Towards Cognitive Modelling of the Technical Translation Process

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Abstract

In this study we seek to provide the theoretical background for the cognitive approach to translation and focus upon its main constituents such as frames and translation strategies. We begin by discussing the role of cognitive modelling in understanding the translation process and enhancing translator competence from the perspective of various linguistic scholars. A frame-and prototype approach applied to technical translation will be presented and subjected to critical analysis through a practical qualitative and quantitative examination of written technical translations. Finally, the proposed views will be further elaborated by means of an experiment of on-sight translation that could give a clearer assumption of the concept’s feasibility.

Keywords: Cognitive modelling; translation strategy; frame-and prototype approach; technical translation; translation competence

1. Introduction

There are certain objective difficulties in describing the mental processes of translation. They can be explained by the fact that more than one dimension is possible in translation procedure. The processes of understanding, translation and verbalization are integrated and happen simultaneously. However, there should be a governing unit that will organize the flow of images and evaluate the data produced by various mental processes. Cognitive Science provides valuable tools in the form of concepts and methodologies to find out and understand the internal processes of translation.

We would argue that translation models of Roger Bell, Diller and Cornelius, Nida, Kade analyzed by W. Lüerscher’s (Lüerscher, 1991, p. 7-27) and other construction linguists have provided only limited insight into the mental translation process which takes place in the translator’s brain. There should be a shift from analyzing and

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classifying the changes that are observed by comparing the Source Text and Target Text, which, due to certain limits, cannot reveal the actual process of translation. Yet, a cognitive approach based on the analysis and explanation of the cognitive processes helps, as Roger Bell puts it “to form the twin issues which translation theory must address: how the process takes place and what knowledge and skills the translator must possess in order to carry it out. (Bell, 1991:43) The notion of translation competence is viewed in the sense of expert knowledge and is applicable to problem-solving which involves different cognitive operations and strategies we are going to discuss below.

The PACTE research group (Beeby et al., 2003, p. 57-59) defines translation competence as the ability to carry out the transfer process from the source text to the production of the target text in the function of the receptor’s needs and the purpose of the translation. The PACTE model of translation competence includes the following sub-competencies.

1. Bilingual sub-competence. Procedural knowledge is needed to communicate in two languages; it includes the ability to control language interferences. Translation problems within this category are socio-linguistic, pragmatic, textual, grammatical and lexical. Some of the strategies required to solve them include differentiating and identifying socio-linguistic conventions, textual structures and language registers.

2. Extra-linguistic sub-competence. It refers to the declarative knowledge about the world in general and special areas. It covers bicultural, encyclopedic and subject knowledge. An adequate use of the cognitive capacity to manage knowledge and the proper use of documentation sources are the means to solve these translation problems.

3. Knowledge about translation. Declarative knowledge, both implicit and explicit, about what translation is and what the translator is expected to do. It includes knowledge about the functioning of translation: translation units, processes, methods, procedures and types of translation problems. Lack of this knowledge presents a wide variety of problems: de-verbalization, re-expression, choosing a translation method, etc. In on-sight translation the change of mode (from written to oral), time pressure and difficulties in deviating from the source text are the most common problems.

4. Instrumental sub-competence. Procedural knowledge related to professional practice: management of documentation sources, ICT’s applied to translation, the labor market, professional practice. Problems derive from the particular translation assignment.

5. Psycho-physiological components. PACTE (ibid) considers these to be part of expert knowledge. They include different types of cognitive and attitudinal components and psycho-motor mechanisms. Among them we find cognitive components such as memory, perception, attention span, creativity, logical reasoning capacity, analysis, synthesis and emotion; attitudinal aspects such as intellectual curiosity, motivation, perseverance, rigor, discipline, critical spirit, creativity, as well as confidence in one’s own abilities (self-efficacy) and knowledge about personal limitations. In interpreting many specific problems arise from time pressure and public performance. Many of the mentioned components become crucial

6. Strategic sub-competence. It intervenes by planning the translation process, assessing it, activating the different sub-competencies. The strategic sub-competence compensates for deficiencies in the other sub-competencies, identifies translation problems and applies procedures to solve them. It is therefore the most important sub-competence within the PACTE model. However, they consider only three sub-competencies specific to translation: the strategic, the instrumental and the knowledge-based.

Following G. Shreve, unlike communicative competence, translation competence is not homogeneously distributed among the linguistically enculturated members of a society. Not everyone can translate; those who learn how to translate do so by acquiring a history of translation experience (Shreve, 1997, p. 121).

Wills described translation competence as a union of three partial competencies: a) a receptive competence in the source language (the ability to decode and understand the source text), b) a productive competence in the target language (the ability to use the linguistic and textual resources of the target language), and c) a super-competence, basically defined as an ability to transfer messages between linguistic and textual systems of the source culture and linguistic and textual systems of the target culture (Wills, 1976, p. 120)

Proceeding from Bell’s theory the translator must know (1) how propositions are structured (semantic knowledge), (2) how clauses can be synchronized to carry propositional content and analyzed to retrieve the content embedded in them (syntactic knowledge) and (3) how the clause can be realized as information-bearing text and the text reconstructed into the clause (pragmatic knowledge) (Bell, 1991, p. 36-37). Thus drawing his translation model.
on semantic structure analysis, discourse analytic categories and psycho-linguistic processing. Bell uses functional and linguistic categories, which, owing to the lack of empirical evidence seemed to be hypothetical. Nevertheless, the integrating structure of this model is made implicit through the assumptions including the bottom-up and top-down manner in text processing as well as by means of cascaded and interactive operations which make the model rather attractive from the functional point of view.

Another functional model presented in Nord’s Text Analysis in Translation (Nord, 2005) we find the distinction between two basic types of translation product (and process), referred to as documentary and instrumental to be relevant to the area of technical translation. While documentary translation “serves as a document of a source culture communication between the author and the ST recipient” (Nord, 2005, p. 80), an instrumental translation “serves as an independent message transmitting instrument in a new communicative action in the target culture, and is intended to fulfill its communicative purpose without the recipient being conscious of reading or hearing a text which, in a different form, was used before in a different communicative situation” (Nord, 2005, p. 81). The latter could be seen as applicable to technical translation when the receiver of the message should not be aware that he/she is reading a translation, but, rather, be instructed in the same way as the reader of the original. Thus, the function should be preserved for both ST and TT.

Translation processing implies the observed dichotomy between controlled and uncontrolled levels of the translator’s mind space as the difference between relatively conscious and intuitive or relatively subconscious processes, and will always come into play when trying to investigate the ‘black box’ of the translator’s mind. Therefore, strategies are seen as part of the ‘controlled processing center’ opposed to the ‘intuitive workplace’. Kiraly (1995) describes the strategic position as follows “Translation is a principled strategic process that begins with a translation-specific textual analysis and results in a target language text with a specified, or at least specifiable readership, and a particular textual function (Kiraly 1995, p.16)

One of the possible subdivisions of translation strategies can be found in Venuti’s works where two types of strategies are considered: Domestication and foreignizing. Domestication strategy is employed to bridge cultural gaps and achieve intelligibility in line with the hermeneutic approach which focuses on interpretation and grants the translator the right to manipulate the text so as to make it natural, comprehensible and readable, an approach in which the original text undergoes adaptation so as to be re-created to comply with the target linguistic and cultural conventions, and to fulfill the function or purpose of translation, i.e. skopos. Foreignizing strategy is put as an ethno-deviant pressure on target-language cultural values to register the linguistic and cultural difference of the foreign text, sending the reader abroad (Venuti, 2005, p. 242). Opposing technical translation to literary, the former is considered to be fundamentally domesticating: intended to support scientific research, geopolitical negotiation and economic exchange, it is constrained by the exigencies of communication and therefore renders foreign texts in standard dialects and terminologies to ensure immediate intelligibility (ibid.).

Given the distinction between micro-level and macro-level problems, strategies are also divided between local ones which deal with text segments and global strategies which deal with the whole texts. Both local and global strategies interact with relevant elements of the translator’s background knowledge: critical awareness of the style and content of similar texts, linguistic conventions, the register and intuition about what constitutes the target language (Seguinot, 1989, p. 39).

With its functional and generic value mentioned above, the translation model implies translation-induced mental processes. Following Hans G. Honig’s research such a process should be simultaneous, interdependent and holistic (Höning, 1991, p. 78) as outlined in many psycholinguistic studies. Apart from considering the functional hierarchy of translation problems set out in Nord’s work, we take a closer look at problem-solving cognitive strategies supplemented by strategic competence and thus create an overall translation competence based on the frame-and-prototype approach.

Generally speaking, a frame is a psychological construct, mental projections shaped by a person’s understanding and knowledge. Fillmore claimed that we not only employ cognitive frames to produce and understand language, but also to conceptualize what is going on between speaker and addressee or reader and writer. This introduced the idea of “interactional frames”. Such interactional frames provide a tool for talking about the background knowledge and expectations one brings to bear for the production and interpretation of oral or written discourse, particularly in
relation to genre types (Fillmore, 1982, p. 117). So frames imply projections onto our experiences and knowledge so that we interpret the information that we get from our surroundings.

When problem-solving, techniques are implemented through frames. Frames present selected key terms, examples, through which the translator arrives at the right decision in translation. Frames evoke the translator’s past experiences of working with the same set of vocabulary or grammar structure, and they may also evoke visual connotations of the words used by reinforcing one’s perception or memory of a particular object or notion. The organization and retrieval of linguistic knowledge is not significantly different from the organization and retrieval of other knowledge in the mind (Croft, 2010, p. 2).

The application of a cognitive approach revealing insights into the subtle mechanisms of translation brings about the notion of the translator’s mental spaces, which, applying Gilles Fauconnier’s theory, “are organized as a package we already know … , it is framed and we call that organization a frame. <…> Mental spaces are built up dynamically in working memory, but a mental space can become entrenched in long-term memory. For example, frames are entrenched mental spaces that we can activate all at once” (Fauconnier, 2007, p. 352).

Another approach that puts forward the theory of meaning through the prism of frame semantics was proposed by Fillmore stating that the word “frame” can be used “for any system of linguistic choices of grammatical rules or linguistic categories – that can get associated with prototypical instances of scenes” (Fillmore, 1975, p. 124). The idea rooted in Rosh’s cognitive investigation was developed by Fillmore in the sense that areas of experience systematized by frames can be seen as prototypes. Like Hönig, we would stick to the psycholinguistic perspective in defining the translation competence as “the activating of frames and schemes by the projected ST and the automated association of target language lexems and syntactic structures” (Hönig, 1991, p. 83).

2. Research design and methodology

Purpose and Objectives of Research. The study was approached from two perspectives: 1) technical translation as a product with the identification of frame-based structures of a prototypical character; 2) technical translation as a process with the identification of 2 types of strategies that serve as a basis for professional competence. The main objective of this work is to describe the cognitive process of translation with data provided from written technical translations and an on-site translation experiment.

Hypotheses. In the initial stage of the research we started from the following general hypothesis: frame structures representing syntactic and semantic structures of the ST as a means of organizing the translator’s linguistic and non-linguistic knowledge can predetermine the choice of a cognitive strategy and enhance the translator’s competence. Particular hypotheses are as follows:

- Frames can be subdivided into four types (situational, classifying, dynamic and prototypic) according to the knowledge domains required for text comprehension. Situational frames apply to images of technological processes, the knowledge of which technical translators cannot do without. Classifying frame is included in the situational frame and is used for real technical objects that we call referential items or references. Dynamic frame denotes the dynamic character of a translator’s knowledge structures that have to be acquired and updated during their professional activity, while prototypic frame is another substructure that includes the central aspects of a category that represents it best.
- Strategies can be categorized into prototypical and adaptive with the prototypical type to be applied to basic core features that we associate with syntactic and semantic structures of technical texts and adaptive strategies to be used when translation requires a broader analysis of the context and compensation varieties in the translation process. In brief, prototypical strategies ensure instant responses in the translator’s mind in case of technical texts that contain terminology and certain argument structures which may serve as a frame pattern and are syntactically restricted. Adaptation is needed with texts of a more abstract and pragmatic type of a hermeneutic character with a closer analysis of the text’s broader message and its intra-textual relationships.

Sample group and content. The sample group for the first stage of the experiment was formed of 9 professional translators, the content sample was formed of 56 written technical translations taken from the Technical Lab.
Resource Center of the Magnitogorsk Steel Plant comprising 200,000 words. The translations included past conference papers of international meetings within the field of the Metallurgical Industry, manuals and technical specifications of various kinds of equipment and machines used on the plant. In the second stage the sample group was formed of 12 student-translators of the University of Bath (England) and Magnitogorsk State University (Russia) with B1-B2 level of English. They were asked to translate two texts about a mobile phone. The source texts were chosen in different registers with a different amount of factual terminological consistency and, therefore, with a different percentage of prototypical frame structures. They are 87% and 36% accordingly.

**Methods of Research Used.** In order to valorize the hypotheses and attain the purpose and objectives of the research, we used the following methods and research tools: an introspective method by doing a comparative analysis of written technical translations and psychological observations of the think-aloud protocols for on-site translations. To interpret results we used mathematical-statistical methods and methods of their graphic representation.

Within the experiment, we aimed at observing the following correlations: a) between using cognitive structures and translation competence; b) between choosing the cognitive strategies and efficiency of translation.

### 3. Data analysis

As a result of a comparative analysis of written technical translations we got a set of prototypical syntactical frames within 3 basic metonymic relationships with some internal optional structures, which are considered as parts of the dynamic frame.

#### Table 1. Dynamic frame presented by the metonymic relationship of “One object / process standing for another one”.

<table>
<thead>
<tr>
<th>A</th>
<th>is</th>
<th>corresponds to</th>
<th>B</th>
<th>в виде</th>
<th>A</th>
<th>выступает</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>is to do</td>
<td>B</td>
<td>A заключается в</td>
<td>B</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>is doing</td>
<td>B</td>
<td>A выполняет действие</td>
<td>B</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Table 2. Dynamic frame presented by the metonymic relationship of “Cause – Effect”.

<table>
<thead>
<tr>
<th>A</th>
<th>is done for</th>
<th>B</th>
<th>для</th>
<th>V</th>
<th>создаётся</th>
<th>A</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>A</td>
<td>A создаётся для</td>
<td>B</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>is used to do</td>
<td>B</td>
<td>для создания</td>
<td>B</td>
<td>используется</td>
<td>A</td>
</tr>
<tr>
<td>A</td>
<td>Influences</td>
<td>B</td>
<td>A влияет на</td>
<td>B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>Enables</td>
<td>B</td>
<td>A позволяет осуществлять</td>
<td>B</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Table 3. Dynamic frame presented by the metonymic relationship of “Temporal / logical sequence”.

<table>
<thead>
<tr>
<th>A</th>
<th>is done as</th>
<th>B</th>
<th>по мере создания,</th>
<th>B</th>
<th>создаётся</th>
<th>A</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>is made in</td>
<td>B</td>
<td>в процессе</td>
<td>B</td>
<td>создаётся</td>
<td>A</td>
</tr>
<tr>
<td>A</td>
<td>is done after</td>
<td>B</td>
<td>после</td>
<td>B</td>
<td>создаётся</td>
<td>A</td>
</tr>
</tbody>
</table>

We went through most frequent metonymic forms in the Source and Target texts and worked out a set of equivalent structures as prototypical. In the example below the middle columns show prototypical syntactical structures that represent the argumentative structure of the sentence and denote metonymical relationships, which helps to comprehend the logical argument structure of the sentence.
Table 4. Example of the Russian-English translation of a technical text by means of prototypical frames.

<table>
<thead>
<tr>
<th>Prepositional slot</th>
<th>Central slot</th>
<th>Post-positional slot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chrome</td>
<td>Plated</td>
<td>Work</td>
</tr>
<tr>
<td>dull</td>
<td>finished</td>
<td>work</td>
</tr>
<tr>
<td></td>
<td>processed</td>
<td>work</td>
</tr>
<tr>
<td></td>
<td>deformed</td>
<td>work</td>
</tr>
<tr>
<td></td>
<td>textured</td>
<td>work</td>
</tr>
<tr>
<td>Хромированный</td>
<td>Рабочий</td>
<td>Валок</td>
</tr>
<tr>
<td>деформированный</td>
<td>рабочий</td>
<td>валок</td>
</tr>
<tr>
<td></td>
<td>рабочий</td>
<td>валок</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Прошедший матовую обработку поверхности</td>
</tr>
</tbody>
</table>

The sets of semantic frames drawn up as the result of the experiment clearly showed the attributive nature of the English technical terminology compared to Russian multi-component terminological phrases, which can be identified by the position of the slot entries with a descriptive semantic content. Thus, by identifying regularities in the component transformation we developed a set of terminological units useful for technical translators working with texts on the steel industry. The prototypical frames, worked out as a result of the experiment, were seen as label syntactical and semantic phrases that may evoke the whole frame as a single entity.

Apart from these findings we focused our research on situational frames applicable to the texts analyzed in the experiment needed to produce first-hand notions in the form of images about the equipment. We presumed that the idea of evoking a certain frame by a single entry should work in terms of images, when an image of a technical part of the equipment activates an overview of the whole unit based on the prior knowledge of the translator. This has a clear reference to the theory of the so-called bottom-up and top-down processes at hand during the text comprehension stage. It either derives the meaning of the text based on the incoming language data or uses prior knowledge to understand the text.

Dynamic frames stem from Shreve’s idea of remapping. One way of looking at translation ability is to look at it as a set of schemata for remapping across culturally bound form-function sets. These translation schemata are knowledge organizational structures stored in the memory, and they undergo successive transformations or
modifications during the process of learning. During the process of learning to translate, translators develop more specific, more detailed and more inclusive schemata for remapping (Shreve, 1997, p. 130).

Coming back to Kiraly’s idea of translation as a strategic process, the second part of the investigation was aimed at finding out the types of strategies used by non-professional translators whose translation abilities are usually controlled and conscious processes that could be verbalized and thus analyzed.

As a result of an on-sight-translation experiment run with the student-translators from the University of Bath the use of adaptive and prototypical strategies was analyzed and justified with the help of two types of text: a technical manual of the mobile phone BB10 and a BBC article on a new version of the Blackberry mobile being marketed with some technical specifications described. The chosen texts belong to different registers with a different amount of informative and technical content, with the former containing a lot of technical terminology and the latter being more pragmatically oriented.

1. **Prototypical strategy** takes precedence over adaptive strategy in technical texts.

   - Frames are associated in the shape of images and situations thus creating visual scenes in the translator’s mental space that help to gather the meaning;
   - Prototypical syntactic and semantic frames are the first instances that spring to the translator’s mind in the form of clichés to construct the information content of the text;
   - Students are looking for certain rules and patterns out of context relying on label structures, isolated rules and fixed terminology;
   - The translation process using prototypes can be cognitively controlled by elicitation of data through frames and scenes.

2. **Adaptive strategy** takes precedent over prototypical strategy in the BBC article with a focus on the explanation of new mobile technology;

   - Compensating the lack of understanding by applying students’ prior knowledge of the subject to the context;
   - Using metonymic transfer technique when recalling functional features of the mobile gadgets used earlier and with relevance to those described in the text;
   - Monitoring the conscious mental data processing going through translation-relevant textual analysis which is mostly automatic and difficult to control.

These practical assumptions correlate with Hönig’s ideas on transfer vs translator competence as the result of using micro and macro strategies in the translation process with transfer competence defined as “generating the process taking place in the uncontrolled workspace” (Hönig, 1991, p. 80).

4. **Conclusion**

   Empirical investigations done within the study of both written and on-sight translation revealed valuable features contributing to our understanding of the mental processes of the translation process. Cognitive strategies used by translators are seen as operative tools chosen according to the in-built context-frame structure of the text. Using the methodology of analytical thought and a comparative analysis of written translations, there is evidence of highly recurrent patterns, such as context-based knowledge framing and the reconstruction of frames of a linguistic and non-linguistic character. These findings redefine our understanding that the process of technical translation relies on cognition as a broader term. Also, noting that frames accumulate knowledge of a linguistic and non-linguistic origin, there is also the question of competence in technical translation that approximates with expert knowledge of the subject.

The results obtained confirm not only the hypothesis set out, but also the fact that frames that are considered as mental knowledge structures that capture the typical features of a situation can be applied to the study of the cognitive translation process with a focus on the relation between text, context, external factors and specificities within the technical translation area. Moreover, as has been demonstrated, external factors and text specifics can be represented in source-target text relationships with the help of frames that construct the technical translator’s mind,
as well as the so-called ‘knowledge frame transfer’ contributing to knowledge creation and technical communication.

5. Acknowledgements

The work is supported by the grant # 12-04-00045 from Russian Foundation for Humanities.

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