarily cover scenarios of knowledge communication 'in the wild'. Such settings and the aspired 'transfer process' from A to C are highly complex and can involve a number of asymmetries and barriers which form formidable challenges for all sides. The traditional way to deal with these challenges is to entrust the matter to agents who are (or have been) part of both the source and the target community and should thus be able to handle the transition by bridging the two worlds with mediating activities and artefacts. A classic example is the assumption that any person sufficiently proficient in both the source and the target language will be able to translate a text, i. e. viewing translation as a linguistic process of decoding and encoding an invariant, text-inherent meaning.

Knowledge communication can be defined as the "(deliberate) activity of interactively conveying and co-constructing insights, assessments, experiences, or skills through verbal and non-verbal means" (Eppler 2006: 317). This includes a change of perspective away from trying to communicate knowledge from A to C (as in the classic model above) towards a view of a dialogical, transactive process of co-construction (Kastberg 2010, Peschl/Fundneider 2010, Risku/Peschl 2010). Co-construction is most easily accomplished in direct face-to-face communication situations. In all other situations (particularly those involving media-based or mass communication as is often the case in translation or information visualization) this transactive situation has to be consciously reproduced (this is the overall goal situation as depicted in Figure 5; however in practice, trade-offs often have to be made, as shown in Figures 2–4). Some of our approaches therefore build on a classic communication model and only become transactive through their supplementation with other approaches. In this article, we seek to discuss the range of opportunities that can be used to make the process partially or fully transactive.

In this process, visual information designers and translators – as managers of this communication process – have to adapt their activities and products to the target community (see functional theories on translation; Vermeer 1989, Holz-Mänttäri 1984, Nord 1997). In other words, they have to take into account the knowledge held by senders and recipients and the asymmetries in this knowledge. Clark and Murphy (1982) refer to this adaptation to the target group as "audience design". In the absence of detailed information on the recipients' knowledge, communicators may make use of heuristics, e.g. assume that the target group's knowledge is similar to their own (Nickerson 1999) or that the target group is part of a specific community with a specific knowledge background (Clark/Murphy 1982). However, in practice, the situation is more complicated.

3 Asymmetries, Challenges and Barriers in Knowledge Communication

A highly simplistic view on knowledge regards it as 'transferable', i.e. as an object that can be easily conveyed from one person to another. However, knowledge is not a 'mailable' product (Risku/Peschl 2010); it has to be actively reconstructed by the receiver based on the information provided by the sender. This reconstruction is not an isolated activity in the human brain, but emerges instead "from multiple domains and systems, including the environment, perception, action, affect, and sociocultural systems" (Barsalou 2010: 325). This means that (1) understanding is always embedded in the meaning and reference systems of the different *individuals*, (2) information is interpreted according to the values and knowledge systems of the relevant *cultures* and *communities*, and (3) knowledge construction and communication are dynamic processes which adapt to the actual *situation* (see theories on situated cognition, e.g. Suchman 1987, 2007, and cognitive ecology, e.g. Hutchins 1995, 2010). Consequently, we will now take a closer look at these three sources of knowledge asymmetries and diversity.

3.1 Individual Asymmetries

It is common knowledge that people differ in their attitudes, personality, abilities, and numerous other aspects. However, the fact that these differences affect the way a person reconstructs the knowledge drawn from an artefact (e.g. a text or an image) is often neglected in the design and translation of information. In a knowledge communication context, prior knowledge, ex-

pertise and experiences are particularly relevant examples of such individual attributes. Classic text comprehension theories (Kintsch/van Dijk 1978) assume that bottom-up, artefact-driven and top-down, prior-knowledge-driven processes interact when a text is processed. Prior knowledge also influences the way we process information visualizations (Schnotz 2002). In communication situations involving subject matter experts, the influence of prior knowledge on comprehension rises from the fact that their knowledge is organized more efficiently than that of laypeople (Bédard/Chi 1992): expert knowledge is organized according to meaning, not superficial characteristics, with more connections between the single units. Accordingly, experts can build on a more structured knowledge base when they process new information and understand this information differently to their lay counterparts.

Creating an artefact which accommodates users with different attitudes, skills, and knowledge (Shneiderman 2000) poses a difficult challenge to information designers. For an artefact and its communicative function to be understood, the former has to meet the user's prior knowledge to some extent. Consequently, the designer has to establish a certain level of common ground with the user (Chen 2005).

Similarly, translations are meant to be read and interpreted by members of the target culture, whose understanding is grounded in their individual expectations, interests, and prior knowledge. Thus, the end result of the intercultural knowledge communication process is influenced by the individual transformations carried out by the target readers.

But these are not the only interpretations and transformations included in the process. Before a translated text reaches the reader, it has already been transformed by the translator. Translators try to understand texts for a specific reason and in a specific situation: they read a text in order to use it as source material for another text in another situation and for another culture. In doing so, they activate numerous patterns and use different interpretations, simultaneously trying to anticipate the possibility of integrating target relevant contents in the target cultural situation. Each translator's know-how, experience and prior knowledge of the source culture affect the way he/she understands. The picture of understanding that emerges here is one of a prospective interpretation process based on the individual knowledge of the translator as a communicator with a job to fulfil (not a subject independent decoding of a linguistically transparent meaning). Depending on their level of competence and the complexity of the job, translators in their capacity as mediators might use learned checklists or various individual, systematic text analysis routines (involving extra-textual aspects such as place, time, sender, receiver, and medium, and intra-textual aspects like word order, verbal and nonverbal signs; see Nord 1991). The actual aspects which are given most attention in a specific translation project depend on the job itself and the anticipated function of the target text (i. e. the translation).

3.2 Community and Culture-Based Asymmetries

In addition to individual factors like prior knowledge, membership in a group, culture, or community also influences how an artefact is understood. In a work context, employees can be members of *communities of practice* (CoPs), i. e. "groups of people informally bound together by shared expertise and passion for a joint enterprise" (Wenger/Snyder 2000: 139). In addition to their individual knowledge, CoP members have a shared knowledge system that includes both socio-technical systems and conceptual frameworks (Fischer/Ostwald 2003, Lave/Wenger 1991). Information is interpreted with reference to this knowledge system, which

serves as common ground for knowledge communication (Clark/Brennan 1991), thereby enabling members of the community to communicate effectively, but at the same time acting as a barrier to people outside the community who do not share this common ground.

Interactive communities of practice share many characteristics with cultures and can thus be seen as subcultures, i.e. parts of larger cultural frameworks. Chiu and Hong (2005: 490) emphasize the dynamic and agentic aspects of culture:

> In this view, culture consists of a network of knowledge and practices that is produced, distributed, and reproduced among a collection of interconnected people; [...] because cultural knowledge in a delineated population is not perfectly shared, cultures are not homogeneous monoliths.

Thus, the concept of culture is closely linked to the concept of knowledge. The cultural anthropologist Fredrik Barth (2002: 1) refers to knowledge as "all the ways of understanding that we use to make up our experienced, grasped reality". According to Barth (2001: 1), "knowledge provides people with materials for reflection and premises for action" and "action becomes knowledge to others".[2] Cultures are characterized by partly shared value and knowledge systems that result from interaction, common experiences, and specific cultural (mental and physical) artefacts. As an essential element of culture, languages are interpreted within these value and knowledge systems. Unlocalized icons and product names, for example, often acquire unprecedented meanings in a target culture. Similarly, a technical translation may need to be written and designed in a fundamentally different way to the source text in order to achieve a similar function or impact in the target culture as the original did in the source culture.

In contrast to members of communities of practice or cultures, the members of a *community of interest* (CoI) cannot base their communication on a shared knowledge system. When members of different communities of practice come together with a shared goal (e.g. to gain insights from a translated text or an information visualization), they build a community of interest. Yet, the members of a community of interest lack a shared understanding (Fischer/Ostwald 2003), and knowledge asymmetries and diversities are likely. Since "communities are emergent [...] in the process of activity" (Brown/Duguid 1991: 49), they cannot be easily defined and characterized, but must instead be analyzed on a situational level.

3.3 Situational Asymmetries

Communication happens in the here and now. When readers and users look for meaning, try to make sense of an artefact and act, they draw on a number of environmental cues, starting with situational factors like the occasion, task at hand, aim, physical environment, what has been said before, and actual people involved (Risku 2002). More or less by accident, even the smallest environmental factors can play a crucial role for (or against) understanding. We thus rely on specific, prevailing spatio-temporal circumstances as a fundamental source of understanding: successful communication is dependent not only on knowing preconceived meanings and conventions, but also on designing for the contingencies of the target situation (Suchman 2007).

According to the situated action approach, one of the main reasons for our intelligence is that we delegate knowledge to our environment. By doing so, we reduce the need to store, search for, and process this knowledge in our brains. When we need information, these exter-

nal aids, like the artefacts in our communication scenario, are used as scaffolds (Clark 1997) and serve as teaching, learning, and organizational aids ('plan as resource'). A mediating artefact can support – or hinder – knowledge communication, depending on how well its design matches the situation and the user's individual and cultural knowledge. To communicate knowledge effectively and sustainably, the target audience, communities, and situations have to be analyzed and profiled accordingly (see Chapter 4).

Even though prior knowledge does not totally determine action, it does play an essential role in communication. In complex situations such as translation, where at least two different communication situations have to be grasped, prior knowledge allows us to make good use of the resources at our disposal and to interpret the situation and its verbalized components in a way that makes sense. However, prior knowledge can also be highly misleading: the sense the readers and users thus construct might follow a line of thinking that stems from another context or relies on prior information that is not adequate for the situation in question. This can be seen and experienced for example when new concepts and/or technologies are introduced: knowledge of mechanical machines might not apply in the PC world, while computer literacy might not suffice for interaction with the location-sensitive software on the touch screen of a handheld.

Figures 2–4 illustrate different asymmetries discussed in this article. They should be viewed as detail elements of the overall situation shown in Figure 5. In other words, the unidirectional arrows in Figures 2–4 only represent the middle main arrow in the overall model (Figure 5) in zoomed out or simplified form. All the bidirectional and interactive transactions in Figure 5 remain intact and also applicable to Figures 2–4 (including the iterative and participative loops).

Figure 2 provides an overview of the communication asymmetries described above. One of the major problems in information design is the knowledge gap between source and target (a), which is more severe when different target groups and receivers come into play. In these cases, the communicators have to deal with different knowledge levels (b), community and culture induced reception differences (c), and the effects of different situations (d). In the next section, we will introduce and illustrate different strategies that can be used by information designers and translators to take these knowledge asymmetries into account.
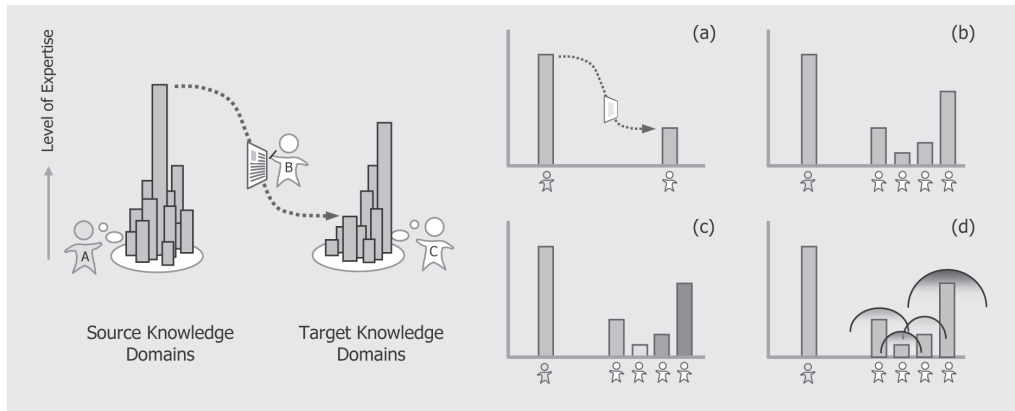
Figure 2: Knowledge communication as mediating activity between various levels and asymmetries of domain knowledge: (a) knowledge gap, (b) differing knowledge gaps of various individuals, (c) differing individual and community induced knowledge styles, (d) differently situated knowledge domains. This illustration is intended as a detail element of the extended model of knowledge communication shown in Figure 5.[3]

4 Overcoming the Challenges of Knowledge Communication

If knowledge is considered to be constructive and situative, this not only means that artefacts are received differently by each target person, but also that they have to be created differently: translators and information designers have to take into account the knowledge asymmetries and diversities shown in Figure 2 in the process of designing mediating artefacts. This affects not only the actual design of the artefact (Section 4.4), but also the information which needs to be gathered in advance (Sections 4.2 and 4.3), the participants in the process (Sections 4.1 and 4.7), and the support provided to receivers when they actually use the artefact (Sections 4.5 and 4.6).

4.1 Participative and Iterative Design

There are many approaches to bringing users or receivers into the communication design process. Ortlieb and Holz auf der Heide (1993) structured these based on the users' role, activity and temporal integration in the process by asking the following questions: (1) Who are the participants? This could be either the users themselves or representatives of the users. (2) How do the users participate? Users can be passive contributors or active co-decision makers (along with other stakeholders). Users are most active in so-called *user driven design*, where they can be viewed as (co-)creators. (3) When do the users participate? Users can be integrated during the whole process or only at specific times.

In contrast to closed and unidirectional artefact development processes, iterative development cycles permit information designers to consult the users more frequently. The major advantage of constant user participation (and usability testing) is the possibility it offers to obtain feedback on early versions and prototypes of an artefact, to observe artefacts in direct use in authentic situations, and to adapt the artefacts to the different ways they are used. Nearly all the examples in the following sections build on this iterative approach.

4.2 Information Analysis

As a precondition for translation or information design activities, communicators approach the source topics and facts, generate a deeper understanding of the source content, structure, and meaning, and identify which (prior) knowledge is required to understand or make use of them. Methods for analyzing verbally structured information include content analysis (Krippendorff 2004), close reading, discourse analysis, and heuristic approaches; corresponding methods for information design include document or data analysis, visual analysis and exploration, and workshops with experts.

Nord's model of translation oriented text analysis (Nord 1991) has become a text book approach in translation studies: the model shows translators how to situate the source material in its extra-textual situation and carry out a detailed intra-textual analysis in order to produce a translation that does justice to the original in those aspects of the text that are relevant for the target group. For example, when translating instruction manuals (for a similar purpose and function in the target culture), intra-textual characteristics such as lexis and text composition might have to be changed to accommodate knowledge levels and cultural conventions in the target culture.

In many translation projects, it is crucial to try to retrace the understanding of the source text receivers. Vannerem and Snell-Hornby (1986) and Kußmaul (2007) implement Fillmore's (1977) model of scenes and frames to explain the experiential basis of text comprehension. Source text writers and source text readers activate their individual and culture specific scenes in line with their experience. Depending on the communicative purpose of the translation, it may be necessary to try to find the nearest possible scene or else resort to trying to evoke different, yet communicatively adequate scenes in the target culture.

Since information design projects also rarely start from scratch, preparatory information analysis plays a crucial role here, too. From a practitioner´s perspective, there are several challenges to be overcome in the interplay between the communicator and the client. These can range from knowledge asymmetries about the domain to a lack of understanding of the client's intentions. All too often, the data basis is compellingly large, complex, and interrelated, and/ or the contents are over- or under-documented. Alongside classic solutions to overcoming these barriers (like glossaries, executive summaries, or document analyses), pre-processing information for restructuring purposes can also be of valuable benefit. For example, in one of our recent research projects (Smuc et al. 2009), the clients had to deal with hundreds of different statistical graphs to analyze their time-dependent data. The research team restructured the data by generating a 'theme park' of the complete collection of graphs on a single poster, using the visual metaphor of a river to represent the flow of time, and the operations on this river (e. g. reservoirs) for data aggregation. In the course of the project, these and other metaphors facilitated communication between the project partners by providing a common frame of understanding.

4.3 User and Situation Analysis

Indispensable insights can be generated by getting to know the (many different current and potential future) users and analyzing their (prior) knowledge, most important tasks, or (collective) activities in their own specific environments. Methods of doing so include in-depth interviews (the most common method), as well as ethnographic approaches (e. g. contextual

inquiry; see Beyer/Holzblatt 1998) in which the interviewer assumes, for example, the role of a trainee learning the job or tasks to be redesigned. Other, less user and/or situation invasive methods based primarily on estimations of representative users include target group definitions or user and task analysis (DIN EN ISO 9241 1997, DIN EN ISO 13407 1999), scenario techniques, and the persona method (Cooper 1999).

There is also an emphasis on user/reader and situation analysis in translation studies. The above mentioned extra-textual factors in Christiane Nord's analysis model (1991) are a case in point. In addition, Nord (1991: 38) stresses that the starting point in a translation process is not the source text and its analysis, but the analysis of the translation brief/order, including the prospective target communication situation.

Theoretically, professional translators could be expected to already be well equipped for target situation and target group analysis. Translators are aware of the situative aspects of knowledge communication. They also analyze target groups, target situations, and source texts. However, empirical evidence suggests that translators lack competence in target group and situation analysis. In a series of interviews conducted by Hanna Risku, one of the interviewees (six former translators now working in the field of technical communication) expressed her feelings when first faced with the challenge of target situation analysis as follows: "I felt totally out of my depth, like a complete moron" (Risku 2004: 187). The interviewees found target analysis and maintaining the user perspective when talking to subject matter experts to be the most important and difficult tasks. To some extent, however, they felt unprepared to systematically assess user/reader knowledge levels. When they did manage to assess the target group, they did not know how to carry out task analysis (i. e. research the environment, actions, and needs of the user/reader), and thus lacked the necessary criteria to select the content and structure of the target text. As translators, they had learned to concentrate on linguistic and terminological research, whereas in technical communication, they had to determine, select, and structure argumentation and content. One of the interviewees suggested that attending training courses for users might be beneficial to understanding their needs and issues. Currently, however, there are signs that the roles of translators and technical communicators are partly converging (see Gnecchi et al. 2011), with translators attending technical communication training courses and vice versa, thus overcoming at least in part the traditional boundaries between the two domains.

In the realm of visual information design, user and task analyses are carried out, for instance, in a complex visualization software development context. Even in challenging settings in which innovative prototype software has to be developed with only vague ideas of potential future user groups, user and situation analyses are conducted by bringing together prospective users with partial expert knowledge. This was the situation in one of our current research projects, ViENA (Visual Enterprise Network Analytics), where we brought together prospective users with expertise in one of the two main application domains: process and network visualization. The findings of these analyses guided the development of an integrative framework (Windhager/Zenk/Federico 2011, Zenk et al. 2011) for the design of the technical requirements.

4.4 Design of Mediating Artefacts

Creating mediating artefacts is one of the core processes in knowledge communication and includes the steps of planning, creating, developing, evaluating, and refining texts, information

visualizations, software tools, interfaces, etc. Although 'monomodal' artefacts do exist (e. g. pure textual or pure visual information coding) and can be created using our approach, we recommend the development and implementation of 'enriched artefacts', i. e. combining verbal and visual coding methods (text/image/sound/haptics) and integrating passive perception and interaction in knowledge communication. This recommendation builds on empirical evidence of the advantages of the complementary use of additional perception and information processing channels (such as dual coding, Paivio 1986, or multimedia learning, Mayer 2001).

Designed artefacts act as boundary objects, i. e. they create a shared context for knowledge communication (Clark/Brennan 1991, Fischer/Ostwald 2003). To ensure that the artefact corresponds to the target users' (diverse) prior knowledge and builds on common ground, there are three different (re-)design strategies that can be applied (see Figure 3).
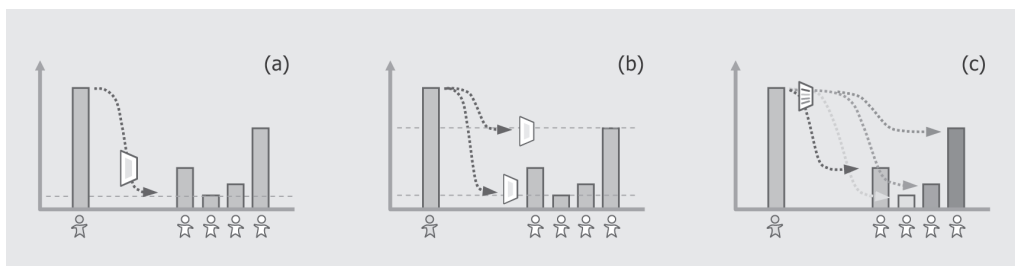

Figure 3: Some typical strategies as combinable patterns to overcome knowledge communication barriers: (a) designing a single ('universal') artefact with reduced complexity ('one-fits-all' approach), (b) designing multiple artefacts, and (c) designing adaptive and situation-aware artefacts. This illustration is intended as a detail element of the extended model of knowledge communication shown in Figure 5.

(a) *Designing a single artefact with reduced complexity*. Translators and information designers can orient themselves on the target user with the lowest level of prior knowledge and design one artefact that all users can understand (see Figure 3a). The aim of this strategy is to create one low threshold artefact for all. This is feasible (and sometimes indispensable) if a text is to be translated for a broad audience or information designed for public use. A common fear here is that this lowest common denominator will be useful for some, but not most users (Shneiderman 2000). If the artefact is too simplistic, it might not meet the requirements of expert or power users. As Einstein once suggested, things should be made as simple as possible, but not any simpler. Especially in situations in which every user has to act fast and accurately, parsimony and simplicity are often seen as desirable design goals. Although empirical research in traffic safety has long contributed to designing communication elements that are universally comprehensible and not too demanding for drivers, there are still a number of notable research gaps. In the recent IN-SAFETY project, for example, we studied the effects of individual skills, culture, and context on the comprehension of variable message traffic signs, with the goal of testing novel pictogram variants which would be comprehensible across the entire European transport network. Our results showed a clear need for low threshold artefacts in this time critical area of public use: in contrast to the findings of classic memory and recognition experiments (Miller 1956), only a strikingly low number of pictograms could be recognized and correctly memorized in test settings designed to be similar to real life driving situations.

Furthermore, our results showed that pictograms with many information elements should be avoided, while animated traffic signs were too demanding and raised critical safety concerns. In further experiments, we found that contextual information could (at least to some extent) improve user performance (Siebenhandl et al. 2008). In the design of verbal artefacts, language-specific concepts like plain English suggest using the corresponding strategy of creating a single artefact with reduced complexity. In an international context, the use of so-called 'international English' is an attempt to find a common denominator by reducing the complexity inherent in native language use (see Snell-Hornby 1999: 104 for a discussion on 'McLanguage'). For literary translation, the topic of writing for an international audience is discussed by Tymoczko (1999: 32) in the post-colonial literature context.

(b) *Designing multiple artefacts which meet different user needs*. If it is not possible to create a single artefact for all users, multiple – or at least two – artefacts can be designed for different users (user groups) and situations (Shneiderman 2010). We are currently working, for example, on a research project in which we have designed an innovative rail ticket vending machine. In the user analysis, we identified users with low technological self-efficacy who were reluctant to use a ticket machine at all. A ticket machine with a step-by-step purchase process in which each question has to be answered separately would allow tickets to be bought in a similar manner to conventional ticket counter sales. But 'power users' want to purchase tickets with two clicks and would reject such a step-by-step interface. Consequently, two different modes of purchase are potentially required to meet the needs of both user groups (Schreder/Siebenhandl/Mayr 2009; see Figure 3b). In intercultural knowledge communication, instead of trying to create a text that is comprehensible to all users (Figure 3a), a corresponding strategy of designing for two 'extremes' (Figure 3b) would be to write one version of a company newsletter for staff at head office and an adapted version for subsidiaries in other countries (leaving out specific information only relevant to head office staff, yet still keeping international staff up to date on key developments and events).

(c) *Designing adaptive and situation-aware artefacts*. Advanced interactive artefacts can be designed to adapt to and be 'aware' of the user's current situation (see Figure 3c). These either adapt to explicit user input (e. g. the level of expertise indicated or choice of settings) or implicitly to user behavior or the actual context (see Mayr/Zahn/Hesse 2007). In the case of artefacts that adapt implicitly, the user's current location (identified, for example, via GPS or IP address data) or activity can serve as user information. Examples of such artefacts include satnavs which adapt maps to the current location or websites and search engines which are automatically translated to the default language for the user's home location (based on the IP address). Similarly, a hypertext could be adapted to a user's assumed level of knowledge level by 'observing' how often the user looks up technical terms in a glossary (for example, a user who consults the glossary frequently could be shown a version of the text designed for users with lower terminological fluency). A drawback of situation-aware artefacts is their dependency on technology. Along with the multiple artefacts that have to be designed (e. g. a website in different languages), program adaptation algorithms are also required. This cannot be achieved by a single translator or information designer, as we will discuss in Section 4.7.

4.5 User and Community Design

If it is not possible to create multiple artefacts, and the lowest possible threshold does not meet the needs of some users (e. g. those with low linguistic capabilities or low prior knowledge), it may ultimately become necessary to design a medium-level artefact and allow for comprehension issues by training some of the users. This procedure is often the last resort if the subject matter to be communicated is simply too complex: you adapt the users to the artefact after doing your best to adapt the artefact to the users.

While user design might, at first glance, seem to exceed the sphere of duties of knowledge communication experts, given our guiding paradigm of situated cognition, this strategy and further situation-aware approaches are obvious next steps (see Figure 4).

The aim of user design is to change the users' prior knowledge and thereby reduce existing knowledge asymmetries (see Figure 4d). This knowledge can be changed by designing additional artefacts (e. g. manuals, glossaries, and guides for beginners) or collective training measures (e. g. preliminary or further education courses or seminars). An example of such measures in the field of intercultural training can be found in Denman-Maier (2004), in which she conducted a contextual study and requirements analysis in preparation for designing web-based training modules for culturally heterogeneous user groups sharing the same professional background (helicopter pilots and technicians).

Figure 4: Further strategies to overcome knowledge communication asymmetries: d) user and community design, (e) creating enabling user situations, and (f) collaborative information design (see also Figure 5). This illustration is intended as a detail element of the extended model of knowledge communication shown in Figure 5.

4.6 Situation Design

In the situational view on cognition and communication, insights into the decisive role of the receivers' environments ultimately lead to the question of how such environments can themselves be designed or developed to enable processes of knowledge (re-)creation. Examples here include situation adaptation (e. g. designing situation-aware artefacts which in turn influence the situation), change in workplace layout (e. g. 'getting rid of distractors', Risku/Mayr/Smuc 2009), knowledge-intensive workplace design (Meusburger/Funke/Wunder 2009, Sailer 2006), and the design of 'enabling spaces' (Peschl 2007, Wiltschnig/Peschl 2008). The aim behind designing enabling spaces is to support knowledge work and processes of innovation, knowledge construction, and knowledge creation on the individual and collective levels. To reach this goal, communicators direct their attention to enhancing situative factors like the participative optimization of physical and architectural spaces, the technological infrastructure, the reflec-

tion and discussion of social, epistemological and emotional framework conditions, and the collaborative use of virtual space(s).

Translation projects can frequently include the production of presentation materials for scientific and technical communication purposes. In these cases, the source material often only exists in fragmentary text form, as the presentation or lecture will only be given in the target language and there is thus no need for a source presentation. Such source material can be made up of technical specifications and product descriptions or annual reports and public relations texts, with the target text taking the form of presentation slides and a manuscript. For such projects to be successful, the client (i. e. the future speaker) and the translator have to work closely together and exchange detailed information about the required materials and the target setting and design.

4.7 Collaborative Design

When complex source and target artefacts are involved, the measures and strategies to cope with communication barriers described above cannot be mastered by one single person. A task as complex as the design of multilingual or multimedia information products, be they technical, medical or scientific in nature, requires extensive cooperation between many qualified experts. It is this collaboration between editors, translators, localization experts, graphic designers, and developers (and the combination of print and electronic media) that makes professional text design possible in the first place (Risku/Pircher 2006). The immediate transfer of documents and texts made possible by technology means projects can now be handled by global teams. Communication and translation projects can now be realized by virtual teams distributed around the world in new forms of collaborative work where the participants have to meet high demands in terms of work pace, productivity, and availability (Risku/Dickinson/Pircher 2010).

Accordingly, translation can be seen as a good example of computer-supported cooperative work (CSCW – in itself an interdisciplinary field of study in technology development and systems design). Meeting with experts to gather information, coordinating teams, researching subject matter, creating, managing, and distributing documents and glossaries, working with project or translation management systems, networking with colleagues around the globe, and providing consulting services to customers are now very much part of the day-to-day work of many writers and translators (Risku 2007).

Computer-supported collaborative visualization (CSCV, see Wood/Wright/Brodlie 1995) can be viewed as a subfield of CSCW and has undergone some dynamic developments in recent years. The emergence of various web-based collaborative visualization networks allows in particular for a new collaborative way of handling complex datasets, which can be jointly discussed, explored, visualized, evaluated, and refined by many experts (Heer 2008).

These developments have been enabled and enforced by major trends in knowledge communication. In a recent participative observation study of working practices in a translation company by Risku et al. (2010; see also Risku 2010), the changes observed were grouped into four key areas: (1) increased standardization of processes and communication, (2) increased dependence on translation specific information and communication technologies (including a shift towards screen-based work and an increased proportion of indirect, electronic communication), (3) increased professionalization and specialization in work distribution (including a shift in competences, such as the reduction in the linguistic and cultural ties in translation

management), and (4) increased relevance of networking and external cooperation partners. In short, a higher level of professionalization and specialization can be observed in the distribution of work, along with more networking and greater use of digital technologies.

5 Conclusion and Outlook

Knowledge communication is often conceptualized as the transfer of (some) information from a sender to a receiver. In this paper, we have delineated how the view on this knowledge communication setting changes when knowledge is considered as constructive and situated. Consequently, professionals like translators and information designers, who manage knowledge communication processes by designing mediating artefacts, have to adapt their design processes and strategies to take into account the ways different users might (re-)create knowledge. This change in perspective can be described as a shift from a classic form of knowledge transfer (see Figure 1) to an extended model of knowledge communication (see Figure 5). In our graphical illustration of this extended view, we seek to emphasize transactivity and co-construction by showing multiple communication paths in both directions and expanding the scope of attention from knowledge to situations and communities, thus avoiding the directional transfer view from "source" to "target".
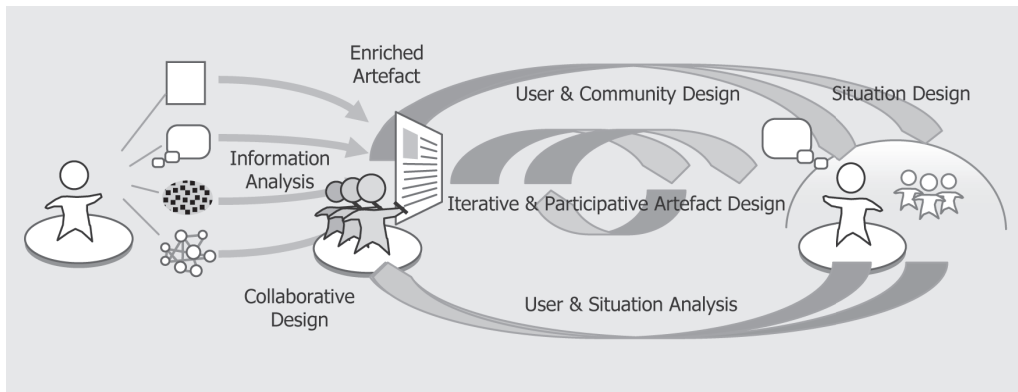

Figure 5: Extended Model of Knowledge Communication

This novel conceptualization of the knowledge communication setting manifests itself in four changes to the information design process:

(1) *Changed view on user knowledge as situated*. If we dismiss the classic notion that knowledge can be transferred like a mailable product from the sender to the receiver in favor of the idea that knowledge is reconstructed by the receiver (Risku/Peschl 2010), we have to consider factors which influence how this reconstruction is actually achieved. In this paper, we have emphasized three factors relevant for knowledge communication: individual prior knowledge, common knowledge of the receiver's (sub)cultures and communities, and the situation in which the mediating artefact is used. Consequently, knowledge differs not only between cultures, but also between individuals, and even within individuals! A receiver will re-create knowledge differently when using the mediating artefact in another situation, in another environment, with another task in mind, and with other people involved. To cope with the situatedness of knowledge in information

design processes, it is very important to gain an in-depth understanding of the target group during the user and situation analysis: their potential individual differences in expertise, relevant cultural influences, typical situations, and the resulting knowledge asymmetries.

(2) *Changed concept of artefacts as enriched*. From this situated, constructive view on knowledge, it seems problematic to regard knowledge communication as mass-medial, where one artefact is interpreted equally by all users in all situations, and where all users (re-) construct knowledge in a similar manner. We therefore emphasize the option of designing enriched artefacts, i. e. artefacts which combine different modes of presentation. For example, if a text is complemented with information visualizations, these illustrations can make it accessible to further user groups who are less familiar with the subject matter. Situation awareness can also enrich an artefact, as it supports the user in an ongoing situational activity and adapts to situational needs and reference frameworks.

(3) *Changed roles of target users as innovators*. In our view, the target users are no longer bystanders in the design process, who are only involved afterwards. Instead, they are repeatedly consulted during the design process. The target users are thus no longer passive 'mailbox-like' receivers; they become co-designers and innovators of the design process (Risku/Mayr/Smuc 2009). In open design communities (e. g. Wikipedia), they can become even more involved and blur the borders between the design team and the users (Fischer/ Ostwald 2003). As Kastberg (2010: 68) notes, we could "look upon knowledge asymmetry not as a barrier but as a vehicle for change".

(4) *Changed role of information designers as situation designers*. To enable efficient information design within the knowledge communication scenario (with its diverse knowledge asymmetries), we recommend that information designers and translators focus not only on the design of the artefact, but also on the design of the situation: There might be the option that the receivers themselves be "designed". In other words, it might be possible to train them to (re-)create knowledge from the artefact in a way that is more coherent with the intended knowledge (which would in fact lead to convergences between the fields of technical communication, translation, training and development). The option of designing the situation in general might also be available. For socially disadvantaged target groups, for example, this would mean making the newest version of the technology accessible and including it in training and further education programs. In this way, we could change the context in which the artefact is used, so that the actual activity is more similar to the one intended. These are options that go beyond designing the artefact in a way that supports the users' situated activities. They open new doors for further research worth looking at more closely in future projects (see also Peschl/Fundneider 2010).

In this paper, we have focused primarily on knowledge asymmetries within the target group and between the target group and the sender. However, if we develop the ideas presented further, we see that knowledge asymmetries also exist within the sender (e. g. depending on his/her situation and/or active membership in communities) and within the design team. The strategies and communication model should be further enhanced to also allow for these asymmetries.

We have promoted a situated view on cognition and knowledge which has a strong impact on how a knowledge communication setting is conceptualized and how practitioners (like translators or information designers) can manage this process. We have also presented an extended model of knowledge communication and different strategies for addressing the chang-

es in information design and translation practice that result from a situated view on knowledge communication. Of these, we emphasize the value of designing or translating information in a collaborative team setting. However, we are aware that it is often not feasible to implement all these strategies, especially in small communication projects. Nonetheless, we hope to have provided an overview of the multiple sources for the complex, critical phenomenon of asymmetries in knowledge communication. Even if only some of these strategies are systematically applied in practice, taking them into account will certainly put us in a better position to manage the challenges of global knowledge communication. ◆

Notes

[1]   This paper is a result of four years of collaboration and intensive discussions between the authors. It brings together and integrates views from cognitive science, translation studies, philosophy, cognitive psychology, information design, and usability.

[2]   The increased dynamics and ephemeral nature of the current concept of culture have rightfully even raised the question of whether this concept is still feasible in a scientific context (Gürses 2003).

[3]   We are aware that these diagrams are interpretable and may thus raise more questions than they are able to answer. However, we feel that it makes sense to probe the power of visualizations in a paper on the present topic and hope that they serve to illustrate the relevant aspects and inspire further discussion. The arrows in Figures 2–4 are only intended as simplified representations and should not be confused with a traditional sender-receiver model. Complex transactive and interactive processes can take place around these arrows (hence the use of dotted lines) as indicated in Figure 5.

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