ASPECTS OF MACHINE-ASSISTED TRANSLATION IN TECHNICAL SUBLANGUAGE COMMUNICATION

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Abstract

This paper focuses on technical sublanguages as a medium for communication between individuals, corporations and non commercial organizations. The technical translator's professional activities are regarded as a means for achieving specific goals in communication. Features of languages for specific purposes (LSP) and sublanguages are discussed briefly. Computer-assisted tools intended to ease the burden on the hardworking technical translator are presented. Experiences with a simple implementation of an elementary program for machine assisted translation are described. Finally, knowledge-based methods for natural language processing are outlined. Standards for the evaluation of professional performance in terms immediately related to the communication process are proposed.[2]

Communication using technical sublanguages

Goals and objectives

Communication means commitment to specific goals, and devotion and loyalty to the objectives of individuals and organisations. Thus, human communication will always involve something more than plain mechanical exchange of information between 'senders' and 'receivers'.

Communication networks

In a corporate environment communication will depend on a large network of individuals and facilities often with complex and non-obvious interrelations between the 'components'. Commercial companies or non-commercial organisations will be involved. Success or failure of individual acts of communication depend heavily on the actors' personal skills.

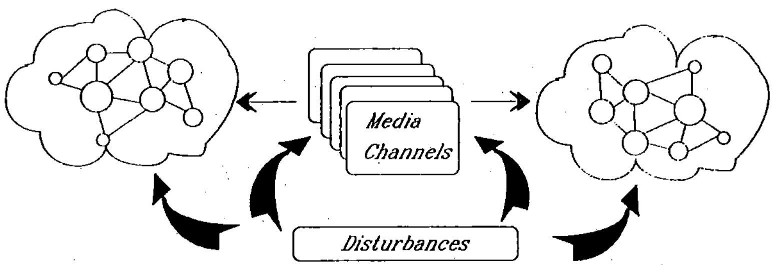

Figure 1
Communicating networks (people and technical resources). The cloud symbol will be used throughout this paper to designate not well-defined concepts.

Technical communicators' basic knowledge
In addition to subject matter knowledge a successful technical communicator must possess basic knowledge concerning current target groups, competitors to the organisation, and the environment, where the communication is to take place. Information about the sender(s), the contents to be communicated, and the goals of the operation is crucial.

Furthermore, the media and their properties as well as the intended way of presentation must be well known. Ability to evaluate the who, what, why, when, where and how series of questions is an important part of the essential professional knowledge.[3]

In technical documentation, manual writing and related activities the art and craft of communication will be even more intricate. Often, there are more than one author, and consequently, the possibility of more than one intention concerning target groups, contents, goals, media and ways of presentation etc.

Cognitive models
Above, technical communication was treated at a rather abstract – and perhaps also very superficial – level. The contents intended to be conveyed were not analysed.

Unfortunately, this is also the strategy adopted in many manuals on technical documentation, and numerous papers on the subject. These often seem inclined to reduce the problem of 'user-usability' to audience analysis, manual organization, poor language usage, design of the manual, graphics design, typesetting and typography etc.[4]

Actually, a prime responsibility in technical communication is to provide the user with an appropriate, explicit mental model of the system she or he is expected to be using. If we fail to provide a model, the user will develop a naive model of her or his own.[5] Trouble will be experienced, when this model does not match reality.[6]

A system could be any complex entity of components operated together and interacting with each other and the user to perform desired functions. Fuel systems of motor-cars are systems in the same right as pulp and paper machinery, computers, and telecommunications equipment, to mention but a few examples. In interactive systems the user will also be 'part of the system' in one way or another.

Design model – system image – user model

The model held by the user should, ideally, be an accurate, consistent and complete projection of the model held by the designer of the system.

Normally, however, the user will develop a user model of the system only through interaction with specific equipment, sets of documentation, technical support, training courses and materials, and other after sales activities. The equipment and its performance, documentation, support, training etc. will form a system image. That image is also influenced by other printed matter, oral presentations, and experience with vendors. Users do not have direct and immediate access to the design model, which is the model used to govern the work of the design team.[7]

Usually, the design model is expressed in different and more formal manners than the components of the system image. Design models use drawings, flowcharts, system description languages (which may even be compiled for system simulation on computers).[8]

These different formal expressions must be translated into natural language to be incorporated into the documentation and other verbal components of the system image.[9] User models are normally not documented at all. They are seldom explicitly expressed – and, clearly, neither complete nor accurate.

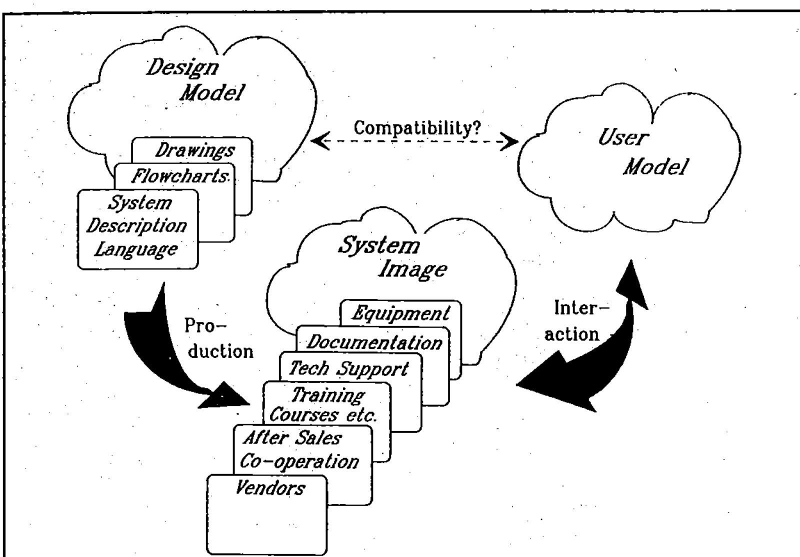

Figure 2
User models develop through interaction.

The responsibility to make the user model compatible with the design model is at the heart of technical communication. Essentially, we must create an explicit system image, which is easy to understand. To nobody's surprise, this process of 'model matching' makes technical writing and translating a notoriously difficult task.[10]

Translators' activities

For the purpose of the present paper the professional translator is regarded as a text discourse expert. She or he acts as a human interface between otherwise non-communicating cultures.

Combining the communicative information and skills outlined above with contrastive knowledge of essential features of the source and target culture and language the translator will decide on a useful and adequate text strategy to employ in the creation of the target language text.

Preferably, the translator is working from a foreign language as a source language into her or his native tongue. In doing so, she or he will be in a position to exercise sound judgement on issues of target language grammar, and the essentials and objectives of the specific act of communication.[11]

For the technical translator the ability to relate the translation in progress to the design model is crucial. She or he must evaluate desired correspondences against possible discrepancies caused by the mapping of the design model via the system image into the (tacit) user model.

Finally, the translator must be qualified to assess the target language text for correctness and communicative adequacy.[12]

Sublanguage communication and machine-assisted translation

Language for specific purposes (LSP) has been investigated in the Nordic countries at least since 1970.[13] Studies are usually based on comprehensive text corpora. Communicative aspects have been studied since the mid-1970s.[14]

Features of LSP and sublanguages

A variety of definitions of LSP coexist, indicating that the subject is neither obvious nor simple.[15]

For the purpose of this study, subworlds were considered subsets of possible worlds.[16] Subworlds could, among other things, be the physical environment made up of a specific equipment. Thus, the design model would be one possible description of a subworld.

Sublanguages are subsets of a natural language used to discuss fenomena occurring within subworlds. As far as technical communication and translation is concerned, a sublanguage may be limited to a certain kind of equipment, or even a subsystem of such equipment.

Sublanguages are characterized by limited use of the full expressive power of the natural language common to a specific community. They may show restricted registers (e.g. only a few cases out of the entire repertoire supplied by the morphology of the language concerned are used), stereotyped syntactic structures, narrow use of the lexical armour, and limited semantic scope.[17]

TM-fourish - a case study of a technical sublanguage

The designation TM-fourish is derived from the TM4 Design Practice, a cartridge and rack mounting system for telecommunications equipment manufactured by Nokia Telecommunications.
TM-fourish was investigated as a feasibility study concerning the likelihood that machine-assisted methods might be helpful to technical translators. My intention was to evaluate to shat extent simple programs could improve the translator's work situation.

The corpus consisted of 5855 running words and 1822 different graphic word forms.[18] Only eight dominating nominal cases[19] out of a total of 16 cases in the Finnish nominal morphology were, for example, found to be used by the authors of the technical manual for the TM4 system.[20]

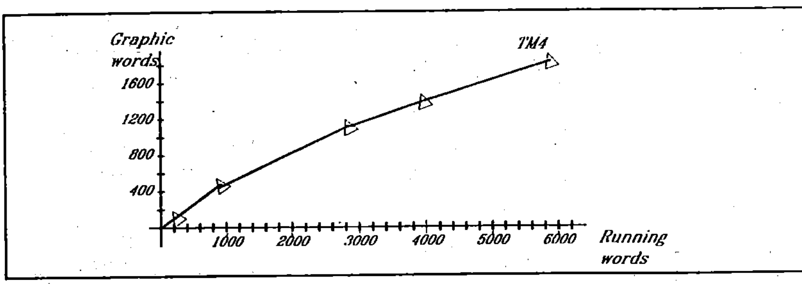

Figure 3
TM4 vocabulary shows closure.

Since the corpus was part of the author's regular translation work, there was not time to pursue issues of syntax, semantics and pragmatics explicitly. These and many other features will, however, be fertile fields for future studies.

Simple computer assisted tools for technical translation

Because the feasibility study showed that machine-assisted translation of the TM4 sublanguage might be computationally tractable, a set of simple pilot programs were written.[21] These programs assist in translation from Finnish into Swedish.

Word form handling is done by two programs, which write words from the source text to a disk file, where the translator will supply corresponding target language items.

After the lexicon file has been prepared a third program will take the source text, query the user for the name of the lexicon file and the output file. Then it will proceed reading paragraphs from the source text one by one. The program will do lexical substitution and allow the user to enter the desired word order on a sentence by sentence basis.

As soon as a paragraph has been completed, the translator will be offered the option to enter her or his favourite word processor for final editing of the paragraph. Thus, the user will continually have full manual control of the translation process.[22]

Standard tools for proof-reading may be employed, after the translation have been completed.

The translation may also be tested for readability using a separate program, which computes a readability index for Swedish text (LIX).[23]

Results and discussion

Very far-reaching conclusions should not be drawn from this experiment. After all, only 90 pages of text were translated using the programs described above.

The time spent on the actual translation of the texts was reduced to approximately 30 minutes per page. An additional amount of about 15 minutes per page were spent on editing and adding to the lexicon file. Thus, a net saving of about 30 minutes per page was recorded as compared to conventional non-machine-assisted methods.[24]

Since the user had full manual control, no major flaws were recorded in the target language texts. Every sentence and paragraph could be finalised immediately using the word processor attached to the translation program.

Thus, the conclusion must be, that even very simple pieces of software may be helpful to the professional translator in terms of saving time and physical effort. Provided the sublanguage concerned shows sufficient lexical closure.

Knowledge-based methods for natural language processing

Obviously, the simplistic approach outlined above must be enhanced in almost every aspect. Components for morphological, syntactical and semantical analysis have to be added. The present sequential lexical files should be converted into a true lexical database. Programs for the maintenance of this database must be added etc.

Here is not the time nor the space to pursue the formalisms used to describe grammatical knowledge needed in natural language processing to any depth. Only a brief listing of interesting methods can be given.[25]

Morphological analysis is conducted along at least two lines: a generative phonology and morphology approach[26] and an associative model avoiding intermediate syntagmatic categories[27].

Roughly, there seem to be three or four basic frameworks of grammatical formalisms in use: descendants of generative transformational grammar[28], dependency grammar[29], and referent grammar[30].

An attempt at establishing the correlation between linear syntax and hierarchical semantics has been made lately in order to avoid 'built in' problems with constituent structures.[31]

A number of methods are applied to lexicon management. The subworld and sublanguage approach seems, not surprisingly, especially attractive.[32] Among other things, sublanguage constrains will severely limit the notorious polysemy and homonomy problems normally encountered in a more 'total' linguistic competence.

Experiences gained in building large general purpose lexical databases should, however, not be overlooked.[33]

Novel approaches in software engineering, which cross the demarcation lines between programming languages, knowledge bases, hypertext and graphic presentation have emerged. One object-oriented programming language offers the user access to its internal parser.[34] These and similar tools may, hopefully, allow innovative ways to acquire and maintain specific subject matter knowledge, also in technical subworld and sublanguage domains.

Knowledge representation and acquisition systems for semantic analyses of natural language have already been successfully implemented for Finnish.[35]

Intelligibility, readability, usability – setting standards for the final analysis

Efforts to evaluate technical communication and documentation are seldom consistent. Sometimes they are even non-existent. Simple (and may be even 'simplified') language, examination by independent checkers, painstaking proof-reading etc. are the traditional approaches.[36] One person or a small group acting as 'transformers' with the sole responsibility to ensure 'maximal usability' of texts and manuals have also been proposed.[37]

Naturally, standards proposed for the evaluation of professional performance of writers, editors, translators, typesetters, printers, graphic artists and others involved should be stated in terms immediately related to the communication process (e.g. target group acceptance, intelligibility, readability, usability).

However, this is just about a necessary but not sufficient condition. The crucial question is: acceptable, intelligible, readable and usable in relation to what?

Let us regard technical communication and documentation as a part of the system, contributing to the formation of a user model compatible with the design model as outlined above. This approach will provide a viable framework for our attempts to evaluate our communicative endeavours.

Within this framework, we will be able to test, to which extent users' explicit verbal reports on the model they believe they are holding coincide with the design model.[38]

Alternatively, we may observe user behaviour and try to establish, whether the resulting technical performance will be correct (i.e. whether the users will adequately operate or correctly install and maintain specific equipment).

Now, if the users' models do not agree with the design model, we have to revise our communication and documentation. If there is a fair correlation, the communication perhaps may be left as is. If the users' model is exactly identical with the design model, we witness a work of miracle.

On our way toward miracle, small well crafted computational tools for limited, local analyses of things like readability may be very useful to writers and translators. Such tools must, however, not merely present a numerical readability index, but locate parts of the text, where problems are suspected, for editing.[39]

Summing up

In technical communication there are at least three important fields for further research:

1) Refining our theory about what is going on behind the scenes, i.e. establishing the relationship between design models, system images and user models more firmly.

2) Relating communicators' activities to these models in order to improve our understanding of technical sublanguages.

3) Development of well crafted computer-assisted tools for technical translators and writers. This should, preferably, be attempted on computationally tractable tasks, where new methods will facilitate and improve the daily work.

Future investigations will shed new light on almost every aspect of the issues addressed in this paper. There is fair hope, that powerful computational tools will be built to ease the mutual efforts of professional designers, writers, translators and users toward global communication and understanding.

Notes

[1]I wish to express my gratitude to Nokia Telecommunication for making a Nokia PC Model 3TT available for the experiments described in this paper.

[2]Since the present paper is a report on work in progress it will by necessity be incomplete and open-ended.[3]The interested reader is referred to any standard textbook on technical communication, documentation, advertising and related fields. A valuable source of information is the Journal of the Society for Technical Communication.

[4]For but one example, see Stephan (1984). Such problems are important, but do address a somewhat secondary issue.

[5]Cf. Owen (1986).

[6]Recent findings on mental models and technical writing is presented in Lauesen (1988).

[7]This presentation is close to Norman (1986), although I think the formation of user models involve a larger number of factors. Additional analyses of mental models are Farooq & Wayne (1988), Rappaport (1988), Regoczei & Plantinga (1987), diSessa (1986). Somewhat similar ideas of projection were earlier suggested in social psychology, e.g. the 'self and generalized other' of Mead (1972).

[8]See e.g. Belina & Nilsson (1986) on SDL. Kyster (1987) gives additional examples on formal representations from the field of man-machine-interfaces. Friman (1988) describes the evolution of new languages, a kind of hybrids between natural and formal languages. He actually says that every project will generate a new language for its own specific purposes.

[9]Consequently, several levels of translation are involved: 1) from formal representations into a natural language (usually the mother tongue of the organization), 2) from this natural language into one or more additional natural languages.

[10]Different kinds of mental models and their compatibility will be an important field for further study. It was introduced here in order to address an essential issue in technical communication.

[11]Grammar is here taken in a very wide sense, including phonology, orthography and morphology, syntax, semantics, pragmatics, text linguistics, sociolinguistics and psycholinguistics.

[12]The discussion above is deliberately brief. For a more comprehensive account of current issues in the science of translation, refer to Holz-Mänttäri (1982), Koller (1979), Newmark (1988), Stein (1980). Current theories of translation, however, do not cover the concepts of design model, system image and user model.

[13]See Gläser (1988) for an overview (contains bibliography).

[14]Several presentations of this kind are found in Gunnarsson (1987).

[15]Gunnarsson (1987) and Laurén & Nordman (1987) contain more exhaustive discussions.

[16]Somewhat like the concept with the same name introduced by Leibniz. Allwood et al. (1977) provides additional discussions.

[17]Differences between sublanguages are explained by Kittredge (1987). See also Friman (1988).

[18]Graphic words (characters between spaces) were chosen for computational simplicity. The number of different lexemes in the corpus must, consequently, be considerably smaller.

[19]Nominative, genitive, accusative, partitive, inessive, elative, illative, and adessive were by far the most dominating cases; a few instances of essive, ablative, allative and instructive were also recorded.

[20]A very substantial reduction compared to "...some 2000 [...] derived, inflected, and cliticized forms..." reported by Karlsson (1984) for normal Finnish nominals. Thus, it is justified to state that only a fraction of the total morphological competence of native speakers of Finnish was used in TM-fourish.

[21]Computational tractability and automatic translation of sublanguages is discussed by Kittredge (1987), computational tractability in general by Harel (1987). This set of pilot programs were written in the SNOBOL4+ programming language (implemented for the IBM PC and compatibles by Mark Emmer, Catspaw Inc.)

[22]Full manual control is considered a most important feature in the design of user-centred systems. No further efforts to design a good user interface for these experimental programs have currently been undertaken.

[23]Screens from these programs are shown in Appendix 1.

[24]In present translation environments, where advanced graphics and desktop publishing are included, this saving may easily be consumed by additional activities like typography and typesetting, graphics, file transfer and conversion, and more painstaking proof-reading. Consequently, the total process needed to obtain a finalised translation will be more time-consuming today than ever before.

[25]Needless to say, this listing is clearly biased toward my interests in Swedish and Finnish, and technical sublanguages.

[26]For example the two-level model of Koskenniemi (1982).

[27]This is the MORFO model of SITRA. See Jäppinen & Ylilammi (1986). MORFO is a registered trademark of SITRA Foundation.

[28]See Gazdar et al. (1988) for an overview of the category systems of this branch of grammars.

[29]This approach has been used both in Finnish and Japanese projects. See e.g. Jäppinen et al. (1988) and Jäppinen & Nuutila (1988). An introduction to dependency grammar is Nikula (1986).

[30]Referent grammars process discourse referents. Such grammars have been written for fragments of Swedish, English, French and Georgian, and implemented in Prolog. Refer to Sigurd (1987).

[31]For more detailed information, see Hausser (1988).

[32]See Nirenburg & Raskin (1987).

[33]On a semantic performance model and lexical database problems, see Järborg (1984). Also, cf. Allén (1983) for a discussion of the Språkdata Lexibase System.

[34]HyperExpert was developed at Nokia Research Center (cf. Saarinen 1988), KnowledgePro developed at Knowledge Garden, Inc. and the Actor object-oriented programming language at The Whitewater Group (cf. Duff et al. 1988). HyperExpert, KnowledgePro and Actor are registered trademarks of Nokia, Knowledge Garden and The Whitewater Group, respectively.

[35]The approach used in the Kielikone project of SITRA Foundation is described in Lehtola & Honkela (1988) and Honkela & Lehtola (1988). These methods are also applied to machine translation (Lehtola & Honkela 1987).

[36]Seligman (1985) explains the procedure used at EIBIS, a British press service company.

[37]See Kyster (1987).

[38]Beware, however, of the pitfalls associated with verbal reports. See any standard textbook in sociology and/or psychology for further information on methods for this kind of investigations.

[39]A comprehensive survey of readability problems is Platzack (1974). Warren (1988) contain comparative analyses of technical manuals.

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APPENDIX 1: Translating, editing and testing readability (LIX).

READ.SOURCE.PAR
rakennejärjestelmä . tm4 telineen asennus ja käyttöönotto II/2
10.9.1987 sivu 1- #**KAPPALEEN LOPPU**
161.3818 Ktavua muistia käytettävissä.

TRANSLATE.WORDS
~~byggsätt~tm4~av~stativ~installation~och~driftsättning~II~2~10.9.1987~sida~1-~
~

CORRECT.WORD.ORDER

1 byggsätt 2 tm4 3 av 4 stativ 5 installation 6 och 7 driftsättning 8 II 9 2 10
10.9.1987 11 sida 12 1-
Anna oikea sanajärjestys (esim. 1+5+2+3 jne):
1+2+4+5+6+7+8+9+10+11

TARGET.SENT= byggsätt tm4 stativ installation och driftsättning II 2 10.9.1987

sida.

WRITE.TARGET.PAR
161.3086 Ktavua muistia käytettävissä.
Haluatko sanojenkäsittelyä? En halua <RET> Kyllä <MUU MERKKI>

1

Byggsätt TM4
Stativ, installation och driftsättning II/2
10.9.1987 Sida

1 INSTALLATIONSPLANERING

1.1 Allmänt.

Innan installationsarbetet påbörjas utarbetas installationsplan med ledning av föreliggande handbok och anvisningarna i handböckerna för den teleutrustning som skall installeras. Bifogade planeringsblanketter kan användas som hjälp vid utarbetande av planen (jfr bilaga).

Planen skall omfattar.

* Bestyckningsplan, stativ
* installationsplan kraftmatning och stativlarm *
anvisningar för anslutning enhet.

TM4.DOC

COMMAND: Copy Delete Format Gallery Help Insert Jump Library
Options Print Quit Replace Search Transfer Undo Window
Edit document or press Esc to use menu
Pg1 Co3 {} ? Microsoft Word

```
"LIX" - Läsbarhetsindex
Läsbarhetsprövning av svensk text (demoversion 87-06-11)
Copyright (c) 1987 A Larsson
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Texten analyseras...

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Läsbarhetsprövningen av din text visade:
Långa ord uppgår till  28.9% av antalet ord i texten
Meningslängden är      9. ord i genomsnitt
Läsbarhetsindex LIX är 37.9
```

Din text är ungefär lika svår som en artikel i dags- eller veckopressen

Skall svåra partier i texten markeras på särskild fil?(j/n)