

Sjørup, Annette Camilla

Doctoral Thesis

Cognitive effort in metaphor translation: An eye-tracking and key-logging study

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Cognitive effort in metaphor translation

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An eye-tracking and key-logging study

Annette Camilla Sjørup

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An eye-tracking and key-logging study

Annette C. Sjørup

Supervisor: Arnt Lykke Jakobsen

LIMAC PhD School

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Annette C. Sjørup

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Chapter 1 Introduction

Metaphors have been recognised as an important part of language use since the time of Aristotle, and today there is a large body of work in research on metaphors. What is perhaps most fascinating about metaphors is that, despite decades or even centuries of research into this aspect of language production and use, there are still many questions that remain unanswered and many questions with opposing answers. The definition of metaphor varies greatly according to perspective. To Aristotle, it was “the application of an alien name”¹ and he had a rather modern view of metaphor in that he argued that metaphor had a cognitive function,² whereas metaphor was later regarded as a stylistic tool appropriate for both prose and poetry. In this later view, metaphor was viewed as merely decorative without any practical purpose (Richards 1965: 90) and could easily be replaced with a literal paraphrase without any loss of meaning, only a loss of style. Later, Lakoff and Johnson (1980) argued that metaphors as found in text and speech were manifestations of underlying conceptual structures (conceptual metaphors) in our minds and that these metaphors were necessary for us to be able to grasp and relate to abstract concepts in the world around us. Perhaps no one put it more eloquently than Dagut (1987), who described metaphor as “an individual creative flash of imagination fusing disparate categories of experience in a powerfully meaningful semantic anomaly” (Dagut 1987: 77).

The modern view of metaphor is that metaphors are more than a stylistic device to make a phrase sound clever. Metaphors are regarded as adding a new layer of meaning to the concepts they refer to and have been found to be more common than generally expected (five uses per 100 words of text (Martin 1994: 6)).³ But metaphor still remains a controversial phenomenon. The many forms of advanced technologies, which have been developed during the last few decades, have enabled a deeper insight into how metaphors are processed, but the findings are as varied as the many methodologies applied. Think-aloud protocols (TAPs), key-logging, eye-tracking, and fMRI are only some of the technologies used to investigate aspects of metaphor

¹ From Aristotle *Poetics* 21, 1457b9–16 and 20–22, <http://plato.stanford.edu/entries/aristotle-rhetoric/#8.2>

² From *Rhet.* III.10, 1410b14f, <http://plato.stanford.edu/entries/aristotle-rhetoric/#8.2>

³ Martin reports on corpus analyses of naturally occurring metaphor in texts carried out by Pollio et al. (1990) (Martin 1994: 6).

comprehension. Even with all these advances in technology, it has still not been possible to reach consensus on how metaphors are processed in the human mind and on whether or not they are more effortful to process than literal expressions.

Metaphor is not only a cognitive concept, but also a cultural one. As recognized by Lakoff and Johnson (1980), our metaphor use reveals the way we perceive the world and consequently the culture in which we live. Some metaphors are shared across very different cultures and may perhaps be considered universal, whereas others are closely connected and limited to the society in which they are used. Such culture-specific metaphors can present a dilemma to the translator, who wishes to remain as true as possible to the source text (ST) without compromising the authenticity of target language (TL) use. Even for closely related languages and cultures such as English and Danish, there may still be differences in the metaphors used to express shared beliefs and values.

The participants in the experiments underlying the present study were a homogenous group consisting of professional translators with Danish as their L1 and English as their L2 (see section 4.2). Although it is acknowledged that the individual experience with metaphor translation may nevertheless vary within the participant group, the aim of the study was to identify commonalities of metaphor translation rather than investigate effects of individual factors such as experience within various translation genres, etc. At some point, however, it would obviously be relevant to follow up such a general focus on supra-individual features of metaphor processing with more detailed studies of individual differences.

Methodologically, this thesis seeks to combine empirical research on metaphor comprehension with translation research in order to gain insight into the cognitive effort of the translator when translating metaphors in context. The investigation of metaphor comprehension and metaphor translation is a complicated task because it is necessary to take a lot of individual factors into account, such as textual context, participant background, etc, but it is no less a necessary task.

The discussion of the level of cognitive effort necessary for metaphor comprehension relative to literal (i.e. non-metaphorical) expressions is ongoing.⁴ Cognitive effort can be defined as the mental effort spent by the individual on a mental process, which for example could be reading and understanding a sentence, producing a new sentence or making a strategic decision about what words to choose in a translation. By measuring cognitive effort, it is possible to learn about the energy the human mind spends on processing and producing language. The way in which the present study proposes to measure cognitive effort is through analysis of translators' gaze and typing behaviour. If a word or group of words containing a metaphorical expression was looked at longer than a comparable (sequence of) non-metaphorical word(s), then the cognitive effort involved in processing the metaphorical expression was hypothesized to be higher than in processing the non-metaphorical expression, following the assumption that longer gaze times indicate more cognitive effort invested (Rayner 1998). Similarly, if the typing of a (sequence of) metaphorical word(s) took more time than the typing of a comparable literal string, then the cognitive effort involved in processing and typing the metaphorical string was hypothesized to be higher than for the non-metaphorical string, following the assumption that slower typing speed and longer pauses between production indicate increased cognitive effort (Schilperoord 1996).

Gaze behaviour was recorded by means of eye-tracking equipment (Tobii 1750). Eye-tracking has been used for research purposes in investigations of both metaphor comprehension and translation processes, but the methodology has apparently not been used before for research in metaphor translation. Eye-tracking with a 'remote' tracker is well suited for research prioritizing ecological validity as it is a non-intrusive technology enabling the participant to focus on the given task undisturbed by the recording equipment. At the same time, it provides hard data on the basis of which the researcher can make grounded assumptions about the mental processes of the participant based on the gaze behaviour. Longer gaze times have been taken to be a direct indication of increased cognitive effort (Just and Carpenter 1980, Rayner 1998). Although modifications to Just and Carpenter's assumption of gaze time being a direct reflection of cognitive effort have been suggested (e.g. by Vonk and Cozijn 2003: 292), it is still possible to

⁴ See table 2, section 3.1.6 for the definition of literal as used in this thesis.

identify, with a high degree of probability, the points in the text where the translator invests additional cognitive resources. Eye-tracking has the additional benefit that it provides evidence of the allocation of cognitive effort independently of what participants are themselves aware of. Sometimes we are conscious of making a mental effort, but our gaze behaviour reveals more about our distribution of cognitive effort than we are consciously aware of.

Eye-tracking was the preferred methodology for investigating cognitive effort in the comprehension stage of the translation process. Though the translator's eyes are also actively involved in monitoring target text production, gaze data was not used as evidence of the cognitive effort involved in production, mainly for the technical reason that the stream of gaze data relating to production is interrupted whenever a translator looks away from the screen. Therefore, key-logging was the preferred methodology for investigating cognitive effort in the production stage. Studies by Schilperoord (1996) as well as by Dragsted (2004) and Immonen (2006) have shown that there are fundamental similarities between monolingual text production and translation, but also essential differences. Briefly stated, the similarities are in the indication of pauses as signs of increases in cognitive effort and in the non-random occurrences of these pauses. The differences lie to some extent in the location of these pauses as Dragsted and Immonen found indications that translations tend to result in more pauses at word level (and below) and fewer at higher syntactic levels (sentence and paragraph) compared with monolingual text production. Their research indicates the relevancy of key-logging for investigation of the production aspect of translation, where pauses can be regarded as constituents in a larger whole defined as *Production Time*. The key-logging measure *Production Time* is a parallel to the eye-tracking measure *Gaze Time* as both measures are temporal values of the time (and cognitive effort) spent on production and comprehension, respectively.

Chapter 2 will introduce the research questions forming the basis of the investigation. These research questions will then be grounded in a theoretical framework based on earlier research on metaphor and translation.

This theoretical framework combining metaphor research, translation research, and cognitive research will be presented in chapter 3. In chapter 4 follows a presentation of the two data collection methodologies chosen: eye-tracking and key-logging. The two data sets will be analysed using a linear mixed-effects regression model or LMER, and the construction of the statistical models and the definitions of the included variables will also be discussed. This will be followed by the presentation and discussion of the actual empirical results (chapters 5 and 6). After this, there will be a brief qualitative discussion of the findings from retrospective interviews as well as of the actual translation products (chapter 7). Chapter 8 will discuss a few potential issues with the experimental methodology after which the conclusion will sum up the findings from the triangulated data in chapter 9.

Chapter 2 Research Questions

As will be seen in the theoretical framework presented in chapter 3, there are opposing views on metaphor comprehension and whether or not they require more cognitive effort to process than literal expressions. Furthermore, there are a multitude of factors which can affect the comprehension process, such as the reader's familiarity with the expression and information from the textual context. These factors have been researched from a monolingual perspective, but only sparsely from the point of view of research on L2 metaphor comprehension and translation. Because of the heterogeneity of the views on metaphor comprehension, it was decided that open research questions would provide a more suitable point of departure for the investigation in this thesis rather than hypotheses indicating a specific point of view. When not otherwise stated, the term "metaphor" will refer to a metaphorical expression, i.e. a linguistic metaphor, following the definition set out in section 3.1.⁵

As outlined in the introduction, the thesis investigates the cognitive effort invested by professional translators in metaphor translation from L2 (English) to L1 (Danish). Although English and Danish cultures are in many respects quite similar, this does not mean that all metaphors can be transferred directly and be equally salient in the target language. Chapter 3 will provide a theoretical framework in which the research questions will be grounded.

The comprehension and production stages of the translation process should not be viewed as two distinct and separate stages, but rather as interlinked and overlapping (see section 3.2 and Figure 7 in section 3.3.2). However, the study assumes that the main cognitive effort invested in comprehension takes place while visual attention is on the L2 source text and the main cognitive effort invested in production is assumed to take place during the typing of the L1 target text.

⁵ It is not within the scope of this thesis to argue the existence of any potentially existing conceptual metaphors.

Eye-tracking and key-logging are both non-intrusive technologies allowing for naturalistic experimentation, which makes it easier for the researcher to simulate an authentic translation process, as the participating translators are able to work under conditions similar to their normal working conditions.

For the comprehension stage, the following research question was formulated:

1) When read for the purpose of translation by a professional translator, will L2 metaphors require more cognitive effort to process than literal expressions as indicated by the eye-tracking data through longer fixation times, a higher number of fixations, and longer first pass durations? Or will the cognitive effort be similar to the effort invested in comprehension of L2 literal expressions?

For the production stage, the following research questions were formulated:

2) Does a professional translator's translation of metaphorical expressions into L1 require more cognitive effort than translation of literal expressions as indicated by longer production times in the key-logging data?

3) Is the indirect translation strategy of paraphrasing more cognitively effortful than a direct translation strategy in which the ST metaphorical image is transferred directly?

4) Is it more cognitively effortful to replace the ST metaphorical image with a new TT metaphorical image than to use a direct translation strategy in which the ST metaphorical image is transferred directly?

These research questions are investigated in the analyses of the eye-tracking and key-logging data in chapters 5 and 6 in which the data sets are analysed using the statistical tool R, which can be freely downloaded from the Internet.⁶ The data are analysed in LMER models, allowing

⁶ The R application can be downloaded from <http://www.r-project.org/>

for a number of factors to be controlled for. The results will then be discussed in light of the above research questions in sections 5.5 and 6.3.

Chapter 3 Theoretical Framework

The purpose of this chapter is to outline the main lines of thought in metaphor and translation research as well as to provide a framework in which to ground the research questions presented in the previous section. Furthermore, the theoretical background behind the experimental methodology will be discussed and the measures chosen as the most relevant indicators of cognitive effort will be defined.

3.1 Metaphor

If one looks back on the large volume of metaphor research from just the last 40 years, it will soon become evident that there is little agreement on a formal definition of what a metaphor is. Historically, metaphor was viewed as nothing more than decorative language, serving no other purpose but to sound good, but in recent decades, this view has been more or less discarded in favour of a more comprehensive view of metaphor in language. At the other end of the scale is conceptual metaphor theory in which conceptual metaphors are regarded as the means through which we are all able to grasp and relate to abstract concepts (see section 3.1.3). In addition, the constituents making up a metaphor have multiple names and definitions. Finally, the different types of metaphor are categorised and termed differently depending on the researcher, and the same metaphor may be defined as either conventional, lexicalised or dead depending on the researcher.

Goatly offers perhaps the most comprehensive definition of metaphors among the wide range of definitions possible:

“Metaphor occurs when a unit of discourse is used to refer unconventionally to an object, process or concept, or colligates in an unconventional way. And when this unconventional act of reference or colligation is understood on the basis of similarity, matching

or analogy involving the conventional referent or colligates of the unit and the actual unconventional referent or colligates” (Goatly 1997: 8)

The following definition by Dickins is very much along the same lines:

“A figure of speech in which a word or phrase is used in a non-basic sense, this non-basic sense suggesting a likeness or analogy [...] with another more basic sense of the same word or phrase” (Dickins 2005: 228)

Deignan’s (2005) metaphor definition, which is again very similar to the two definitions above, underlines that the relationship between the two referents is in fact dependent on the comprehender:

“A metaphor is a word or expression that is used to talk about an entity or quality other than that referred to by its core, or most basic meaning. This non-core use expresses a perceived relationship with the core meaning of the word, and in many cases between two semantic fields” (Deignan 2005: 34)

Dickins used the example of the noun *rat*, which has two definitions in Collins English Dictionary: (i) “any of numerous long-tailed murine rodents, esp. of the genus *Rattus*, that are similar to but larger than mice and are now distributed all over the world”, and (ii) “a person who deserts his friends or associates, esp. in times of trouble” (Dickins 2005: 228). The first sense of the word is the basic physical sense and the second non-basic sense is a lexicalised metaphor (lexicalised because it has been used often enough to be recorded in a dictionary). The second, non-basic sense suggests a likeness between sense (i) and sense (ii) by attributing some of the characteristics of sense (i) to sense (ii) (but never vice versa), thereby creating a metaphorical sense (Dickins 2005: 228).

One advantage of Dickins's metaphor definition is that it excludes analogies, metonymic expressions and idioms, which are sometimes included in metaphor research but are linguistic entities outside the scope of this thesis. Dickins's metaphor definition is therefore chosen as the operational definition of a linguistic metaphor in this study.

3.1.1 Opposing Views of Metaphor: Substitution and Comparison vs. Interaction

Black's (1981) interaction theory of metaphor states that metaphors are not merely decorative but are necessary to understand the world around us. Black pointed out that the metaphor itself creates a similarity between two concepts and ascribes certain properties to the concepts. These ascribed properties would not exist without the metaphor (Black 1981: 37ff.). This observation is closely similar to Lakoff and Johnson's concept of "highlighting" (Lakoff and Johnson 1980: 10ff). In their view the metaphor changes the reader's view of the conceptual domains used in the metaphor and highlights specific characteristics and "maps" them (i.e., links them) from one domain to the other.

Black's views on metaphor are in agreement with the views of later researchers in discarding the substitution and comparison views of metaphor's role in language and communication. Briefly stated, the substitution theory holds that the metaphor stands instead of a literal expression and that the statement could equally well be expressed with a literal expression (Black 1981: 31). The comparison theory posits that a metaphor is, in short, nothing more than a form of simile (Black 1981: 35). These two views of the nature of a metaphor were prevalent for decades, but research carried out in recent decades discarding these theories is convincing (see e.g. Glucksberg 2001, Gibbs 2001). For this reason, the substitution and comparison theories will not be discussed any further in this thesis.

Black touched upon one of the core elements of the "new" view of metaphor when he stated that "the metaphor creates the similarity [rather] than to say that it formulates some similarity

antecedently existing” (Black 1981: 37). In other words, a metaphor is not merely a decorative way of saying something which could be stated more directly with a literal expression. A metaphor actually creates a new perspective or interaction between one or more specific properties of a given semantic domain (Coney and Lange 2006: 94). For this reason, Black’s view is referred to as the *interaction theory* of metaphor.

Another less controversial aspect of metaphor theory and research is the definition of and terms for the individual constituents of a metaphor. The *frame* was Black’s term for the sentence, i.e., the textual context, in which the metaphor is present (Black 1981: 28). He was less clear in his definition of what he termed the *focus* of the metaphor, which is only defined by the example “*the chairman plowed through the discussion*” in which the word “*plowed*” is the focus (Black 1981: 27ff.). An attempt at defining the term *focus* in more detail could perhaps be as follows: the focus of the metaphor is that part of the sentence which has a different semantic origin and which would conventionally have a different frame (e.g., textual context). The word “*plowed*” normally belongs in a semantic domain of farming and is therefore separate in terms of pragmatic origin from the rest of the sentence, which seems to have its origin in the field of business.

It is perhaps telling that Black only used the terms *focus* and *frame* a few times after their introduction and later began to refer to the *principal* and *subsidiary subjects* and the distinction between the *focus* and the *subsidiary subject* was so vague that the two terms may in fact be synonyms (Black 1981: 41). The *principal and subsidiary subjects* seem to roughly correspond to Richards’ (1965) *tenor* and *vehicle*, which are equally opaque in their definition and application, as also criticised by Black (Black 1981: 47). *Tenor* meant the “underlying idea or principal subject”, which was described by the *vehicle*, i.e., the second concept used to provide the *tenor* with specific characteristics (Richards 1965: 97). In other words, the *vehicle* attributes the metaphoric characteristics to the *tenor*. In the example *men are wolves*, the word *men* is the *tenor* and the word *wolves* is the *vehicle* (Way 1994: 28). In the example “the chairman plowed through the discussion”, the vehicle is “plowed through”, but in this example it is less clear how the principal subject (the *tenor*) should be identified.

Goatly's (1997) terminology is based on that of Richards, but has received a more widespread use, perhaps from having more clearly defined terms. Goatly uses the terms **topic**, **vehicle**, and **grounds** to refer to the elements of a linguistic metaphor. The terms are perhaps best understood with a metaphor example: In *The past is another country; they do things differently there*, the topic is 'the past', which is being likened to 'another country', the vehicle, and the grounds are the perceived shared characteristics between the topic and the vehicle, in this case stated explicitly as 'they do things differently there' (Goatly 1997: 9, see also Dickins 2005: 231). The topic is often an abstract concept (like 'the past'), which is understood through the more conventional referent in the vehicle ('another country'). Goatly's terminology is adopted in this thesis as the terminological definitions are concise and therefore easily implemented in a research design.

Andersen (2004) credits Richards as the first scholar to take a cognitive approach to metaphors and Black is recognised as furthering the cognitive metaphor theory based on Richards' theories (Andersen 2004: 21). Richards proposed that metaphor was not only a linguistic structure but also "two thoughts of different things active together and supported by a single word, or phrase, whose meaning is a resultant of their interaction" (Richards 1965: 93). In other words, Richards and Black took the view that metaphor was not only creative language use, but also a means of creating new ways of understanding the world around us.

It can be argued that one of the more important contributions of Black's work is his awareness of the importance of context to the comprehension of metaphors. He exemplified why context is necessary in order to identify and comprehend a metaphor: "how recognition and interpretation of a metaphor may require attention to the **particular circumstances** of its utterance" (Black 1981: 29). This observation is also an important reason why the results of some psycholinguistic experiment on metaphors should perhaps not be taken as absolute truths, as many of these types of experiments disregard the context as a variable in order to keep focus on the metaphors in question, presenting the participants with individual phrases or sentences without support from the context in which they occur. Often, the sentences or phrases will not even have an original

context as they have been constructed for the purposes of the experiment. Whether these types of experiment are able to reflect the processes in which natural language is used and expressions are comprehended in a textual context is debatable, as also argued by Deignan (Deignan 2008: 284). Gibbs and Perlman also recommend recognising context as an important parameter in metaphor research (Gibbs and Perlman 2006: 217). For this reason, the metaphors reported here were presented within context, which were slightly abbreviated authentic texts.

On the other hand, these carefully controlled experiments are able to provide insights into the minute elements of cognitive processing in a way that is perhaps not possible with more naturalistic research. Obviously, if rigidly controlled experiments could also have high ecological validity, this would provide the strongest basis for insight into the workings of the human mind, but in real-life experiments a compromise has to be struck between maximum control and maximum ecology. Alternatively, findings from controlled experiments can be tested against findings from strictly ecological situations, and the reverse. Steen (2004) is also a proponent of the benefits of verifying findings from “experimental metaphor research” with the findings from “behavioral research” and vice versa instead of dismissing other methodologies as lacking in validity (Steen 2004: 1186). This study attempts to find the middle ground by using authentic texts in an experiment with a relatively high level of ecological validity, but with a high number of statistical controls.

3.1.2 Metaphor Across Languages and Cultures

One of the major considerations in any discussion of metaphors across languages is the question: are metaphors universal? Kövecses defined culture as “a set of shared understandings that characterize smaller or larger groups of people” (Kövecses 2007: 1) with language being the most prominent shared characteristic.

Dobrzynska took this line of thought even further and stated that “language boundaries are at the same time boundaries of distinct cultural communities” (Dobrzynska 1995: 598). Her claim was

that communication is the foundation of shared beliefs and attitudes and thereby culture. According to Dobrzynska, the transfer of a linguistic metaphor from one language to another “puts it into an entirely different communicative situation” (Dobrzynska 1995: 598). Dobrzynska’s argument was that the metaphor is transformed into a new product caused by the different setting, resulting in a different sense of the metaphor (Dobrzynska 1995: 599).

On the other hand, Kövecses is a proponent of Lakoff and Johnson’s claim that some conceptual metaphors are so inherent in the human mind’s capability of relating to abstract concepts that they can reasonably be labelled universal. He attempted to explain the gap between Lakoff and Johnson’s claim that conceptual metaphors are almost entirely universal and the infinite variety of linguistic metaphors across languages and cultures. His argument was that while a conceptual metaphor may be shared across languages and cultures, the conceptual metaphor may be expressed in very different ways in two languages and cultures (Kövecses 2007: 119ff) as illustrated in Figure 1 by Trim (2007).

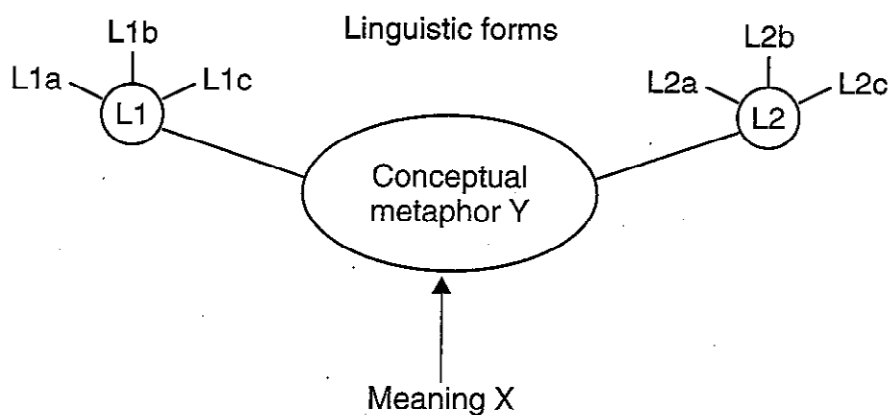


Figure 1: Comparative networking in shared conceptual metaphors (Trim 2007: 70)

Figure 2 illustrates how meaning is conveyed through different conceptual metaphors with different linguistic manifestations, which would apply to potential culture or language-specific conceptual metaphors.

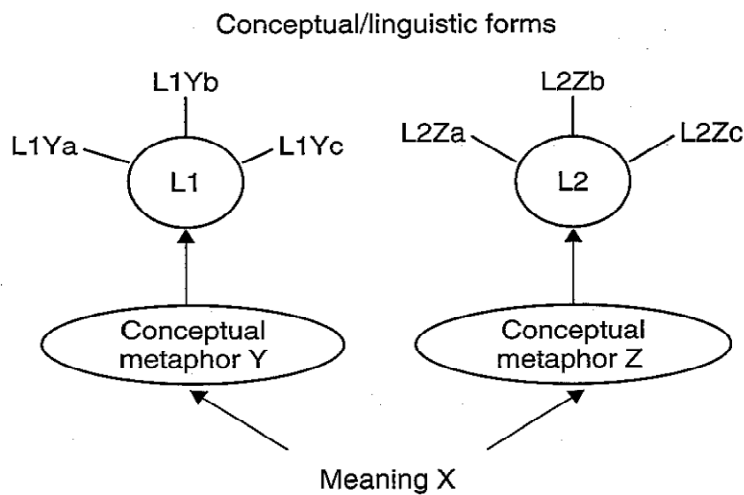


Figure 2: Comparative networking in language-specific conceptual metaphors (Trim 2007: 71)

Trim (2007) observed that cross-linguistic “equivalence does tend to be flexible in figurative language but there are definitely some items which sound strange in one language but not in another” (Trim 2007: 70). He used the phrase “language-specific saliency” (Trim 2007: 64) to describe these cross-linguistic variations. Language-specific saliency is understood as the suitability of a metaphor in a specific language, i.e., if a ST metaphor is highly salient in the TL, it will be easier to transfer the ST image to the TT. Trim argued that the translator has more creative freedom in the translation of literature than in other genres such as journalism due to “poetic license” but also due to the fact that the metaphors in the ST may even appear odd or at least unfamiliar to a native speaker and should therefore perhaps be allowed the same unfamiliarity in the TT (Trim 2007: 65). It could perhaps be argued that journalists often use metaphors that are as creative as metaphors in literature, not least to catch the readers’ attention. Whether or not the translator of a journalistic text feels the same poetic license is debatable and could depend on the translation brief.

Cristofoli et al. (1998) claimed that there is another difference between metaphors, viz. between metaphors in fiction and non-fiction. Metaphors in non-fiction must have the ability to be understood immediately without any effort on the part of the comprehender. Metaphors in this text genre are often recycled (Cristofoli et al. 1998: 168), which increases the reader’s chance to

have encountered these metaphors before and integrated them in her mental lexicon. However, this familiarity with specific genres of metaphors and journalistic text does not necessarily mean that they should be translated in the same manner each time as metaphors are highly context dependent. Following Trim's terminology, it would seem that metaphors with a low degree of TL saliency would be more effortful to translate than metaphors with a high degree of TL saliency as the ST metaphor could not be directly transferred into a TL equivalent. Of course, this assumption would only be found to be valid if a direct translation of metaphor is less effortful in terms of cognitive effort than paraphrasing or replacing the metaphor with a different image.

3.1.3 Conceptual Metaphor Theory

The above theories of metaphor concern linguistic metaphors, i.e., the actual metaphorical manifestations in a phrase. However, it is impossible to discuss metaphor theory without considering the conceptual metaphor theory, which has continued to raise attention as well as debate ever since Lakoff and Johnson's seminal work *Metaphors we live by* (1980) was published. Lakoff and Johnson argued that the linguistic expressions labelled metaphor in a given text or speech are actually manifestations of metaphorical structures in the human conceptual system (Lakoff and Johnson 1980: 6). A conceptual metaphor is a cognitive concept deeply embedded in our culture through which we are able to relate to abstract concepts in the world around us. In fact, Lakoff and Johnson take their statement a step further and argue that humans generally perceive their world metaphorically (Lakoff and Johnson 1999: 45). Lakoff and Johnson use the conceptual metaphors LOVE IS WAR and TIME IS MONEY⁷ to explain how non-physical and abstract concepts such as love and time are understood through the conceptual metaphors and expressed through instances of linguistic metaphors manifested on the basis of these conceptual metaphors. In other words, conceptual metaphor theory regards linguistic metaphors as instantiations of conceptual metaphors in specific utterances or sentences. Examples of linguistic metaphors are *He won her hand* (Lakoff and Johnson 1980: 49) and *I've invested a lot of time in her* (ibid: 8). In other words, the linguistic metaphors are

⁷ Conceptual metaphors are conventionally represented in capital letters.

regarded as manifestations of underlying conceptual metaphors. The existence of conceptual metaphors is argued on the basis of patterns of use in linguistic metaphors. Lakoff and Johnson argue that humans understand and relate to their world through metaphors and that these linguistic metaphors are the proof.

Another classic example of a conceptual metaphor is HAPPY IS UP. This conceptual metaphor is argued to be manifested through a number of linguistic metaphors such as *I'm feeling up today* (Lakoff and Johnson 1999: 50). According to Lakoff and Johnson's theory of conceptual metaphors, the target domain of the conceptual metaphor is HAPPY, which is defined by the source domain of UP. The reason that it is UP rather than HAPPY which is defined as the source domain is because it is the source domain, which is superimposed (or "mapped") onto the second domain, the target domain (Barcelona 2003: 3). The target domain is, in other words, defined by the source domain through these "mappings". Examples of manifestations of the conceptual metaphor FEAR IS COLD include *cold feet, in a cold sweat, make your blood freeze, make your blood run cold* (Goatly 2007: 238).

As can be deduced from the above examples, conceptual metaphors are difficult to investigate empirically, as they are manifested through a variety of linguistic metaphors, and it is only through induction that the existence of conceptual metaphors can be argued. Of course, historically, this has been the way that the majority of research in the humanities, including linguistic research, has been carried out. In recent years, however, there seems to be a shift towards more empirically-focused research in language and translation research, in part thanks to the new and more precise technologies available today such as eye-tracking, key-logging, ERP⁸, fMRI⁹, etc. There has also been a shift in recent years away from emphasis on conceptual metaphor theory to a cognitive view of metaphor in which empirical research forms the basis for deductive arguments about metaphors as cognitive concepts (for a discussion of this

⁸ Event-related Potential (ERP): "*the pattern of electrical brain activity recorded by several scalp electrodes is averaged to produce a single waveform*" (Eysenck and Keane 2010: 7).

⁹ Functional magnetic resonance imaging (fMRI): "*this technique involves imaging blood oxygenation using an MRI machine*" (Eysenck and Keane 2010: 7).

development, see e.g., Steen 1994). Steen argued that the analysis of language structure such as is done in conceptual metaphor theory should not be equated with the study of actual language use.

In other words, the weakness of conceptual metaphor theory is that it is only possible to surmise the existence of any given conceptual metaphor through empirical research on its linguistic manifestations. It is evident that metaphors in a specific genre of text, financial texts for example, tend to group around a limited number of semantic domains (Charteris-Black 2000: 149), but it is very difficult to make the leap to proving the existence of a conceptual metaphor based on these findings (see also Gibbs and Perlman 2006: 215). Patterns of linguistic metaphor may suggest a conceptual metaphor but do not confirm the psychological validity of the metaphor, i.e., is there an actual mental representation in the mind that is shared by different linguistic manifestations? In partial opposition to Charteris-Black's claim of metaphorical groupings, Kimmel (2010) argued that metaphor clusters (in "textual adjacency") in journalistic texts are in fact very often from mixed domains and that, contrary to previous opinion, this is not a sign of linguistic confusion. In fact, Kimmel found that mixed metaphors accounted for 76% of all metaphor clusters in a corpus consisting of British newspaper texts, and he furthermore argued that these metaphors from mixed domains are no less comprehensible than non-mixed metaphors (Kimmel 2010: 97). Although Kimmel's findings do not disprove conceptual metaphor theory, they at least make it reasonable to question if conceptual metaphors are always necessarily present beneath linguistic metaphors.

Linguistic metaphors are present in text and speech and are therefore directly observable. The arguments for the existence of conceptual metaphors are certainly appealing as an explanation of patterns found in linguistic metaphors, but the cognitive reality of conceptual metaphors has not been definitely established. This thesis will focus on the language structures and units directly present in STs and TTs, i.e., the linguistic metaphors.

However, this should not be taken to mean that conceptual metaphor theory is viewed as having no validity in metaphor translation studies. Schäffner has offered an in-depth analysis of

conceptual metaphors underlying political discourse in the European Union from a translation perspective (Schäffner 2004, 2012), and Crerar-Bromelow (2008) posited that “once the translator goes beyond merely identifying a metaphor’s static stylistic category and examines the structure which informs it, s/he is in an empowered position to investigate the nature of the idiom [sic]” (Crerar-Bromelow 2008: 90). However, to establish the existence of a conceptual metaphor with any reasonable level of certainty would require a substantial amount of corpus research, and the focus of this study was the cognitive effort invested in comprehension and translation of the individual linguistic metaphors.

Mühlhäusler (1995) stated that “the metaphorical schemes of English are shared, or at least largely overlap, with those of most Standard Average European languages but are absent or different in so-called ‘exotic’ languages” (Mühlhäusler 1995: 282). This should mean that a Danish translator working from English, her L2, into Danish, her L1, would be able to use the same underlying conceptual metaphor in the TT as was used in the ST. An awareness and understanding of this underlying conceptual metaphor could be assumed to facilitate the cognitive effort involved in translating different linguistic expressions of conceptually identical metaphors. However, as argued by Trim, the conceptual metaphors may still be expressed differently in two languages (see section 3.1.2).

3.1.4 Metaphor Comprehension: Ambiguous or Not

Recent decades have seen a strong increase in empirical psycholinguistic research on metaphor comprehension. The applied methodologies include ERP measurements (Blasko and Kazmerski 2006), neuro-imaging (Mashal and Faust 2010), eye-tracking (Inhoff et al 1984) and response times (Glucksberg 2001). Inhoff et al’s research from 1984 used a pioneering eye-tracking methodology to investigate reading times for metaphorical expressions compared with literal expressions and found no difference when the metaphors were supported by context. Blasko and Kazmerski found that metaphors were interpreted directly when supported by context or when the connection between the two semantic domains was clear (Blasko and Kazmerski 2006:

280ff.). Using neuro-imaging, Mashal and Faust concluded that metaphorical interpretation was influenced by several variables including metaphoricity¹⁰ and text presentation style.

There are two opposing views on the process of metaphor comprehension. The first, more traditional view, argues that metaphor comprehension requires a greater cognitive effort than literal language and that the process itself differs in terms of stages (Searle 1979, Coney and Lange 2006: 94). Searle argued that the metaphorical interpretation of a metaphor only takes place once a literal interpretation has been found defective (Searle 1979: 105), termed the *indirect processing approach* by Blasko and Connine (1993: 295). The other view of metaphor claims that metaphors are processed in a manner similar to literal language and do not require an additional processing effort (Glucksberg 2001). This is the *direct processing model* in Blasko and Connine's terms.

Glucksberg investigated participants' response times for rejecting metaphorical statements as literally false compared with response times for rejecting non-metaphorical and literally false statements and found that participants took longer to reject metaphorical statements, indicating that the metaphors were in fact interpreted as metaphors. An example of a literally true statement was *some birds are robins*, while a literally false but metaphorical statement could be *some jobs are jails*, which is a metaphor although it is perhaps possible to question the aptness of some of the metaphors reported by Glucksberg. An example of a literally false and non-metaphorical statement could be *some birds are apples*. Glucksberg found a mean response time of 1239 milliseconds for rejection of the metaphorical statements as literally false compared with a mean rejection time of 1185 milliseconds for literally false non-metaphorical statements (Glucksberg 2001: 22). The longer response time was ascribed to a metaphor interference effect, in other words that the metaphorical interpretation could not be ignored even if it was not the focus of the task.

¹⁰ i.e., the power of the metaphorical image

Glucksberg posited that metaphors will always be interpreted metaphorically and that this metaphorical interpretation is non-optional (Glucksberg 2001: 28), a statement based on experiments in which college students preferred metaphorical interpretations of noun combinations when such interpretations were available. With a background in psychology rather than linguistics, Glucksberg's methodologies had a strong empirical foundation with highly controlled experiments. However, the majority of experiments relied on offline measures such as response times and response accuracy in experiments with a low level of ecological validity. This sacrifice of ecological validity for the ability to construct a carefully controlled experiment may be necessary, but at the same time, findings from such experiments would be solidified if aligned with findings from experiments with a higher level of ecological validity.

Experiments in which the eyes are tracked during a task in which a text is read for comprehension could perhaps reveal differences in the way in which metaphorical expressions are read in comparison with literal expressions instead of the offline measure of response time. However, the claim that metaphors are always comprehended metaphorically would be difficult to verify even with online measures, as longer gaze times only indicate an increase in cognitive effort and does not enable any conclusions on the way in which the read metaphor was interpreted. Glucksberg's claim must stand alone on the basis of his response methodology.

Gerrig and Healy (1983) found that metaphors preceded by priming context were comprehended faster than metaphors succeeded by informative context. An example of such a manipulated metaphor is "*The night sky was filled with drops of molten silver*" versus "*Drops of molten silver filled the night sky*". The experiment had college students read sentences presented individually and press a response button once the sentence was comprehended. Sentences containing metaphors were then presented either before or after a context sentence. Gerrig and Healy claimed that the reason for the shorter response times was because the preceding context primed the reader for a metaphorical interpretation of "*drops of molten silver*" whereas the interpretation of the metaphor without preceding context would initially receive a literal interpretation, which would subsequently be discarded in favour of a metaphorical interpretation, i.e., a garden-path structure (Gerrig and Healy 1983: 668). In a garden-path sentence, the reader may become aware of inconsistencies in an earlier interpretation of a

sentence because of a structural or syntactic ambiguity and will go back and reread segments earlier in the sentence based on a new understanding of the entire sentence (see e.g., Frazier and Rayner 1982, Pickering et al. 2000).

Gerrig and Healy's argument that priming context results in a faster comprehension process seems to be supported by later research by Inhoff et al. (1984) and Glucksberg (2001), claiming that comprehension of metaphors with supporting context does not require a greater cognitive effort than comprehension of literal expressions.

Glucksberg stated that metaphors are not ambiguous if embedded in a context and will not be interpreted literally (Glucksberg 2001: 28). This statement receives support from a paper by Blasko and Kazmerski (2006) citing several ERP studies on metaphor processing. One of those studies cited showed that when metaphors were presented in context, only the metaphorical meaning was activated (Blasko and Kazmerski 2006: 271). Blasko and Kazmerski emphasised the importance of supporting context. However, they further argued that when the link between the metaphor's two concepts is less strong, then a number of other factors may determine the level of cognitive effort required. These factors may include "the personality, knowledge, and expertise of the comprehender" (Blasko and Kazmerski 2006: 280).

In an eye-tracking study, Inhoff et al. (1984) investigated the cognitive effort invested in metaphor comprehension. As stated by Just and Carpenter (1980), "readers make longer pauses at points where processing loads are greater". These points could be at infrequent words, sentence-end positions or while integrating information (Just and Carpenter 1980: abstract). Following Just and Carpenter, longer reading times are generally accepted to be an indication of an increase in cognitive effort as a norm in eye-tracking studies (Rayner and Sereno 1994: 58, Jakobsen and Jensen 2008: 114). Inhoff et al. (1984) found that metaphor comprehension does not constitute an increase in cognitive effort as compared with comprehension of literal expressions, but only when the metaphor was presented in context. In contrast with this, a recent ERP study, measuring participants' electrophysiological responses to stimuli containing literal expressions, conventional and novel metaphors as well as anomalous expressions, found that

both conventional and novel metaphors¹¹ required a higher processing effort and that especially novel metaphors required a sustained effort (Lai et al. 2009). Noveck et al. (2001) found longer reading times for metaphoric expressions than for controls. With less clear data, Noveck et al. also found that a “metaphoric reference has the potential to yield benefits” (Noveck et al. 2001: 118) in terms of a slightly higher number of correct responses to questions after a metaphoric reference than after a synonymous literal one. This observation seems to support the views of cognitive linguists as well as Black’s interactionist views on metaphor and Lakoff and Johnson’s theory on how we perceive our world metaphorically as Noveck et al’s findings indicate that metaphors facilitate comprehension rather than hinder it.

As is evident from the research reported in the previous sections, there is still little agreement on whether metaphors do in fact require an increase in cognitive effort compared with literal language. Furthermore, there are a multitude of other parameters which could have an effect on the process of comprehending metaphors potentially confounding analysis of the data. The most important of these will be discussed in the following sections.

3.1.5 Metaphor Conventionality

Gentner and Bowdle’s (2001) *career of metaphor* theory posited that novel and conventional metaphors are processed differently in the sense that when processing a conventional metaphor, two possible interpretations may be activated and the irrelevant literal interpretation is filtered out. Gentner and Bowdle’s argument was that conventional metaphors become lexicalised as a secondary meaning of the topic term (Gentner and Bowdle 2001: 228). In other words, the metaphorical interpretation is retrieved from a lexical repository. Lexicalised metaphors are fixed expressions as opposed to novel metaphors, which may be created or adapted ad-hoc.¹²

¹¹ Conventional metaphors are more frequent and established in the language than novel metaphors. For further information about conventional versus novel metaphors, please refer to section 3.1.5.

¹² <http://www.merriam-webster.com/dictionary/lexicalization>

For novel metaphors, no interpretation is available in the repository or “mental dictionary” and two conceptual concepts must be connected via a “cross-domain mapping” (Steen 2007: 77). Gentner and Bowdle provide “*blueprint*” as an example of a conventional metaphor in that, according to them, it has two meanings, a domain-specific and a domain-general : “a blue and white photographic print in showing an architect’s plan” and “anything that provides a plan”. In contrast, the example of a novel vehicle term “glacier” as in “Science is a glacier” only has a literal meaning, “a large body of ice spreading outward over a land surface”, but no related metaphoric meaning (e.g., “anything that progresses slowly but steadily”) and therefore has to be connected by a process of cross-domain mapping (Gentner and Bowdle 2001: 229).

In a related fMRI study of conventional and anomalous metaphors in Mandarin Chinese, Ahrens et al. (2007) found that conventional and anomalous metaphors activated different areas of the brain, indicating different processing patterns (Ahrens et al. 2007: abstract). Anomalous metaphors are defined as highly novel metaphors made up of two conceptual pairings not normally used, such as FOOD and WAR in “the two sides are digesting natural resources” (Ahrens et al. 2007: 164). The anomalous metaphors were made up of pairings of conceptual metaphor source and target domains that were evaluated by a group of native speakers not to exist in Mandarin Chinese (Ahrens et al. 2007: 165). Ahrens et al. found no significant difference in reading time for conventional metaphors versus literal expressions but found a slight activation in the brain’s right hemisphere for the conventional metaphors, which was speculated to be an effect of metaphorical processing or an effect of increase in working memory load (Ahrens et al. 2007: 168). There was a significant difference in reading time for the anomalous metaphors compared with both the conventional metaphors and the literal expressions, but perhaps it is more interesting to note the differences in activation patterns in the brain found, not only between anomalous metaphors and literal expressions, but also between anomalous and conventional metaphors, which the researchers conclude show that metaphors cannot always be grouped together as one homogenous group to be compared with literal expressions but that a finer-grained distinction between different types of metaphors should be made.

Of course, it is possible to speculate that part of the explanation of the differences in activation patterns could be found in the fact that Ahrens et al. compared conventional metaphors with anomalous metaphors rather than with novel metaphors (see section 4.6 for a clarification of how metaphor conventionality was taken into account in this study). The issue with the comparison with anomalous metaphors is that it is possible that other factors such as salience (see later in this section) have an effect on the activation patterns, which does not seem to be included as a variable in the reported experiment. Certainly, the examples provided by Ahrens et al. suggest that salience or aptness rather than conventionality is the main difference between the two metaphor types. Their example of a conventional metaphor from the experiment is “*the framework of this theory is very loose*” whereas the example of an anomalous metaphor is “*their (financial) capital has a lot of rhythm*” (Ahrens et al. 2007: 165). Intuitively, the anomalous metaphor is more difficult to comprehend, not because it is novel or different, but because the connection between the topic and the vehicle is less obvious, i.e., the metaphor is less apt than the conventional. This does not necessarily mean that Ahrens et al.’s observation that metaphor processing may differ according to the type and nature of metaphor is less valid, but perhaps their findings and experimental design only emphasise the complexity of any investigation of metaphor processing, precisely because of the complex, multi-faceted nature of metaphor.

The claim that different types of metaphor may be processed differently received indirect support from research by Erman (2007) in which Sinclair’s *idiom principle* (Sinclair 1991) was investigated through corpus research on speech pauses. The idiom principle states that a language user’s mental lexicon will contain not only single words but also a number of multi-word units, such as idioms and collocations. Through investigating the duration and frequency of speech pauses in spontaneous speech, Erman found indication in the low frequency of pauses in multi-word units that these units “remain unanalyzed in production” (Erman 2007: 48). In other words, multi-word units, which the language user is confronted with frequently, can become fixed units in the mental lexicon and retrieved as one unit rather than as several individual lexical choices. Erman also makes the observation that perhaps contexts and situations in which the conventionalised multi-word units appear may also be stored in the mental lexicon (Erman 2007: 45), enabling faster retrieval of the appropriate collocation for speech production. For the translator this would mean that she would be able to store an encountered metaphor, either in L1 or L2, in her mental lexicon, enabling faster retrieval and

therefore faster comprehension the next time the same metaphor is encountered. Following Erman, the translator would also store the context in which the metaphor occurred, which would make her able to retrieve the metaphor from the mental lexicon for use in the appropriate context, such as using words or phrases from the semantic domain of healthcare as vehicles for the economy as topic, as is seen in Text 4 (see Appendix 1).

However, it is also possible that metaphors are so context dependent that the comprehension process is not facilitated unless the metaphor was encountered in a completely identical situation in which the translator received the same translation task, intended for the same audience at the same point in time and with the translator having the exact same level of translation experience. Intuitively, it would seem more likely that the translator would encounter a metaphor similar to one previously encountered but this time perhaps intended for a different target audience or used with a different intention by the author. It could therefore be questioned whether familiarity with a metaphor would in fact reduce the cognitive effort required for its translation.

Jones and Estes (2006) defined conventionality as “the strength of association between a metaphor vehicle and its figurative meaning” (Jones and Estes 2006: 19). Giora defined conventionality as “the lexical meanings automatically associated with entries before any extra inferences based on contextual assumptions have been derived” (Giora 1997: 185). A helpful tool to ascertain whether a certain metaphor should be classified as original or conventional is a dictionary. If the metaphorical sense of a lexical item is listed in the dictionary, the lexical item can reliably be defined as conventional (Way 1994: 240). The Pragglejaz Group (2007) used this method as part of their procedure for determining whether or not a lexical unit was used metaphorically. Way (1994) defined dead metaphors as “usages which have lost their metaphoric import and have been so thoroughly integrated into language that they have become literal” (Way 1994: 16), i.e., dead metaphors are highly conventional metaphors frozen in their form. Way offered expressions such as *running water* and *the foot of a mountain* as examples of dead metaphors (Way 1994:16) and made the observation that, at any given time in language, there will be metaphors which range the entire scale from live to dead or from original to conventional. In other words, the classification of metaphor should not necessarily be seen as

fixed categories but rather as a sliding scale on which a metaphor may move throughout its existence from inception.

This statement received support by Bowdle and Gentner who argued that “*some conventional metaphors are more conventional than others*” (Bowdle and Gentner 2005: 208), which perhaps does not make it practicable to include conventionality as a variable in empirical research, simply because the distinction between novelty and conventionality is too vague for identification. It could furthermore be argued that the terms *original* and *conventional* are more appropriate than *live* and *dead* as it intuitively makes more sense to refer to a metaphor as being relatively conventional rather than relatively dead (see section 4.6 for a clarification of how metaphor conventionality was indirectly taken into account in this study).

A widely acknowledged hypothesis is Giora’s graded salience hypothesis (1997), which posited that the important distinction determining the cognitive effort required is in fact not between literal and figurative meanings but between salient and nonsalient meanings. Giora defined salience as “a function of its conventionality (cf. Gibbs 1980), familiarity (cf. Blasko and Conine 1993), frequency (cf. Hogaboam and Perfetti 1975; Neill, Hilliard, and Cooper 1988), or givenness status in a certain (linguistic and non-linguistic) context” (Giora 1997: 185). In other words, the more immediately available meaning will be interpreted first, and only when this interpretation is evaluated as incorrect, will a less salient meaning be interpreted irrespective of whether the more salient meaning is literal or figurative. Giora also referred to a salient meaning as being *coded* as she argued that, for a specific meaning of a word to be salient, it must necessarily be encoded in the mental lexicon and furthermore have a prominent position in the mental lexicon on the basis of “*conventionality, frequency, familiarity, or prototypicality*” (Giora 2002: 490). This implies that any meaning not in the mental lexicon is nonsalient and a less-frequent meaning is less salient. Context can affect the saliency of any given conventional meaning, but according to Giora, context is only one of many factors with an effect on the saliency of a meaning. The degree of saliency can be influenced by degrees of familiarity or frequency of the expression. Thus, an expression will not have a fixed degree of saliency as the level of familiarity with the expression can differ from person to person and, consequently, the degree of saliency will differ (Giora 2002: 491).

On the other hand, the conventionality of a specific metaphor must be expected to have a significant effect on the saliency of the expression as frequency and conventionality necessarily must be correlated to some degree. After all, a metaphor becomes conventional through frequent use, which again must be expected to have an effect on the familiarity with a metaphor as there must be a higher chance of familiarity with a metaphor which is conventional and therefore frequently used, resulting in more exposure. This thesis therefore assumes some level of correlation between metaphor conventionality and familiarity while also acknowledging that a metaphor's general level of conventionality does not necessarily mean that a specific individual is familiar with the metaphor. On the other hand, any individual is more likely to be familiar with a conventional metaphor than with a novel one. Both conventionality and familiarity were taken into account in the statistical model for the data.

One of the strengths of the graded salience hypothesis is the way in which it seeks to explain the arguments from proponents of the direct processing view, arguing that metaphors are processed in a similar and equal manner to literal expressions (Glucksberg 2001), as well as the arguments from proponents of the standard pragmatic model also known as the indirect processing view (see section 3.1.4), claiming that comprehension of metaphors is different from and more effortful than comprehension of literal expressions (Searle 1979, Noveck et al. 2001).

Giora explained the disparity of findings from the two opposing views of meaning processing and metaphor with the hypothesis that salience takes precedence over the distinction between literal and figurative and between conventional and novel expressions and also over context effects (Giora 2002: 490). The graded salience hypothesis is not inconsistent with arguments from either side, but instead tries to bridge the gap between the opposing viewpoints. Although both salience and conventionality are well-defined in the hypothesis, the main weakness of the applicability of the hypothesis seems to be the subjective manner in which saliency is evaluated. No clear-cut methodology is provided for judging the saliency of an expression, which perhaps renders the hypothesis less useful than it has the potential to be. The hypothesis is also inconsistent with findings from an ERP study done by Lai et al. (2009), which reported that

conventional metaphors deemed “as interpretable and as familiar as literal sentences” by participants still showed an effect different from that of literal sentences (Lai et al. 2009: 152). For Giora’s graded salience hypothesis to have been confirmed, there should have been no difference between the effects from the conventional metaphors and their literal counterparts as the metaphorical meaning should have been equally salient unless the difference in effect was caused by a difference in the way metaphors are processed compared with literal expressions. This difference may not necessarily mean that metaphors are more cognitively effortful to process but only that they may be inherently different from literal expressions and will therefore be processed differently in the mind.

Gibbs proposed that a flexible and very general model is perhaps the best solution for a model of metaphor comprehension (Gibbs 2001: 325). An example of such a flexible model could be Giora’s graded salience model or perhaps Katz and Ferretti’s constraint satisfaction model (Katz and Ferretti 2001), which Gibbs described as a hybrid model which seems able to make sense of the many aspects of metaphor comprehension (Gibbs 2001: 322). By measuring reading times of proverbs with a moving word-by-word text window, Katz and Ferretti investigated context effects in relation to saliency and familiarity. Based on their findings, which offer no unequivocal support for what they term the obligatory-first model (literal interpretation first), the direct access model (direct figurative interpretation when supported by context) or the graded saliency model, Katz and Ferretti argued that the reason for the diverse and often contradicting results in research on ambiguity resolution can best be explained by the constraint satisfaction model, which posited that the various units of disambiguating information, such as not only syntactic, lexical and conceptual information but also information derived from context and familiarity, will act in parallel as constraints on the interpretation of a given lexical unit. Katz and Ferretti interpreted the results of their experiments within the framework of the constraint satisfaction model: familiar proverbs are processed faster than unfamiliar proverbs because the interpretation of the familiar proverb will be constrained by information retrieved from a lexical repository as well as contextual constraints, which work together to support a figurative interpretation (Katz and Ferretti 2001: 215).

There are several differences between proverbs and metaphors, not least the fact that metaphors are generally flexible units, which can be altered to fit the context (unless the metaphor is highly conventionalised, i.e., frozen in its lexical form) and infinite in number, whereas proverbs are conventional phrases and by their nature frozen in their conventional lexical form. It must also be assumed that there is a limit to the number of proverbs in any given language, although it is of course possible that new proverbs can be created.

Despite the differences between proverbs and metaphors, there are more similarities than differences as both concepts are part of figurative language, which was also evident with some of the examples from Katz and Ferretti such as the familiar proverb *you can't get blood from a stone* and the less familiar proverb *straight trees have crooked roots*¹³ (Katz and Ferretti 2001: 219ff.), where “*a stone*” can be interpreted metaphorically as something or someone cold and hard, and “*straight trees*” could be interpreted metaphorically into the familiar phrase of “appearances can be deceiving”. It seems reasonable to assume that the arguments made by Katz and Ferretti regarding the constraint satisfaction model’s ability to explain the comprehension of proverbs can be applied to metaphorical expressions with the same amount of validity. The constraint satisfaction model can perhaps also help explain why empirical research, using various forms of methodologies, has found such varying results in the investigation of cognitive effort invested in metaphor comprehension. In other words, the process of metaphor comprehension is likely too complex to be understood solely in terms of saliency, conventionality or any of the other factors, which all instead act as multiple constraints on the interpretation process.

3.1.5.1 Classification Schemes

As can be seen from the above sections, there are many different ways of viewing the nature of a metaphor, but there is one finding which there seems to be consistent agreement about. The conventionality of the metaphor will have an effect on the comprehension process and

¹³ These proverbs could also be regarded as dead metaphors according to Way’s definition, see section 3.1.5.

consequently on the cognitive effort invested in the process. But as is the case for metaphor definition, there seems to be little consistency in metaphor classification.

In his work on translation, Newmark presented perhaps the most extensive classification scheme for metaphors with five categories: dead, cliché, stock, recent, and original (Newmark 1981: 85). *Dead* metaphors are metaphors where the comprehender is “hardly conscious of the image”. Newmark argued that the vehicles of dead metaphors are often taken from terminology from “space and time, the main part of the body, general ecological features and the main human activities” (Newmark 1988: 106). Newmark’s examples of dead metaphors included “field, line, top, bottom [...] fall, rise”, as e.g. in ‘the field of human knowledge’. The category of *cliché* metaphor was defined as a category of metaphors which are used “emotively” “as a substitute for clear thought” (Newmark 1988: 107). Newmark illustrated this category with the examples of e.g., *backwater* and *break through*. The third category was termed *stock or standard* metaphors. Newmark acknowledged that the distinction between cliché and stock metaphors is quite vague and may be context dependent. A stock metaphor is an “established” metaphor which can be efficient when used informally. It can have an emotional value similar to a cliché metaphor but is “not deadened by overuse” (He exemplified this category with *keep the pot boiling*, *wooden face* and *a drain on resources* (Newmark 1988: 108ff.)). The fourth category was *recent* metaphors which are new expressions which have quickly become popularised in the language such as e.g., *head-hunting* (Newmark 1988: 112). The final category of *original* metaphors were created or quoted by the sender, and the few examples provided by Newmark seemed to indicate that many of this type are quite elaborate or even ‘bizarre’ (p. 112) such as *and on the second day, the squealing (sic) of brakes was loud in the land ... The National Coal Board had gone about as far as it could go* (Newmark 1988: 113). How a metaphor can be original if quoted is not obvious, but it would seem to depend on its lack of widespread use.

Newmark’s classification scheme is finely granulated, but for the purpose of empirical research, especially considering the apparent difficulty of documenting processing differences, two or three metaphor categories will be sufficient as this will help avoid any overlap in classifying the investigated metaphors, i.e., that a specific metaphor could be categorised in more than one category.

Deignan (2005) classified linguistic metaphors according to their frequency in a corpus. Her model is partly based on Lakoff's discussion of dead metaphors (Lakoff 1987) and Goatly's classification scheme (1997) with metaphors from naturally occurring texts, which she then combined with her corpus methodology. Her model can be seen below.

Table 1: Identification and classification of metaphorically-motivated linguistic expressions (Deignan 2005: 47)

Types of metaphorically-motivated linguistic expressions	Identification	Example
1. Innovative metaphors	Fewer than one use per thousand corpus citations of word, or all citations from a single source.	He held five <i>icicles</i> in each hand. (Larkin, cited in Goatly 1997:34)
2. Conventional metaphors	Not innovative or historical by corpus criteria (see 1 and 4). Metaphorical sense dependent on core senses by corpus linguistic and/or semantic criteria.	The wind was <i>whispering</i> through the trees. (Allbritton 1995:35) <i>grasp</i> (Lakoff 1987b) (spending) <i>cut</i> (Goatly 1997)
3. Dead metaphors	Not innovative or historical by corpus criteria (see 1 and 4). Metaphorical sense not dependent on a core sense by either corpus linguistic or semantic criteria	<i>deep</i> (of colour) <i>crane</i> (machine for moving heavy objects) (Goatly 1997)
4. Historical metaphors	The former literal sense is either not represented in	<i>comprehend</i> , <i>pedigree</i> , <i>pupil</i> (meaning "young student")

	corpus or is so different in meaning as to be homonymic for current speakers.	
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Although Deignan’s methodology may be different, her classification categories are not drastically different from those of other researchers. An important aspect of Deignan’s work is the observation that methodologies in metaphor research need not be entirely intuitive and can in fact be based on objective empirical criteria rather than subjective introspections (Deignan 2005: 118). However, because of the lack of sharply delineated borders between the different metaphor categories, it can be somewhat complex to work with a specific category of metaphors unless one is able to incorporate corpus-based research as Deignan did.

However, the concept of using corpora to investigate the frequency of metaphorical expressions occurring in natural text was applied indirectly in this thesis as the effects of word frequency and word-in-context probabilities were included in the analyses of both the eye-tracking and key-logging data sets. The values were from the British National Corpus (BNC) and especially the word-in-context probability or trigram probability could be compared with Deignan’s corpora research as the trigram probability provides a value for the probability of a specific word occurring together with the words to the immediate left and right of the word. In other words, if there are very few occurrences of a word and its two neighbours occurring together in the BNC, the trigram probability value will be correspondingly low. Although this cannot be compared to actual corpus research such as the work done by Deignan, the unigram and trigram independent variables provide some of the same benefits as corpus research targeted specifically at classifying metaphors.

3.1.5.2 Metaphor Familiarity

As it has been established that the cognitive effort of metaphor comprehension is closely linked to individual factors such as vocabulary skills and working memory capacity (see section 3.2.2),

a general classification may not necessarily be more suitable than a more participant-focused classification based on metaphor familiarity, which would perhaps be more reflective of the cognitive processes of a specific group of participants with a shared profile. Gentili et al. (2008) specifically investigated familiarity rather than conventionality in an fMRI study in which they found significant differences in the activation pattern of non-familiar versus familiar metaphors. A control group was asked to rate a set of metaphors as familiar or non-familiar and another group of participants silently read passages containing either familiar, non-familiar or literal expressions (Gentili et al. 2008: 1). A similar procedure was adopted for the experimental methodology in this thesis in which a control group was asked to rate the familiarity of the metaphors in the texts which the participants were to translate. In other words, where word frequency values are typically based on a specific corpus, familiarity ratings are normally determined by a control group (Clifton et al. 2007: 345).

Gentili et al. defined familiarity “as an umbrella notion that embraces frequency, lexicalization, aptness and other parameters of metaphor complexity” (Gentili et al. 2008: 1). The concepts of frequency and lexicalisation are parameters of metaphor conventionality, and, following Gentili et al., also parameters of metaphor familiarity. The more lexicalized a metaphor is, the more conventional until the metaphor becomes dead or frozen. Intuitively, it follows that it is reasonable to assume some form of correlation between conventionality and familiarity. After all, if a metaphor is highly conventional, it means that it is used often, which would indicate that there is a good chance that the comprehender has gained a high level of familiarity with it.

Metaphor conventionality and familiarity consequently seem to be closely correlated concepts. Metaphor familiarity could be argued to be another measure of metaphor conventionality more oriented towards the individual reader whereas a corpus-based classification scheme of conventionality as used by Deignan (2005) could be argued to be more oriented towards the metaphorical expression itself. Danks and Griffin posited that the translator’s comprehension of the ST will function as a filter on the TT (Danks and Griffin 1997: 169). Intuitively, there would be a higher chance of an easier and more correct interpretation process for ST metaphors (and literal expressions) if the metaphor had been encountered and processed on previous occasions.

In other words, Danks and Griffin's statement could be regarded as support for familiarity as an indicator of cognitive effort in comprehension and production.

Gentner and Bowdle (2001) argued that conventionality should not be considered parallel to familiarity. Their point of view was that conventionalisation occurs through repeated use of a given vehicle term until that term becomes polysemous with two related meanings, a literal and a metaphorical. Familiarisation, on the other hand, takes place through repeated use of a given vehicle-topic pairing, leading to the creation of stock expressions such as "time is money" according to Gentner and Bowdle (Gentner and Bowdle 2001: 229). But it is never made quite clear how Gentner and Bowdle make the distinction between a conventional metaphor and a stock expression, which seem closely related, or how this distinction could be applied in empirical research. In this thesis, conventionality is assumed to be a component in the concept of familiarity, which is regarded as a more flexible parameter better suited for the investigation of a specific target group. This assumption is based on the reasoning that a frequently used expression, i.e. therefore one that has become conventional, will be more likely to be familiar to the reader than a less frequent and conventional expression.

3.1.6 Summary

As can be seen from the above sections, the number of factors which may have an influence on the process of monolingual metaphor comprehension is very large, and the bulk of research on metaphor comprehension consists of monolingual studies. Therefore, these findings may not necessarily all be fully relevant for research on L2 metaphor comprehension, but they are nevertheless useful for forming a theoretical framework and concepts.

It is assumed that all of these factors will also have some form of effect on the bilingual metaphor comprehension process, although perhaps to a lesser extent as the effect of these factors may be overshadowed by the cognitive effort of bilingual language processing. It is impossible to take all these factors into account when investigating metaphor processing, especially as many of these factors are so closely interlinked that it may be neither feasible nor necessary to keep them separate in a research design. This section will attempt to give an overview of the factors which have, in some form, been taken into account in the research reported here as well as give an account of the viewpoints and arguments which help form the theoretical framework of the present study.

Table 2 offers an overview of the main concepts applied in this thesis:

Table 2: Definitions of main concepts

Term	Definition
Literal meaning	The basic, non-metaphorical meaning or sense of a word or expression as found in a dictionary
Metaphor	A figure of speech in which a

	word or phrase is used in a non-basic sense, this non-basic sense suggesting a likeness or analogy [...] with another more basic sense of the same word or phrase” (Dickins 2005: 228)
Topic	The unconventional or abstract referent in the metaphorical expression
Vehicle	The conventional referent, the characteristics of which are mapped onto the topic
Grounds	The properties shared between the topic and vehicle
Cognitive effort	The mental effort spent by an individual on a mental process. In this thesis, cognitive effort is measured by gaze time and typing speed.

Further operationalisations of relevant concepts can be found in section 4.6.

This thesis takes a point of departure in the interactionist view of metaphor as a cognitive concept creating a new understanding of the topic included in the metaphor. Metaphors are regarded as serving a purpose beyond the merely decorative, a viewpoint which is supported by research by Glucksberg (2001), Koller (2004) and Lakoff and Johnson (1980). Although there is general consensus today on the view of metaphor as less of a rhetorical device and more of a cognitive concept contributing to a deeper understanding of, sometimes abstract, concepts, there is still little consensus on whether metaphors are ambiguous or not. This discussion is between

the opposing views of the standard pragmatic theory as supported by e.g., Searle (1979) and the direct processing model or direct access view as supported by e.g., Inhoff (1984) and Glucksberg (2001). On the basis of the research reported in this chapter, the direct access view appears to be the most convincing, i.e. the view that metaphors are not ambiguous and that a metaphorical interpretation is not second to a literal interpretation found to be false. This should not be taken to mean that metaphors are necessarily regarded as being processed in the same manner as literal expressions, rather that they are not considered to be ambiguous nor is any increased cognitive effort in the comprehension process ascribed to ambiguity.

Although this thesis does not specifically investigate the occurrence of conceptual metaphors, which are claimed by Lakoff and Johnson (1980) to form the basis of our understanding of abstract concepts, the linguistic metaphors found in the texts chosen for this experiment indicated a certain form of clustering around specific semantic domains. It seems intuitively logical that linguistic metaphors are not created randomly and ad-hoc, but are instead created on the basis of underlying topoi, which it has become customary to apply metaphorically to abstract concepts (see e.g., Charteris-Black 2000). The underlying, assumed conceptual metaphors and the associated linguistic metaphors may vary from language culture to language culture, whereas other metaphors may be almost universal in their use, bridging both languages and cultures. This issue of universal versus culture-specific metaphors will be discussed more in depth in the section Metaphor Translation (see section 3.2.4).

In this thesis, conventionality is understood according to Giora's definition, "the lexical meanings automatically associated with entries before any extra inferences based on contextual assumptions have been derived" (Giora 1997: 185). Gentner and Bowdle's *career of metaphor* theory (Gentner and Bowdle 2001), claiming that novel and conventional metaphors are processed differently, seems to have some validity, but Katz and Ferretti's (2001) constraint satisfaction model, described by Gibbs as a hybrid model, does seem to offer the most intuitively plausible explanation for the wide array of highly varied research results on metaphor comprehension and cognitive effort. There is such a multitude of unique and overlapping factors affecting the process of metaphor comprehension that it is perhaps not feasible to pinpoint a single one of them as the deciding factor for the cognitive effort required for the process.

Therefore, the flexibility of the constraint satisfaction model perhaps provides a more realistic picture of the comprehension process because it acknowledges that it is a process in which multiple pieces of disambiguating information act in parallel.

Saliency can be regarded as an effect of other factors such as context and familiarity. The present study examines metaphor comprehension in the light of the constraint satisfaction model, meaning that the cognitive effort required for comprehension will be regarded as being a result of an amalgamation of information derived from context, vocabulary, syntax, familiarity and several other factors, which are all regarded as overlapping to one extent or another. The effects of context, word frequency, and familiarity are some of the variables which are taken into account in the statistical regression model applied to the analyses of the eye-tracking and key-logging data sets. Although some of these elements and their effects may be overlapping in the comprehension process, the experiments were designed so as to control for as many influences as possible in order to investigate the effect of metaphor comprehension and production on cognitive effort without the ‘noise’ from all these other elements which come into play. The statistical regression model allows for analysis that eliminates noise effects.

With this said, familiarity was regarded as being a more comprehensive umbrella factor under which several other factors were included. Familiarity is defined in this thesis as an umbrella concept encompassing frequency, lexicalisation, and others in accordance with the definition put forth by Gentili et al. (2008). The comprehensiveness of the concept of familiarity means that it is perhaps the most suitable of the various factors for inclusion in the research design as an investigation of the effect of familiarity is also an indirect investigation of the effect of the many factors included in the concept of familiarity. Metaphor familiarity is also deemed more relevant than metaphor conventionality for investigation in this research design in which the group of participants is relatively homogenous.¹⁴ Conventionality is more generic and less reflective of the level of metaphor expertise with this specific group of participants with their particular background.

¹⁴ All 17 participants were professional translators (see section 4.2).

Because of the multitude of factors, it may be helpful to have an overview of the parameters involved in metaphor comprehension and how they are taken into account in this thesis. The purpose of Table 3 is to provide such an overview. The table should not be regarded as exhaustive, but it lists the essential elements of the theoretical framework of the thesis with regard to metaphors.

Table 3: Parameters of metaphor processing

Parameter	Researcher	Statement	Relevance to thesis	Data analysis
<i>Purpose and meaning</i>	Richards (1965)	The meaning of a metaphor is a result of the interaction of two concepts	This thesis holds the interactionist view of metaphor in line with Richards and Black.	The interactionist view was not investigated directly but was an underlying assumption about the metaphors in the experimental texts.
	Black (1981)	A metaphor creates a new perspective on one or more properties of the two concepts in interaction		
<i>Conceptual Metaphor Theory</i>	Lakoff and Johnson (1980)	Linguistic metaphors are manifestations of underlying metaphorical structures in the human conceptual system	The thesis investigates cognitive effort involved in translation of actual linguistic metaphors. The metaphors referred to in research questions One and Two refer to linguistic metaphors and not conceptual metaphors.	The metaphors in the experimental texts are linguistic metaphors and no underlying conceptual metaphors were identified.
	Steen (2004)	Beneficial to move from hypotheses on potential conceptual metaphors to empirically founded research on linguistic		

		metaphors	In line with Steen's (2004) point of view, it was not deemed feasible to ascertain the potential existence of underlying conceptual metaphors.	
<i>Conventionality</i>	Gentner and Bowdle (2001)	The career of metaphor theory posits that novel and conventional metaphors are processed differently: conventional metaphors become lexicalised as a second meaning of the topic term and novel metaphors are processed by mapping the two	Conventionality and familiarity were regarded as closely interlinked concepts of which familiarity was deemed to be the stronger predictor because familiarity was more closely linked to the particular background of the participant group.	The variable Trigram Probability is based on word frequency values from the BNC. The values are a measure of the probability of a word occurring together with the word on each side of it.

		<p>conceptual concepts involved.</p> <p>Conventionality was posited to be the main predictor of metaphor comprehension.</p>	<p>However, conventionality was investigated indirectly through the variable Trigram Probability, a value of the probability of a word occurring in a three-word context. Trigram Probability does not take into account whether the words are used metaphorically or literally.</p> <p>The Familiarity parameter is of relevance to all four research questions as metaphor familiarity was assumed to have an effect on both comprehension and production.</p>	
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	<p>Giora (1997)</p>	<p>The graded salience hypothesis posited that cognitive effort is dependent on an expression's saliency, an umbrella expression for conventionality, familiarity, frequency, and givenness in a certain context. Salience was argued to take precedence over the distinction between metaphorical and literal.</p>	<p>Giora's graded salience hypothesis was interpreted to mean that perhaps there would be no difference in the cognitive effort required for comprehension and translation of L2 metaphors if salience is more important than the difference between metaphorical and literal.</p> <p>The hypothesis was only investigated indirectly as the metaphor and comparison AOIs were not rated in terms of saliency.</p>	<p>The variable Type investigated whether there was any difference in cognitive effort required for comprehension and translation of metaphorical versus literal expressions. If no difference was found, this could be seen as indirect support of Giora's graded salience hypothesis.</p>
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<i>Familiarity</i>	Gentili et al. (2008)	Familiarity was defined as an umbrella concept of frequency, lexicalisation, aptness as well as other parameters.	<p>Familiarity was regarded as a stronger predictor than conventionality because familiarity was more directly targeted towards the specific background of the participant group.</p> <p>Following Gentili et al. (2008), familiarity was regarded as an umbrella concept and was seen as a special form of metaphor conventionality as frequency and lexicalisation are also parameters in metaphor conventionality. The familiarity ratings were therefore also assumed to be indirectly reflective</p>	A group of raters (professional translators) rated their familiarity with the metaphor AOIs. The averages of these ratings were included in statistical analyses 1.1. and 4.1 in the metaphor versus metaphor comparisons (see section 5.2, 6.2 and appendix 6).
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			of the metaphors' conventionality.	
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3.2 Translation as a Process

Gile (2009) offered a general model of the translation process, which illustrates how a translator may reread a sentence or a unit several times before deciding on the preferred choice of translation. Gile argued that the translator will decide on an initial hypothesis about the meaning of the unit, which may or may not be revised after drawing on both linguistic and extra-linguistic knowledge and the translator's general world knowledge as seen on the left- and right-hand sides of the model below. Gile talked of a translation unit, which was vaguely defined as a processing unit, which he acknowledged as a subjective definition (Gile 2009: 102). According to this definition, a metaphor could be assumed to be an example of a translation or processing unit. The subjectivity inherent in the definition of a translation unit could be regarded as an advantage as this subjectivity acknowledges the individuality that characterises not only translation output but also the translation process itself. In other words, what may constitute a translation unit to one translator may be only part of a larger translation unit for another translator. This was also the finding in Dragsted's (2004) empirical research on segmentation in translation from a cognitive perspective, in which a translation unit is regarded as a hybrid between the linguistic and normative concept of a source language and target language equivalent (in this case observed through pauses in key-logging) (Dragsted 2004: 43). However, in this thesis, the words central to the investigation of the research questions, i.e., the metaphorical expressions in the experimental texts, were assumed to be processed relatively uniformly in terms of their boundaries as the metaphors were assumed to be processed as relatively coherent units.

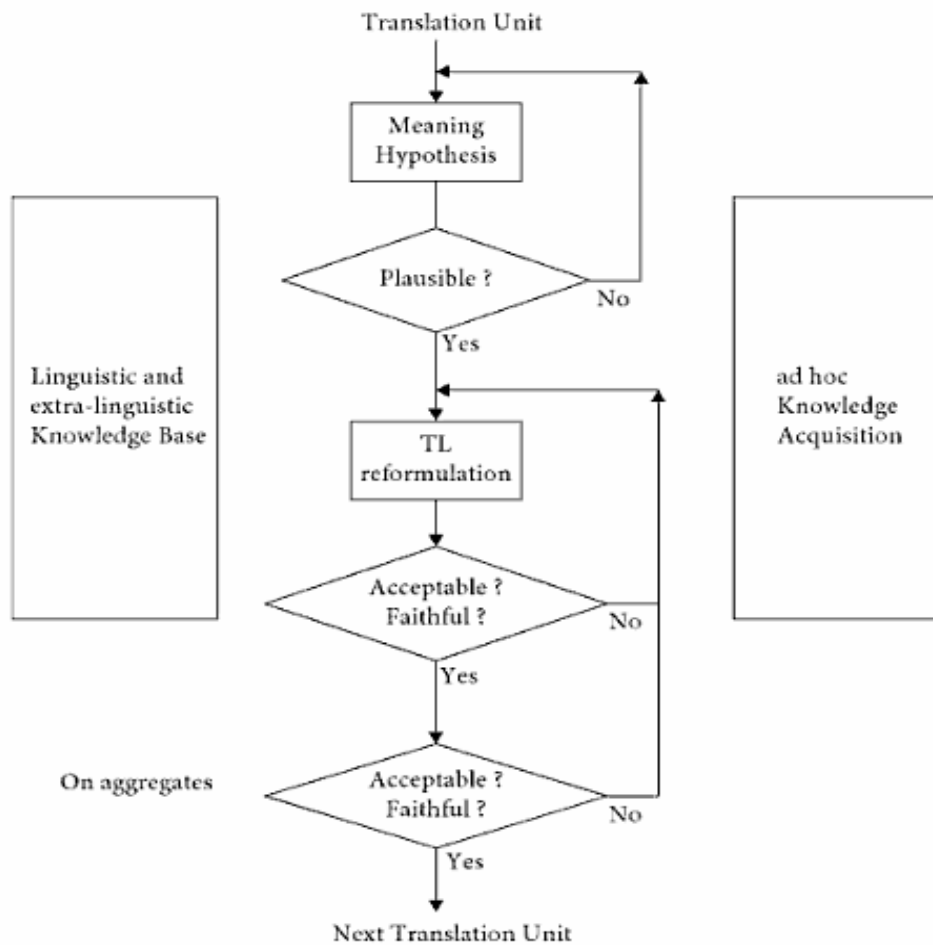


Figure 3: Gile's model of the translation process (Gile 2009: 102)

Gile created his model for didactic purposes, but it is also relevant for empirical research in translation. The idea of a meaning hypothesis, which is tested for plausibility against the translator's knowledge base, aligns well with empirical research on garden path sentences as well as other psycholinguistic work on e.g., regressions in eye-tracking research. In the translation process, the translator forms a hypothesis about the meaning of the read translation unit and tests this hypothesis against the knowledge available to her in the text as well as her own mental lexicon and external sources such as e.g., a dictionary or the web.

Gile's model is also relevant in relation to research on both metaphor comprehension and translation. Several researchers have argued that metaphors are not ambiguous and that the

comprehension of metaphors does not require a higher cognitive effort than comprehension of literal expressions (Glucksberg 2001, Inhoff et al. 1984). Following the line of thought in Gile's model, this means that, when reading a metaphor in a sentence, the initial meaning hypothesis will have a metaphorical interpretation, which will be found plausible based on the translator's knowledge base.

When the translator has decided that the meaning hypothesis is plausible, she will then move on to the reformulation in the target language according to Gile's model. The target language translation unit is provisional in the same way as the meaning hypothesis in that its initial version may also be modified several times during the translation process if for example it does not show fidelity to the ST (Gile 2009: 104). A relevant aspect of the reformulation phase is what Gile termed the "editorial acceptability", which is perhaps too narrow a term for a quite broad concept, as Gile included under this header "clarity, language correctness, stylistic appropriateness, cultural/social adequacy and compliance with conventional terminological usage" (Gile 2009: 104). Stylistic appropriateness, cultural adequacy as well as conventional terminological usage are all aspects which should be considered when translating metaphor, as metaphor is not only a stylistic rhetorical device but also a cultural phenomenon and certain types of metaphors are often predominant in specific genres (see e.g., Charteris-Black 2000).

Gile also pointed out that the translator will perform these tests of plausibility and acceptability for larger chunks of texts or "groups of translation units" (Gile 2009: 105). In other words, Gile's sequential model of translation can also be applied to sentences, paragraphs and entire texts and not only translation units. An important reason for carrying out these tests on larger text units is that the translator may gain a fuller understanding of the text the further into the text she comes (Gile's "ad-hoc knowledge" on the right-hand side of the model). It may then become necessary for the translator to revise either the meaning hypothesis or the reformulation of one or more translation units earlier in the text based on this new knowledge. In other words, the reader will retrace her steps on the garden path ready to form a new meaning hypothesis based on newly acquired ad-hoc knowledge about the possible meaning of the sentence.

On the basis of empirical research on orally produced translations, Lörcher (1992) concluded that the translation process of professional translators is characterised by a top-down sense-oriented approach in which the translator separates the sense from the sign in the source language and searches for equivalent target language signs on the basis of the sense rather than using a sign-oriented approach, which Lörcher argued is generally used by the foreign language learner (Lörcher 1992: 153). This is illustrated graphically in the following model:

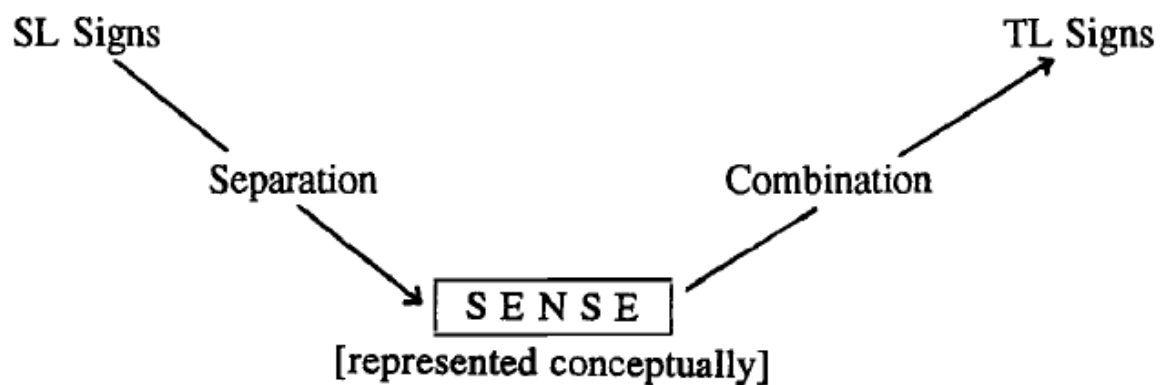


Figure 4: Sense-oriented translating (Lörcher 1992: 154)

Lörcher's model of sense-oriented translation could perhaps be even more relevant for metaphor translation than for translation of literal expressions. After all, interpretation of a metaphor requires that the translator moves beyond the signs or words, which will not make any sense if interpreted merely at surface level. It is necessary for the translator to interpret the sense of the metaphor based on the situational context of the metaphor and also, to some extent, the text. A bottom-up approach in which signs or words in the source language are equated more or less automatically with signs or words in the target language will be insufficient as a translation strategy for metaphors. This bottom-up approach is illustrated graphically by Lörcher in Figure 5:

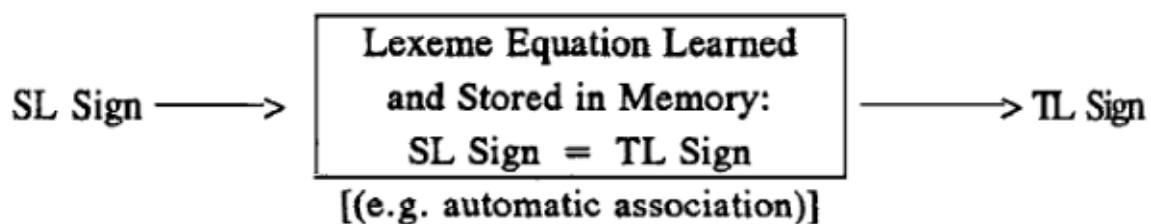


Figure 5: Sign-oriented translating (Lörscher 1992: 153)

As Lörscher argued that professional translators will generally translate through a sense-oriented approach, it is reasonable to assume that the same approach would be preferred by the professional translators involved as participants in the experiment reported here. Although it may be difficult to verify empirically which approach the participants in the current experiment employed, it can perhaps be argued that a more or less direct word-by-word translation could be an indication of a preference for a more sign-oriented translation approach whereas a reformulation of the source language metaphor into a different image or a literal expression could be an indication of a more sense-oriented translation approach. On the other hand, a direct translation could often be the optimal choice in terms of target language use and can therefore not be said to be an indication of a less professional translation approach. Schäffner (2005) pointed out the difficulty of verifying whether differences in ST and TT metaphors are the result of conscious and strategic decisions or simply “ignorance” on the part of the translator (Schäffner 2005: 75).

On the other hand, a lack of conscious decision-making need not necessarily mean ignorance but could also be interpreted as the result of the professional translator’s more or less automated processes, a phenomenon which Shreve and LaCruz describe as when “the ability to perform transfer quickly and accurately increases and conscious effort decreases” (Shreve and LaCruz, in press).

Gile's sequential model of translation and Lörscher's model of sense-oriented translating are plausible representations of the cognitive process of translation and, as argued by Kußmaul, it is necessary for the empirical researcher to base his hermeneutic investigation on pre-existing models to be able to make sense of his data (Kußmaul 2007: 105), and particularly Gile's model of translation would seem well-suited as a point of departure for empirical research on the translation processes.

3.2.1 Is Translation Sequential or Parallel?

Translation can be regarded as either a sequential or a parallel process or a hybrid of both. The proponents of the sequential view claim that only when the ST has been comprehended in full will TT production take place. In contrast, the parallel view states that SL linguistic structures are replaced with TT equivalents on an ongoing basis (de Groot 1997: 30). One proponent of the parallel view is Mossop (2003), who proposed that the translator will automatically begin to produce TT renderings of ST linguistic structures as soon as they are encountered and that this is an unconscious process, which cannot be controlled. There is empirical support for the parallel view in the eye-tracking research carried out by Hvelplund (2011), who investigated the duration of attention units (i.e. the time before the attention switches from ST to TT and vice versa) and interpreted the occurrences in which the participants were looking at the ST while simultaneously typing the TT as evidence of parallel processing. However, the data also indicated occurrences of sequential processing, and Hvelplund concluded that in fact both processes take place during a translation process (Hvelplund 2011: 128). Following Mossop (2003) and Hvelplund (2011), this thesis regards the translation process as mainly parallel, with occurrences of sequential processing rather than a strictly sequential or parallel process.

3.2.1.1 The Sequential View of the Translation Process

Gile's model of the translation process (see section 3.2.) represents the sequential view of translation (also referred to as the vertical view (de Groot 1997)). Following Seleskovitch (1976), the sequential view of the translation process proposes that the meaning of the ST is

deverbalised before it is reconstructed in the TT. In other words, ST syntax and lexis are processed, i.e. comprehended, and the meaning is dissociated, i.e. deverbalised, from the ST language, before moving on to the output of the TT. Only when the comprehension process is finished will the deverbalised meaning be reconstructed under the constraints of the TT language. These constraints would include not only target language syntax and lexis, but also norms of language use and idiomatic expressions.

Mossop (2003: 2) and Hvelplund (2011: 62) pointed out that Seleskovitch's argumentation for the sequential view is based on the observation that the TT sometimes bears very little resemblance to the ST in terms of syntax and lexis. They also observed that Seleskovitch offers no empirical support for the deverbalisation theory, which is based on personal experience as an interpreter (Seleskovitch 1976). Macizo and Bajo (2004) observed that evidence from bilingual studies would instead seem to support the parallel view of translation (also referred to as the horizontal view (de Groot 1997: 30)) (Macizo and Bajo 2004: 182).

3.2.1.2 The Parallel View of the Translation Process

Whereas proponents of the sequential view of translation claim that comprehension and production take place one after the other, proponents of the parallel view argue that comprehension and production occur more or less in parallel (Mossop 2003, Macizo and Bajo 2004). According to the parallel view, ST comprehension is affected by target language influence (Macizo and Bajo 2004: 183) and therefore differs from normal monolingual text comprehension.

Macizo and Bajo designed an experiment in which participants were asked to read sentences, either for translation or for repetition. Because of working memory (WM) constraints, it was assumed that code switching would slow down reading times because of the WM capacity required (Macizo and Bajo 2004: 193). Macizo and Bajo argued that if the sequential translation process theory were to hold true, reading times would be the same whether or not reading was

done for translation or repetition as code switching would only take place once comprehension of the sentence was completed following the sequential translation process theory (Macizo and Bajo 2004: 186). However, this was not the case as sentences read for translation had longer reading times than sentences read for repetition, indicating that more cognitive processes appeared to be occurring during reading for translation than during monolingual reading for comprehension.

3.2.2 Translation and Working Memory

The working memory system includes both “active processing and transient storage of information” and the working memory is assumed to be “involved in all complex cognitive tasks, such as language comprehension [...] and reasoning [...]” (Eysenck and Keane 2010: 223). It is not within the scope of this thesis to go into detail regarding the individual components of the working memory,¹⁵ but as working memory capacity (WMC) has an effect on the cognitive effort required for translation, it is nevertheless an important concept to discuss.

Carpenter et al. (1994) emphasised the importance of working memory in language comprehension “because both producing and comprehending language require the processing of a sequence of symbols over time” (Carpenter et al. 1994: 1075). Carpenter et al. found strong relations between WMC and language processing skills across several participant groups. Carpenter et al. also argued that ambiguity required more cognitive resources from participants with a low WMC as these were less able to hold multiple interpretations in the memory storage for a lengthened period of time than participants with a high WMC (Carpenter et al. 1994: 1083). On the basis of these findings, it does not seem unreasonable to assume that translators will generally have a high WMC as translation requires strong language processing skills as well as the ability to manage source and target language interpretations more or less simultaneously. Kaakinen et al. (2003) found that there was a connection between a high WMC and the ability to

¹⁵ For a detailed discussion of the working memory and its components, see e.g., Baddeley (1999), or for a discussion from a translation-process perspective, see e.g., Hvelplund (2011).

focus attention on relevant information in the text (Kaakinen et al. 2003: 456), which could also be regarded as part of the skill set of a professional translator, i.e., to be able to recognise the important elements of a given text, which must be included in the TT.

Shreve and Diamond (1997) argued that a translator has a single working memory capacity with the ability to access two mental lexicons simultaneously. The argument of Shreve and Diamond was that a translator will have one separate mental lexicon, or in their terminology “long-term memory store”, for her L1 and another mental lexicon for L2 and that mappings or connections exist between sets of shared conceptual representations in the two lexicons. In other words, each lexicon contains linguistic structures (orthographic, grammatical, etc.), which are mediated via a shared conceptual store, which presumably also stores the meaning of (lexicalised) metaphors. The metaphor may be expressed with different linguistic structures in L1 and L2 or may be similar, depending on the culture-specificity of the metaphor. This viewpoint is illustrated by Trim’s model in which he shows how one conceptual metaphor may be expressed through different linguistic forms in two different languages (Trim 2007: 70, see section 3.1.2). The simultaneous activation of both mental lexicons in a translation process will increase the cognitive effort required from the working memory system (Shreve and Diamond 1997: 237).

3.2.3 Translation Competence

As seen in earlier research (Jakobsen and Jensen 2008, Lörcher 1992), the translation process may also be affected by participants’ translation experience, including their decision-making capabilities. As previously mentioned, there are many different views on what constitutes a “good” translation. Translation competence is not directly investigated in this study, but it was assumed that the participants’ decision-making processes and therefore also their process behaviour were related to their translation competence, which was assumed to be generally high, as all participants were professional translators (see section 4.2). In other words, the behaviour and decisions made by the participants were assumed to be linked to their translation competence, which would not be the case if the participants were student translators.

Wilss (2001) argued that the decision-making process is especially difficult in a translation task because of the duality of a translation. A translator has to take into consideration not only the ST's "semantic, functional, pragmatic, and stylistic dimension" but also the "needs and expectations of the target-text readership" (Wilss 2001: 57). Wilss' observation on the stages in which a translator may experience difficulties and the potential lack of decision-making skills leads to the question of how to define translation competence. Dimitrova (2005) used the term *translation competence* to emphasise the view of translation as a professional competence. She defined translation competence as not only including competence in the source and target languages and knowledge of both cultures but also including "a more specific competence in the pragmatic, text-linguistic and stylistic aspects of the two languages" (Dimitrova 2005: 12).

Schäffner and Adab (2000) argued that *translation competence* is better understood as an umbrella term for a number of subcompetences such as linguistic and cultural knowledge and domain-specific knowledge, and *competence* should be regarded as an umbrella term for concepts such as "knowledge, skills, awareness, expertise" (Schäffner and Adab 2000: ix ff).

Jäaskeläinen and Tirkkonen-Condit (1991) investigated other characteristics that defined translation competence in a professional translator compared with novice translators and found that novice translators spent more effort on linguistic decisions, whereas the more experienced translators, and presumably more competent translators, focused their efforts more on macro-level factors such as context and the intended audience. This finding was supported by process-oriented experiments using think-aloud protocols or TAPs. Here, Jäaskeläinen and Tirkkonen-Condit found that early decisions made about the style of the translation would automatise style-related decisions later in the text in the sense that subsequent stylistic choices would not be verbalised in the TAP and were therefore taken to have been automatized (Jäaskeläinen and Tirkkonen-Condit 1991: 98 ff.). However, it could be argued that not all participants can be trusted to verbalise every thought during the translation process and a process may not necessarily be automatized simply because it is not verbalised.

The methodology of TAPs is not without its flaws in that the task of thinking aloud and verbalising one's decisions may intrude on the cognitive processes taking place and perhaps place unnatural emphasis on decisions and processes which would not have required the same amount of cognitive effort with a less intrusive methodology such as e.g., keystroke-logging or eye-tracking. The benefit of TAP experiments is that TAPs offer verbalisations of whatever the translator is thinking of whereas the less intrusive methodologies such as eye-tracking, key-logging and ERP only offer findings which can indirectly be linked to cognitive processes. Of course, with TAPs it is always possible to speculate that the translator is only verbalising those considerations which she thinks the experimenter wants to hear or which she is comfortable expressing whereas with key-logging or eye-tracking or similar methodologies, the translator is able work more ecologically while the data is still being produced.

However, if Jäaskeläinen and Tirkkonen-Condit's observation on automated stylistics decisions is taken to be true, would this mean that in a text containing several metaphors, the translator would only make a conscious decision on the preferred translation strategy for the first metaphor encountered and that subsequent metaphors in the same text would automatically be translated using the same strategy? It would be difficult to verify whether this consistent behaviour was a sign of translation competence or rather a result of continuing down a path previously chosen and perhaps Jäaskeläinen and Tirkkonen-Condit's automaticity could instead be regarded as some form of facilitation effect in which the translation of subsequent metaphors would be facilitated by the decisions made previously and, in other words, be less cognitively effortful to produce. Following the line of thought from Jäaskeläinen and Tirkkonen-Condit, it would seem that consistency in metaphor translation strategy should be regarded as a sign of translation competence. It is certainly something to consider in any research on metaphor translation in which the translator is required to translate multiple metaphors within a single text, metaphors which may perhaps be related semantically, as is often the case and which is also the case for texts 3 and 4 in this thesis.

Danks and Griffin stated that a text can be "conceptually quite difficult, say in the abstractness of the concepts or in the complexity of the argumentation, and this difficulty has been demonstrated to affect readers' processing of the text" (Danks and Griffin 1997: 169). They

concluded that the depth of the translator's understanding of a text will function as a filter on the TT. This assumption does seem to be somewhat contradictory to Wilss' observation that the translator is in fact often aware of the problem but just does not have the necessary decision-making skills (Wilss 2001: 57). Danks and Griffin's argument seems to suggest that the translator may not be aware that there is a problem with the understanding or translation of the text, and it could therefore be argued that another element in the definition of translation competence could be the ability to identify potential problems in both comprehension and production in order to be able to solve the problems adequately.

Göpferich includes psycho-motor competence in her definition of translation competence (Göpferich 2009: 21ff). Psycho-motor competence covers capabilities for reading and writing, such as typing, and Göpferich argued that the less sufficient such skills are in a translator, the more cognitive effort is required for this task (Göpferich 2009: 22), thereby using cognitive capacity which could otherwise have been spent on the actual production of the translation. Empirical research could reveal lack of psycho-motor competence when the research involved reading and/or typing, and the competence should certainly be taken into account when looking at individual differences between participants. An aspect of Göpferich's concept of psycho-motor competence which is relevant for research using eye-tracking technology is the participant's competence in touch typing. A participant who is a poor touch typist will look down at the keyboard more often resulting in a loss of eye-tracking data.

The quality criteria for the eye-tracking data included investigation of the proportion of time spent by the participant in looking at the monitor based on the assumption, following Göpferich that a poor touch typist would spend additional cognitive effort on the typing task which might skew the results, also for the key-logging analysis (see section 4.3 for an in-depth explanation).

To sum up, translation competence was not investigated directly in this study, other than an indirect control of the participants' touch typing skills as described above, but translation competence was assumed to have an effect on the translation decisions made by the participants and was therefore regarded as a relevant aspect of the discussion of the results in analyses 1.1.

and 4.1 as well as the qualitative analysis in chapter 7. But since the focus of this study is metaphor translation, it is also necessary to differentiate between general translation competence and metaphor translation competence.

3.2.3.1 Metaphor Translation Competence

This leads to the question of whether there is such a thing as metaphor competence or perhaps more specifically metaphor translation competence? Steen referred to a “mental dictionary” (Steen 2007: 77), and Blasko and Kazmerski pointed to individual experience as a variable in metaphor comprehension (Blasko and Kazmerski 2006). The term *competence* connotes familiarity with a subject, but what does familiarity with metaphors mean? If a person is familiar with one or the other of the two semantic domains constituting a metaphor, is this sufficient to be regarded as having metaphor competence? A translator may have encountered a specific metaphor before in either her L1 or L2, but it could be speculated that it is only when the connection has been made between an L1 metaphor and an L2 metaphor referring to the same underlying concepts that the translator could be said to be familiar with a metaphor from a translation perspective. Metaphor translation competence could be seen as the ability to make the mapping between a source language metaphor and a target language metaphor and not only the ability to draw upon mappings made in previous translations.

From a monolingual perspective, a person working within a specific field, such as an MA student or a scientist in medicine, would be more familiar with the conventional metaphors in his or her specific field. Charteris-Black (2000) argued for the benefits of teaching ESP economics students the register of metaphor used in their specific field as a way of deepening the students’ understanding of the “conceptual domain of their subject” (Charteris-Black 2000: 164). In other words, a person may have expertise in a field-specific terminology, which could include any number of conventional or even lexicalised metaphors within that specific field. This would not necessarily mean that the same person could be said to have a general metaphor competence and consequently be more proficient at metaphor comprehension at large.

Andersen (2004) defined metaphor competence in a translation context in order to investigate the possible correlation between a translator's metaphor competence and translation competence (Andersen 2004: 5). Her definition of a translator's metaphor competence is as follows:

“**Metaphor competence** is the translator's **active conscious knowledge** of the metaphor in all its dimensions, both as a linguistic unit, as a pragmatic unit and as a cognitive unit (Andersen 2004: 57, author's translation).¹⁶ Andersen argued that in order to be able to produce a satisfactory translation of a metaphor, the translator must be aware of the various aspects and theories on the concept of metaphor. She used the phrase “activation of latent knowledge” (ibid: 56, author's translation) and stated that it is necessary for a translator to have both linguistic, pragmatic and cognitive metaphor competence in order to have translation competence.

She made the observation that “a **translator** will therefore **always** be in both a **reception situation** and a **production situation** simultaneously” (Andersen 2004: 56, author's translation). According to Andersen, the translator must be able to evaluate the metaphoricity¹⁷ of both the STs and TTs. She observed that a translator will often only have full metaphor competence in his or her native language and a limited metaphor competence in the second language. Her conclusion was that unless the translator is aware of all aspects of the metaphor concept, the weaker metaphor competence in the second language will weaken the translator's translation competence.

Andersen's empirical findings, though limited in scope, indicated that translators tend to have a relatively high level of linguistic metaphor competence in the sense that they are able to identify metaphorical expressions as metaphors, whereas the pragmatic and cognitive metaphor competence levels are often less satisfactory. More specifically, the ability to evaluate a metaphor's function, knowledge of metaphors in a specific text type, and the ability to identify and reproduce metaphor clusters were especially limited in her findings, and Andersen

¹⁶ Original text: **Metaforkompetence** er oversætterens **aktive bevidste viden** om metaforen i alle dens dimensioner, både som en lingvistisk enhed, som en pragmatisk enhed og som en kognitiv enhed (Andersen 2004: 57).

¹⁷ I.e., the power of the metaphorical image.

concluded that professional translators do not have the necessary training or qualifications to produce a translation strategy for metaphors at the macro level because of a lack of metaphor knowledge, .i.e., metaphor competence (Andersen 2004: 162).

3.2.4 Metaphor Translation

Dagut posited that “metaphor presents a particularly searching test of the translator’s ability” (Dagut 1987: 77), which is agreed with by (Newmark 1988: 104). Throughout the years, the majority of research on metaphor translation has been concerned with prescribing recommended approaches for the translator (see e.g. Newmark 1988, Dobrzynska 1995), and, as pointed out by Alvarez (1993), there has been little consensus on reaching “some kind of theory of metaphor translation” (Alvarez 1993: 479). The recommended approaches have varied from Nida’s recommendation that the translator avoid the problem by translating the metaphors into non-metaphors (Nida 1964: 220) to Kloepfer’s view that original metaphors are easy to translate with a word-by-word strategy as “the structures of fantasy are the same for all humans” (Kloepfer 1967 in Gentzler 2000: 942).

Mason (1982) posited that the problem of metaphor translatability was not caused by the nature of metaphors but rather by cultural differences between the source and target languages and should therefore be considered as part of a more general translation problem. She further stated that “each occurrence of a metaphor for translation must be treated in isolation: each of its components must be dealt with in the light of its cultural connotations before a translation of the whole can take place, and account must also be taken of the textual context in which the metaphor is used” (Mason 1982: 149). Mason therefore concluded that it was not feasible to create a theory for metaphor translation, but only a theory of translation (Mason 1982: 149). While it is certainly true that certain aspects of metaphors, such as cultural specificity, may be shared with other text units for translation, it could also be posited that the combination of metaphorical imagery, potential cultural specificity, and context dependency gives metaphor a unique position in translation studies.

The viewpoints on metaphor translation can be summarised in four groups (Samaniego Fernández et al. 2005):

Metaphors are untranslatable. This viewpoint, held by Nida (1964) and Dagut (1976 and 1987), sets forth that translation of a given metaphor will always result in a different metaphor, resulting in unaccountable translation solutions.

Metaphors are fully translatable. Put briefly, Mason (1982) argued that metaphor translation is no different than translation in general.

Metaphors are translatable but pose a considerable degree of interlinguistic inequivalence. This viewpoint is held by Van Den Broeck (1981), Toury (1995), and Newmark (1988), arguing that metaphor is a particular and unique problem within the field of translation.

Conciliatory approach. This viewpoint is taken by Snell-Hornby, arguing that the translation of a metaphor “cannot be decided by a set of abstract rules, but must depend on the structure and function of the particular metaphor within the text concerned” (Snell-Hornby 1995: 58).

(Adapted from Samaniego Fernández et al. 2005: 67)

Crerar-Bromelow (2008) acknowledged the importance of the ST as well as the necessity of a pragmatic response from the translator (Crerar-Bromelow 2008: 89). But she also argued that by not working more in-depth with the underlying conceptual metaphors, the analysis of the ST would remain superficial and only by understanding the conceptual metaphors would the translator be able to produce more than “mere word-for-word equivalence in the target text” (Crerar-Bromelow 2008: 89), which is in line with Andersen’s finding that professional translators lacked pragmatic and cognitive metaphor translation competence (Andersen 2004:

162). The problem of conceptual metaphor research is the time-consuming effort required for identifying a sufficient number of linguistic metaphors having the same underlying semantic domains in order to be able to make a reasonable claim for the existence of a conceptual metaphor. This was not within the scope of this study, but by investigating inter-textual differences in the statistical analysis, any differences caused by underlying conceptual metaphors were indirectly taken into account.

Newmark stated that of all the difficult choices a translator has to make, “the most important particular problem is the translation of metaphor” (Newmark 1988: 104). According to Newmark, one of the problems of the translator is to determine how much emphasis to place on the shared characteristics of the two semantic domains constituting the metaphor. Following Newmark’s line of thought that metaphor translation should be considered a translation problem for the translator, it would follow that metaphor translation would require increased cognitive effort compared with literal expressions. This difference in cognitive effort should be possible to identify in empirical research as undertaken in this thesis in which both eye-tracking and key-logging methodologies are applied.

3.2.4.1 The Translatability of Metaphor

Dagut talked of the *gradient of translatability* (Dagut 1987: 82), whereas Van den Broeck referred to the *translatability of metaphor* (Van den Broeck 1981). As pointed out by Samaniego Fernández et al. (2005), the degree of lexicalisation is used as the measure of translatability (Samaniego Fernández et al 2005: 68), but there is little agreement on which category of metaphor is the easiest to translate, and Snell-Hornby argued that a metaphor’s position on a scale of lexicalisation is not fixed, but shifts with cultural developments. She furthermore argued that the perception of a metaphorical expression as metaphorical or not will depend on the individual, thereby making distinctions between metaphors based on type obsolete (Snell-Hornby 1995: 57).

Trim, on the other hand, made the argument that the translatability of “creative”, i.e., novel, metaphors is dependent on “the ability to interpret and transfer the source-language metaphor (SLM)” (Trim 2007: 65). The source language metaphor or SLM may indeed be easily interpreted by the translator, but its equivalent in the target language could have a lower saliency, i.e., not fit equally well within the norms of the target language. The translator will then have to decide whether or not to adapt the metaphor to the target language. Trim acknowledged the impossibility of quantifying translatability but defined it as following a scale “from almost complete freedom to use similar metaphors in universal features to considerable constraints in fixed-language and cultural-specific expressions” (Trim 2007: 66). He illustrated his point with the following model:

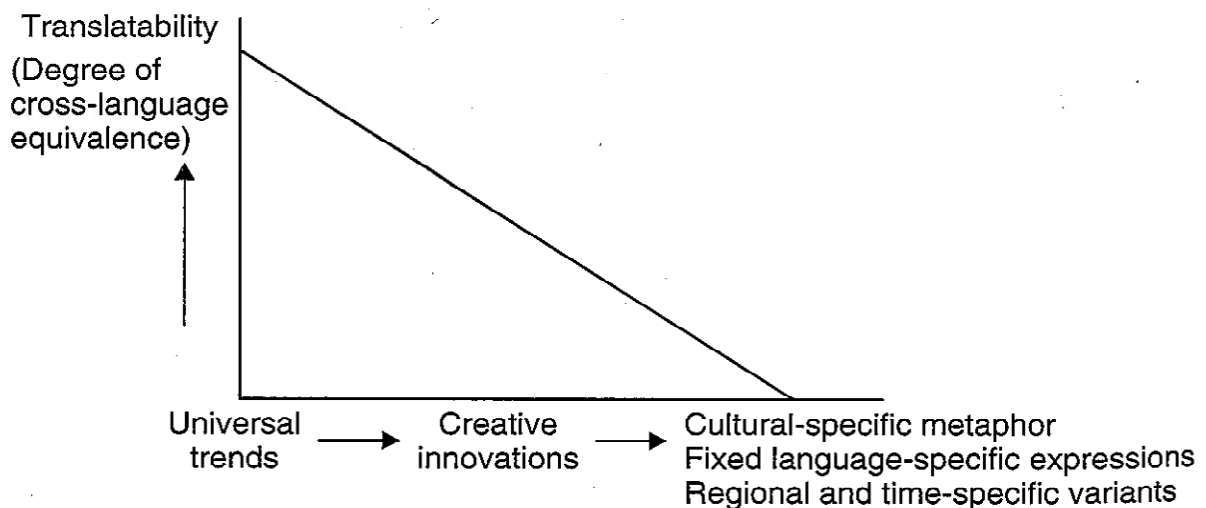


Figure 6: Translatability and cross-language equivalence in metaphor (Trim 2007: 66)

Trim’s model is in line with Dagut’s claim that the problem of metaphor translation varies, depending on “(1) the particular *cultural experiences and semantic associations* exploited by it, and (2) the extent to which these can, or cannot, be reproduced non-anomalously in TL, depending on the *degree of “overlap” in each particular case*” (Dagut 1976: 32, in Snell-Hornby 1995: 58, Snell-Hornby’s emphasis).

Kövecses' argument for universal metaphor receives supports from work by Neumann (2001), who investigated the presence of shared metaphorical concepts across the languages German and Japanese, two languages with major distance, both geographically and linguistically. Neumann investigated highly conventional metaphors because of their lexicalised form, which enabled him to use dictionaries as the objective measure of similarity between a metaphorical concept in German and its counterpart in Japanese. Neumann offered criticism of other cross-language metaphor research because of an implicit expectation of the existence of conceptual metaphor resulting in circular research (Neumann 2001: 126). However, Neumann presented evidence of metaphors, which were similar across the two languages, which he took as proof of "a cognitive grounding" as the similarities could not be caused by language contact. This led him to conclude that "Metaphor seems to be an independent cognitive force and a central word-formation mechanism that is so strong that similar metaphors can be accounted for in such totally unrelated languages as German and Japanese" (Neumann 2001: 136).

The findings by Neumann would seem to suggest that metaphors may overlap language and culture boundaries, in other words that metaphors would to a large extent be universally translatable. However, following Trim (2007), it would be likely that a given conceptual metaphor would be manifested through different linguistic manifestations from language to language (see e.g., Monti 2009: 219). However, Danish and English are two closely related languages and cultures. The two languages are closely related both geographically and linguistically and the two cultures have more similarities than differences, an open market economy, a monarchy and Christianity, to name a few. Consequently, it should intuitively be easier to transfer the metaphor from the ST to the TT, transferability being one of the major issues in metaphor translation research (Schäffner 2004: 1256). Furthermore, a direct transfer of the ST metaphorical image into the TT would therefore be a viable translation option for the translator, which perhaps would not be the case with two more distant languages. This assumption is supported by Wikberg's study of a translation corpus with translations from English into Norwegian, Swedish, and Finnish in which a direct transfer of the ST metaphorical image was the preferred translation strategy (Wikberg 2004: 248).

3.2.4.2 *Metaphor Translation Strategies*

However, a direct transfer of the ST metaphorical image is not the only option available to the translator. Although not empirical in his methodology, Newmark has been quite prolific in his recommendations for metaphor translations, which are based on his metaphor classification scheme introduced earlier in the text (Newmark 1981, 1988). As with Newmark's metaphor classification scheme, his recommended method for translation of each type of metaphor is at times vague. He lists no less than eight translation strategies, which the translator can choose from, with the recommended one first:

1) reproducing the same image in the TL, provided the image has comparable frequency and currency in the appropriate register, 2) the translator may replace the image in the SL with a standard TL image which does not clash with the TL culture, 3) translation of metaphor by simile, retaining the image, 4) translation of a metaphor (or simile) by simile plus sense, 5) conversion of metaphor to sense, 6) modification of metaphor, 7) deletion, 8) same metaphor, combined with sense (Newmark 1985: 304ff.).

Newmark's recommendation of the first translation procedure shows an implicit expectation that the translator will be able to make the proper evaluation of whether or not a source language metaphor will be equally apt in the target language, i.e. if it would be a natural part of a relevant register. Baker (1992) defines *register* as "a variety of language that a language user considers appropriate to a specific situation" (Baker 1992: 15). The translator's task, then, with respect to translating metaphor is to evaluate the appropriateness of using certain target-language metaphors in a specific situation calling for a specific register. This leads to the question of whether or not a translator can be said to have a special form of metaphor expertise? It would seem that the translator must have some level of familiarity with the use of metaphor within a register into which the text is translated in order to be able to make this kind of evaluation.

As stated by Newmark, there are several translation strategies available to the translator when translating a metaphor. The definition of these varies according to the research project and researcher in question, but they essentially all cover the same basic elements which Schäffner summarised in three main strategies, which are (i) metaphor into same metaphor, (ii) metaphor into different metaphor, and (iii) metaphor into sense (Schäffner 2005: 55, see also Snell-Hornby 1995: 82). These three main strategies are in line with an earlier outline by Dobrzynska (Dobrzynska 1995: 595), who suggested that translators have the following metaphor translation strategies at their disposal (see also Van den Broeck 1981):

- **use of an exact equivalent of the original metaphor (M-M),**
- **choice of another metaphorical phrase with the same meaning (M1-M2) or**
- **paraphrase (M-P)**

Following Fuertes Olivera (1998), Dobrzynska's strategy classification is used in this study to identify the participants' translation choices (see section 4.6.2).

As previously mentioned, Wikberg found that, in a study of English source texts being translated into Norwegian, Swedish, and Finnish, the preferred translation strategy was a direct transfer of the image (Wikberg 2004: 248). Fuertes Olivera also found a preference for the M-M translation strategy and commented that this choice sometimes resulted in very poor translations. Of course, it should be noted that his translations were done by experts in the field of economics and not by professional translators, and Fuertes Olivera speculated that the sometimes poor choice of the M-M strategy was caused by a lack of translation skills (Fuertes Olivera 1998: 92).

Dagut (1987) claimed that formulating a new TT metaphor as replacement for a ST metaphor with no TT equivalent was “the special problem of translating metaphor proper” (Dagut 1987: 78, see also Alvarez 1993: 486), i.e. novel or creative metaphors. Dagut did not adhere to the assumption that all metaphors are universal and argued that a word-by-word direct transfer of the ST image (M-M, in Dobrzynska’s terminology) would not be ideal in some instances, but rather that in such cases when the ST metaphor did not have a TT equivalent, the translator should create a new TT metaphorical image (M1-M2, in Dobrzynska’s terminology) (Dagut 1987: 78).

It should be noted that Toury (1995) also identified complete omission of the ST metaphor as a translation strategy as well as two additional TT-oriented translation strategies:

- **non-metaphor *into* metaphor**
- **0 *into* metaphor** (i.e., a target-text addition with no linguistic match in the source text)

(Toury 1995: 82ff)

However valid Toury’s claims may be, his two additional translation strategies involving metaphors are not relevant for the present study, which investigates the cognitive effort invested in translation of ST metaphors for comparison with ST non-metaphors. In line with this, Zabalbeascoa (2004), makes the point that an analysis of translation of non-metaphors into metaphors will not provide any insight into “how metaphors are dealt with in translation” (Zabalbeascoa 2004: 101). Toury argued for the benefits of a TT-oriented approach in descriptive metaphor translation studies, which he claimed offered the researcher a better approach for understanding the translator’s decision-making process. In his view, the TT-oriented vantage point also offered the researcher a better vantage point for forming hypotheses on “*target norms*”, and Toury criticised ST-oriented approaches for being too focused on the nature of the ST metaphors, the ST, and any potential discrepancies between the source and

target languages to be able to look beyond those potential explanations for translator behaviour (Toury 1995: 84). Samaniego et al. (2005) praised the TT-oriented approach for paving the way for a “more open and realistic approach to equivalence” (Samaniego et al. 2005: 63). But again, the focus of this study is the effect of ST metaphors compared with ST non-metaphors, which makes the use of a ST-oriented system of translation strategies more suited.

It is very likely that the choice of translation strategy has an effect on the cognitive effort involved in the metaphor translation. Cristofoli et al. (1998:178) argued that a novel metaphor (labelled an ‘original’ metaphor in their classification system) should preferably be translated with a novel metaphor and a conventional metaphor with a conventional metaphor although they do not elaborate on why this should be so. A possible argument could be that the sender’s motivation for using either a conventional or a novel metaphor should be reflected in the translator’s choice of metaphor type in the TT. In this case the translator has to have some level of competence in evaluating the conventionality or novelty of the source metaphor as well as the ability to choose a matching-level target metaphor.

Newmark suggested that original (i.e., novel) metaphors in informative texts, such as newspaper or magazine articles, may be translated appropriately through several different translation strategies depending on how much emphasis the translator wants to put on the imagery of the metaphor. This is interpreted to mean that novel or unfamiliar metaphors leave the translator with a higher degree of freedom in choosing how to translate the ST metaphor because there is no existing translation equivalent. Newmark furthermore stated that he regarded metaphor translation to be “the epitome of all translation” because of the multitude of decisions required by the translator regarding the transfer of the metaphor into the TT; should the metaphorical image be retained or paraphrased, replaced by a different image or perhaps a combination of metaphor and paraphrase? (Newmark 1988: 113).

On a side note, Nida (2001) rejected the practice of “a set of rules for adapting figurative expressions from one language to another” because the situation in which the metaphor appears is unique. This concurs with Mason’s view (1982) that each metaphor “must be treated on its

own merits” (Mason 1982: 140). Factors such as the purpose of the text, the reader group as well as the skills of the translator are stated as factors which will vary from one text to the next (Nida 2001: 81). This would seem to indicate that factors such as metaphor conventionality and familiarity would be less relevant in empirical research on metaphor translation as they would not be truly reflective of the cognitive process as the unique situation would only occur once. Whether or not this is the case remains to be seen in chapters 5 and 6 in which the results of the statistical analyses will be discussed. The unique decision-making process of metaphor translation as argued by Nida and Mason must, however, be assumed to not preclude the possibility of finding processing generalities on a general level, i.e. processing generalities in terms of time such as gaze time or typing speed.

3.2.5 Summary

The previous sections have introduced a number of concepts relevant to translation research. It is the aim of this section to summarise the view of translation taken in this thesis as well as clarify which concepts have been taken into account in the analysis of the data.

Translation is regarded as a process in which the translator forms a meaning hypothesis on the translation unit in question. This meaning hypothesis is taken to be open for later revision as the translator may encounter disambiguating information as she reads further along in the text or as she extracts further information from her own existing knowledge base. A metaphor could be an example of a translation unit, which, following Lörscher, professional translators will not necessarily automatically translate using existing vocabulary (a sign-oriented approach). The translators may rather translate the metaphor based on the sense of the metaphor in its context. Because metaphors are so context-dependent, it could be argued that even previously encountered metaphors are unique because of the context, which must be supposed to be new each time.

There are many similarities between the two languages cultures of English and Danish, but that does not necessarily mean that a ST metaphor is equally salient in the TT, following Trim's terminology (Trim 2007: 64). In other words, this closeness between the two cultures should not be taken to mean that the metaphors in the texts should preferably be translated with a direct transfer of the metaphorical image, nor do we wish to make categorical statements on whether one translation strategy is preferable or more appropriate than another. For stylistic rather than cultural reasons, the translator may still prefer a paraphrase of the source metaphor or using a different metaphorical image or the translator may choose to either paraphrase or transfer a specific source metaphor directly into the TT because she is unfamiliar with the use of this metaphor in the target language in general or in the semantic domain of the text in the target language. Instead, what concerns us is how much cognitive effort was invested in the process.

As the above has indicated, there are several choices available to the translator for the translation of a metaphorical expression. Depending on the type of metaphor and the researcher in question, there may be anything from three to eight translation strategies which the translator can choose to implement. The broader generalisation outlining only three translation strategies (defined by Schäffner 2005 and Dobrzynska 1995) was found to be preferable to the more granular definitions by Newmark (1985). These three translation strategies or choices are i) use of an exact equivalent of the original metaphor, ii) choice of another metaphorical phrase with the same meaning, and iii) paraphrase (Dobrzynska 1995: 595). The translator must have some awareness of the saliency of the source metaphor in the target language in order to decide on a translation strategy, which may also be influenced by stylistic considerations and preferences as well as consideration of the different context of the TT compared with the ST. By investigating the effect of choice of translation strategy on cognitive effort as measured by *Total Fixation Time* and *Production Time* in analyses 1.1 and 4.1., this study may help support or disprove the claim of Wikberg that a direct transfer is the preferred translation strategy when translating metaphors from English to Scandinavian languages (Wikberg 2004) as well as the claim of Dagut that creating a new TT metaphorical image is a special problem of metaphor translation (Dagut 1987: 78).

3.3 Measures of Cognitive Effort

The following seeks to provide the theoretical framework for the experimental methodology of the study underlying this thesis by outlining the main assumptions behind the use of eye-tracking and key-logging as measures of cognitive effort in cognitive research. The specific measures applied in the study will also be defined in detail.

3.3.1 Eye-tracking

Rayner et al. (2006) stated that by tracking a reader's eye movements it is possible to gain valuable information about online comprehension processes (Rayner et al. 2006: 41), and Frenck-Mestre (2005) pointed out the benefits of online measures to achieve a more finely granulated insight into the cognitive processes of reading and language comprehension. Research shows that there is a strong link between cognitive effort and the duration of the eye's fixation (Rayner 1998). In reading, the eye remains fixated on a particular word (roughly) for as long as the word is being processed. This observation has been labelled the eye-mind assumption (Just and Carpenter 1980) and is the underlying assumption behind eye-tracking research, where researchers have extended the assumption to mean that longer gaze times and/or regressions are indicative of processing difficulties. Eye-tracking has also come to be regarded as a suitable methodology for investigation of online processes during translation (see section 3.3.1.7).

Gaze time is a temporal measure of the duration of fixations within a region such as a word (see section 3.3.1.1 for a definition of fixations). Regressions are backward eye movements to a previously read word and a skilled reader will on average make regressions 10-15% of the time (Starr and Rayner 2001: 157).

A second assumption is the immediacy assumption, which suggests that a reader will attempt to interpret the meaning of a word immediately upon encountering it (Just and Carpenter 1980).

This assumption has been debated over the years and is generally not as well accepted as the eye-mind assumption, which has also been questioned (e.g. by Vonk and Cozijn 2003: 292). A concern that has been raised regarding the immediacy assumption in particular is the so-called spillover effect, in which it has been found that the effect of processing difficult words can spill over onto subsequent words (see e.g. Reichle 2011: 769). Generally, however, gaze data are widely assumed to be indicative of and correlatable to underlying (though not directly observable) cognitive processes that take place during a particular task.

3.3.1.1 Fixations and Saccades

Eye tracking reveals that reading consists of a number of saccades (jumps from one location in a text to the next) and fixations in which the eye is stable (Starr and Rayner 2001: 157). Fixations have been shown to generally last between 200-250 ms. (Rayner et al. 2006: 242). Rayner observed that the reader is not receiving any new visual input during a saccade when the eyes perform saccadic movements because the eyes are moving too rapidly. This is known as saccadic repression (Rayner 1998: 373). Rayner (1998) reports on a number of experiments carried out by others on whether any cognitive processing takes place during saccades. There does not seem to be a definitive answer to this question, but Rayner does conclude on the basis of these findings that “new information is acquired from the text only during fixation” (Rayner 1998: 378). However, this does not necessarily exclude the possibility that existing information can still be processed during saccades.

It has been found that reading patterns differ between skilled readers and beginners. Starr and Rayner (2001) posited that skilled readers will have shorter and fewer fixations as well as longer saccades (7-9 letter spaces, Rayner et al. 2006: 242) than less skilled readers (Starr and Rayner 2001: 158). However, as Rayner et al. also pointed out, the above values are only averages, which can be affected by a number of variables such as text complexity, ambiguity or syntactic complexity. They stated that “It is generally assumed that as text gets more difficult, readers make longer fixations, shorter saccades, and more regressions” (Rayner et al. 2006: 242). It is this assumption which is behind the eye-tracking study reported here. The participants in the

experiment reported in this study are all professional translators and must therefore be assumed to be skilled readers. Word frequency and individual textual differences are also taken into account in the statistical analysis, meaning that the reason for any remaining differences in gaze times between the metaphorical expressions and their literal comparison units must be found elsewhere.

3.3.1.2 Gaze Measures

One of the issues when using eye-tracking in a research methodology aimed at investigating reading patterns is that it is not necessarily all words in a text which receive fixations (Rayner et al 2006: 243). Starr and Rayner (2001) stated that content words are fixated upon 85% of the time whereas function words only receive fixations 35% of the time (Starr and Rayner 2001: 158). Words may be fixated more than once, and especially long or complex words have been found to be likely to be refixated (Rayner et al. 1996: 1189). Lexical properties therefore have to be taken into account when comparing eye-tracking values for different words.

It is generally preferred to report more than one eye-tracking measure to provide a more accurate picture of processing time. These measures include (see Hyönä et al. 2003: 331 for a detailed summary of main eye movement measures):

First fixation duration: duration of the first fixation on a word. This measure is generally assumed to signal lexical access as well as oculomotor processes (Demberg and Keller 2008: 197).

Regional gaze duration or first pass fixation time: the summed duration of all fixations on a target region before exiting it (Hyönä et al. 2003: 331). This measure is generally regarded as indicating “early syntactic and semantic processing (as well as lexical access)” (Demberg and Keller 2008: 197).

Total fixation time: the sum of all fixations, including regressions, in an area of interest or in an entire reading session (cf. Hyönä et al. 2003: 331). This comprehensive measure is generally assumed to relate to textual integration processes and lexical and syntactic/semantic processing (Demberg and Keller 2008: 197).

Total Fixation Number: The number of fixations within an area of interest or an entire reading session, including regressions.

Other measures include calculations of saccade length, regression patterns and the probabilities of a word or Area of Interest (AOI or ROI: Region of Interest) being skipped and words being re-fixated, all of which can be taken as indications of processing difficulty (Frenck-Mestre 2005: 176). The majority of eye-tracking research reports several measures in combination in order to provide comprehensive evidence of the cognitive processes of reading. In this thesis, three eye-tracking measures are reported.

The measures found to be relevant for this thesis, in which several of the AOIs included multiple words, are:

Total Fixation Time: this measure was found relevant to the analysis as it can be used to give an aggregated view of any differences in total fixation time between the different categories of AOI (metaphor and non-metaphor). This is the more comprehensive and less finely granulated of the measures reported as it is a sum of all fixation durations within the AOI, including regressions.

Total Fixation Number: this measure is not as frequently used as *Total Fixation Time* and *First Pass Fixation Time*, which are both widely used in eye-tracking experiments (see e.g., Staub and Rayner 2007: 329). One of the reasons for this could be that *Total Fixation Time* is a function of fixation number and fixation duration, meaning that the two measures are not independent of each other, as also pointed out by Jacob and Karn (Jacob and Karn 2003: 585), who listed the measure “number of fixations” as one of the more common measures in usability studies in which eye-tracking is the chosen experimental methodology. This measure should therefore be regarded as a more finely granulated complement to the more comprehensive *Total Fixation Time*. The measure also includes regressions.

First pass Fixation Time: *First Pass Fixation Time* includes all individual fixations in an AOI rather than the aggregate value as in *Total Fixation Time*, thus generating more data points for the statistical analysis. *First Pass Fixation Time* only includes fixations within the AOI before the eyes move away from the AOI. Regressions are not included in this measure.

3.3.1.3 Regressions

Regressions, which can be defined as movements back to previously read words (Rayner 1998: 375), were included in two of the three eye-tracking measures reported here. Regressions have been investigated quite intensively in eye-tracking research over the years. The phenomenon of garden-path sentences has received particular focus although garden-path sentences can perhaps be argued to be a less pervasive linguistic phenomenon than other potentially ambiguous structures such as metaphors and metonymic expressions. A classic example of a garden-path sentence is *The horse raced past the barn fell* in which the reader is expected to read the sentence up until *fell* as a simple active sentence (Frazier and Rayner 1982: 179), forming a meaning hypothesis which will have to be reformulated once the reader encounters the verb *fell*. Frazier and Rayner defined the garden-path theory as the view that the reader (or to be more specific, the human sentence-parsing mechanism or parser in Frazier and Rayner's terminology) will choose one analysis of a sentence during reading, which may then turn out to be incorrect, i.e., leading down the wrong garden-path, which must then be retraced (Frazier and Rayner 1982: 178).

3.3.1.4 Lexical Factors and Their Effects on Eye Movements

A wide range of factors have been found to have an effect on the eye's movements and gaze times during reading, and only a number of them will be discussed here. Not surprisingly, long words tend to receive longer and/or more fixations than shorter words (Rayner 1998: 375) as do ambiguous words (Liversedge and Findlay 2000: 10), whereas short words may be skipped in an

average of 70% of all cases (Frenck-Mestre 2005: 179). This is correlated to findings that function words, which tend to be short, are skipped more often than content words, which tend to be longer (Rayner 1998: 375). Word frequency is also one of the most important factors found to have an effect on eye movements (also when isolated from the effect of word length) but also the more subjective measure of word familiarity has been found to have an effect on reading time. Ambiguity, both lexical and syntactic, has also been shown to have an effect on reading time, at least when the word is encountered in a neutral context (Staub and Rayner 2007: 330). As there is some debate on whether or not metaphors are in fact ambiguous, the factor of word predictability is perhaps more interesting to consider in relation to this study as metaphors can perhaps better be argued to be unpredictable rather than ambiguous in context (see section 4.6 for a clarification of how word predictability was taken into account in the statistical analysis).

3.3.1.5 Word Predictability

Readers pre-process text in the reading direction, and it has been found that English readers have a perceptual span of maximum four characters to the left and 15 characters to the right of the fixated word (Starr and Rayner 2001: 159). It has been shown that short function words and highly predictable words are more likely to be skipped than other words, which has been interpreted as indication of some form of cognitive processing of the word immediately following the word which is fixated (Starr and Rayner 2001: 160). However, there is some debate on whether much more than visual information such as word length and constituent letter shape is retrieved from the parafoveal region. Research has found evidence supporting the claim that semantic information is retrieved from the parafoveal region as well as evidence to support the counter-claim (Liversedge and Findlay 2000: 10). The parafoveal region can be defined as “the area between 1 and 5 degrees of visual angle from the centre of the fovea” (Underwood and Batt 1996, cited in Lee and Kim 2008: 370).

The predictability of a word occurring in a specific context is another factor which can have an effect on fixation length. Word predictability was investigated indirectly in this thesis through

the control variable Trigram Probability, which investigated the effect of word-in-context probability values (see section 4.6.1). Frisson et al. (2005) defines predictability as follows: “A word is highly predictable when the likelihood that that word will follow a given context fragment is high” (Frisson et al. 2005: 862). Frisson et al. found that the higher the predictability of a word, the faster the processing time, which would be indicated by shorter fixations (ibid: 862). They found this effect to apply to both verbs and nouns (ibid: 867). Their findings partly corroborate earlier research by McDonald and Shillcock (2003), who investigated readers’ ability to anticipate which words would come next in a text. The hypothesis was that the brain would be able to make predictions about the probability of words based on statistical knowledge inherent in the mind, termed transitional probabilities (McDonald and Shillcock 2003: 648).

One of the findings of their research was that word frequency as opposed to word length was not reflected in first fixation or single fixation durations but only on total gaze durations, leading them to the conclusion that frequency “influences later stages of processes” (McDonald and Shillcock 2003: 651). McDonald and Shillcock aimed at separating the effect of contextual predictability from transitional probabilities. They define contextual predictability as “high-level knowledge, in which the meaning derived from integrating the meanings of the individual words in the previous context with knowledge about the world forms the basis of expectations about upcoming words” (McDonald and Shillcock 2003: 649) whereas transitional probability is taken to mean that “the occurrence of one word can be confidently predicted from the occurrence of the other” (McDonald and Shillcock 2003: 648). The practical purpose or benefit of being able to distinguish between these two measures of predictability is never fully established, and Frisson et al. (2005) were not able to replicate the findings of McDonald and Shillcock or to find evidence that transitional probability is independent of contextual predictability (Frisson et al. 2005: 871).

However, the argument and evidence of McDonald and Shillcock do seem to suggest that the mind is in fact able to make inferences or expectations about the word(s) to come next independently of the support of context. This would mean that lexical units such as collocations and idiomatic expressions should result in shorter gaze durations, whereas novel uses of a word or words could reasonably be expected to result in longer gaze durations. This argument would

seem to lead to the assumption that no matter how apt an unfamiliar metaphor may be, the reader or in this case the translator would be expected to have longer gaze durations for these unfamiliar metaphors simply because of their unfamiliarity, which would make them more unexpected.

3.3.1.6 Oculomotor or Cognitive Control

Apart from the multitude of linguistic factors discussed above, a number of low-level oculomotor factors also influence the landing position of the eye. These factors are largely non-linguistic and include visual properties such as word length and spaces between words, which will affect where in the word the eyes will land, i.e., the landing site. Proponents of the oculomotor-control view believe that it is oculomotor factors which determine the movements of the eye and that language processing is only a minor factor in this process (Rayner et al. 2003: 385). Experiments have demonstrated that the eyes' preferred landing site is between the middle and the beginning of a word (or at the beginning and then again at the end of a long word) (Starr and Rayner 2001: 157). Regressions can also sometimes be an effect of oculomotor control to the extent that if a fixation is made at the end of a word, the eyes may make a regression a few characters back in the word (O'Regan 1990, reported in Reichle et al. 2003: 448).

There is some debate about the influence of these oculomotor non-linguistic effects versus the effect of linguistic factors such as frequency and predictability. The cognitive-control view assumes that linguistic rather than oculomotor factors determine the eyes' position (Rayner et al. 2003: 385). Rayner et al. (2003) performed several experiments to test if either of these views is more valid and found that "it is the mental processes associated with understanding the fixated word that determine when the eyes move in reading" (Rayner et al. 2003: 387ff.). They recognised the importance of visual information for the reading process to take place but did not find it to be the most important factor for controlling the eye movements. A model, which takes both views into account, is the widely recognised E-Z Reader by Reichle et al. (2003), a computational model of readers' eye movements, which is based on the main assumption that

word identification is the control of shifts from one word to the next and that reading is serial. The assumption that word identification is the deciding factor for when to move the eyes entails the implicit assumption that any higher linguistic processing only occurs “when something is wrong” and the comprehension process requires refixation or regression (Reichle et al. 2003: 450). An example of a linguistic problem requiring a regression to a previously read word could be a syntactic ambiguity in a garden path sentence, as reported by Frazier and Rayner (1982). The fact that ambiguity, word frequency and predictability have any effect on eye movements is in itself in opposition with the assumptions of the oculomotor-control view. Although there is evidence to suggest that oculomotor control will have some effect on the eyes’ movements, the gaze data from the experiment underlying this thesis will be analysed from a cognitive-control perspective, meaning that any differences in gaze time will be assumed to be related to linguistic factors in the broad sense. It could also be argued that reading could be affected by other factors such as task. Jakobsen and Jensen found that the reading patterns were different when reading for comprehension compared with reading for translation (Jakobsen and Jensen 2008, see section 3.3.1.7 for more information about their findings).

In partial opposition to an earlier model of the E-Z reader model, Inhoff et al. (2000) conducted experiments which only partly corroborated the findings from the E-Z reader model and which led them to the tentative conclusion that attention was not restricted to the word of the fixation but rather to all words within the perceptual span. This finding was tempered by the argument that attention may not necessarily be distributed evenly throughout the perceptual span and that the fixated word itself is likely to have more attention than other words within the perceptual span precisely because it *is* fixated. The argument of Inhoff et al. is that “successively attended areas of text are overlapping rather than nonoverlapping” (Inhoff et al. 2000: 1482). However, this assumption would seem to put into doubt the majority of findings from other eye-tracking experiments in which it is assumed that attention and consequently cognitive effort are spent on the fixated word rather than on any number of words to the left or right of the fixated word. Many of these experiments and their findings have been replicated and verified, indicating the validity of the findings. This thesis relies on the eye-mind assumption, which has been supported by numerous research projects since its inception, although research has also identified potential factors which weaken the link between the eyes and the cognitive processes. These factors include task interruptions and “a high peripheral visual load” (Goldberg and

Wichansky 2003: 508). In other words, the eye-mind assumption is not infallible and should not be regarded as the whole truth. On the other hand, the assumption or hypothesis has helped make sense of eye-tracking data for decades and has provided a plausible framework for analyses.

3.3.1.7 Eye-tracking and Translation

Eye-tracking is not only a popular technology for monolingual experiments. The present study followed in the footsteps of several other researchers who found eye-tracking to be a suitable tool for investigating the translation process. However, as Frenck-Mestre (2005) also pointed out, the number of second-language studies using eye-tracking technology is still quite limited (Frenck-Mestre 2005: 175). Frenck-Mestre's paper offers a quite comprehensive overview of the possibilities in eye-tracking in second-language studies as well as some potential benefits compared with other popular methodologies such as self-paced reading and ERP. The important point of the paper is perhaps that it underscores the suitability of eye-tracking for any study of online language processing, monolingual or bilingual. Frenck-Mestre recommended a combination of several technologies to investigate if the different methodologies present equivalent patterns, and if not, these differences should be investigated in further detail. Consequently, this thesis seeks to combine eye-tracking data with key-logging data to gain a fuller view of the translation process.

An example of how eye-tracking may be applied to a translation process study is set forth by Jakobsen and Jensen (2008), who investigated differences in eye movement behaviour between professional translators and student translators across four different tasks combined.¹⁸ They found that the professionals were faster than the students, with fewer fixations from the professionals. It was also found that there were strong differences between the reading tasks and

¹⁸ The first task was reading for comprehension. The second was reading for translation (without actually producing a translation). The third task was reading while sight translating, and the final task was reading and also producing (typing) a translation.

the translation tasks with longer gaze times, more fixations and longer fixation durations for the translation tasks (Jakobsen and Jensen 2008: 103 abstract). This was across both participant groups, but differences between students and professionals showed themselves in longer gaze times on the ST for the students with professionals devoting more time to the TT, which was interpreted as an indication that the students required more time for comprehension, whereas professionals devoted more time to self-revision.

In a similar study, Sharmin et al. (2008) investigated the effects of time pressure and text complexity on translators' fixations. They analysed how fixation duration and number were affected by time pressure as well as text complexity, which were measured on the basis of lexical frequency and structural complexity. They found time pressure to have an effect on fixation duration only in the ST and not the TT, which was speculated to be due to less flexibility in fixation duration when monitoring one's own output.

As text complexity has repeatedly been found to have an effect on gaze behaviour, it was perhaps somewhat surprising that Sharmin et al. did not find an effect from text complexity on fixation duration. They did, however, see an effect for the number of fixations in that the simple text had significantly fewer fixations than the other two more complex texts (Sharmin et al. 2008: 126). They did not offer any potential explanations for why only one of the dependent variables was affected by text complexity, but it could perhaps be speculated that the uncertainty caused by structural complexity and low-frequency words caused more shifts between ST and TT as well as refixations, resulting in more fixations.

The above are just a few examples of the varied nature in which eye-tracking has been applied as research methodology in translation process studies, and the current study aims to contribute something new to this group. Although metaphor translation has been a popular avenue of discussion for years (see e.g., Newmark 1985), to my knowledge no researchers have previously employed eye-tracking methodology to a metaphor translation process study. However, there are several monolingual metaphor studies in which eye-tracking has been applied and the following section 3.3.1.8 will touch briefly upon a few of those most relevant to the current study.

3.3.1.8 Eye-tracking and Metaphor

A seminal work on metaphor comprehension was carried out by Inhoff et al. (1984) on contextual effects on metaphor, in which they used eye-tracking to investigate the effect of textual context on the reading times for metaphorical expressions as compared with literal expressions. They investigated reading times for full sentences and total viewing times for “critical words [...] assumed to be the focus of metaphoric reinterpretation” (Inhoff et al. 1984: 560). A simple investigation of first regressions was also included and seemed to indicate that regressions occurred more frequently for the metaphoric target sentences than for the literal target sentences (Inhoff et al. 1984: 563). The study found that metaphorical target sentences were only read more slowly than the literal expressions when there was little contextual support. In other words, the findings of Inhoff et al. offered partial support to the direct processing model of metaphor processing and showed the possibilities of metaphor research to be done with eye-tracking technology.

Metonymic expressions lend themselves more easily to eye-tracking studies because they are more likely to be single-word constituents or to be at least more confined structures and although the current study does not hold the view that metonymic and metaphorical expressions are identical or likely to be processed in the same manner, they are both forms of figurative language. Therefore, the eye-tracking study by Frisson and Pickering (1999) on the processing of metonymy is of interest. Frisson and Pickering measured first pass time, first pass regressions, total time, as well as second pass time for their experiments, which must be described as a comprehensive analysis in which they investigated the effects of plausibility ratings, sense frequencies, and predictability (Frisson and Pickering 1999: 1371) on the reading times for constructed sentences containing either a metonym or a literal counterpart. An example of a place-for-institution metonymic expression used in the experiment is “That blasphemous woman had to answer to the convent at the end of last March”, in which the convent building stands in place for the institution behind the convent (Frisson and Pickering 1999: 1369). The sentences were divided into regions in which the metonym or literal counterpart constituted one of the regions to be investigated in the analysis. Their data showed

that the participants were quickly able to process a familiar metonym, and Frisson and Pickering interpreted their findings to support the parallel mode of processing, which in fact originated in metaphor research. They proposed that both a literal and a figurative interpretation are activated in parallel and continue to be so until further disambiguating information renders one of the two interpretations more likely (Cacciari and Glucksberg 1994: 457ff.). Frisson and Pickering speculated that their findings may also apply to other types of figurative language such as metaphor (Frisson and Pickering 1999: 1380), and their research is an example of how eye-tracking may be applied in a highly controlled psycholinguistic experiment, albeit with a low level of ecological validity but nevertheless resulting in findings which may be relevant for the current study.

3.3.2 Key-logging

The first part of the data analysis (chapter 5) will concern the comprehension aspect of the translation process, and the second part (chapter 6) will analyse the production process through an investigation of the participants' production time in the translation task. The distinct feature of comprehension of the ST can be argued to be reading, and the distinct feature of production of the TT can be argued to be writing. Key-logging was therefore regarded as a more relevant methodology for investigation of the production process than eye-tracking.

As stated in section 4.1, the participants' translations were logged in the key-logging application Translog, developed by Schou and Jakobsen (Schou et al. 2009: 37ff). Translog was developed as a tool in translation process research, but it can also be employed for didactic purposes within the field of translation (Schou et al. 2009: 40). Although Translog was later adapted to include eye-tracking software, the current study only used the key-logging functionality, and the eye-tracking data was collected with the Tobii ClearView software (see section 4.1). The key-logging functionality in Translog enables the experimenter to record data on every keystroke and mouse click made during the experiment as well as temporal information on typing speed and pause lengths. There are several similarities between monolingual writing and translation as

pointed out by Kußmaul (2007: 130), who also argued that the concepts used in translation process research may also be applied to text production.

The three main processes in monolingual writing: planning, sentence generation, and revision (Eysenck and Keane 2010: 442) are closely related to the processes typically identified in a translation process and correlate closely to Gile's model (Gile 2009, see section 3.2).¹⁹ As with translation, which can be argued to be a specialised form of writing, writing in general also places a strain on the working memory, more specifically the central executive "involved in organising and coordinating cognitive activities" (Eysenck and Keane 2010: 446). Gerloff (1988, reported in Breedveld 2002: 92) argued that linguistic decoding only requires significant effort for novice translators whereas the decoding takes place more or less automatically in professional translators. This argument suggests that when investigating cognitive effort in a translation task performed by professional translators, any increase in gaze or typing time can be taken as indication of factors other than linguistic decoding such as that required by metaphor comprehension and translation.

Breedveld (2002) interpreted the observations of Jäaskeläinen and Tirkkonen-Condit on professional translators' focus on macro-level decisions as well as the arguments of Gerloff as support of a view of the translation processes as "text-production processes in which linguistic 'recoding' is just one aspect" (Breedveld 2002: 92). Breedveld argued for a view of the translation process as a writing process rather than "just" a recoding process. Breedveld regarded TT production as a writing process which is "guided by a reading and understanding" of the ST (Breedveld 2002: 94). Based on her understanding of the ST, the translator must search for target language equivalents. If the translator is able to retrieve from her memory or other resources equivalent source and target language expressions, e.g., metaphors, Breedveld argued that the translation process may be quite linear. If there is no such equivalence, the translation will require more planning and the process will come to resemble a monolingual writing process more (Breedveld 2002: 94).

¹⁹ Van Waes et al. (2009) offer an overview of the application possibilities of keystroke logging in writing research in general.

On the other hand, Neubert (1997) argued that translation differs from monolingual writing because of three contextual factors “(a) the situation the source text is embedded in, (b) the situation the target text is to be read or heard in, and (c) the situation of *translatio*²⁰ itself” (Neubert 1997: 13). Perhaps the conclusion to be drawn is that translation is a specialised form of writing which shares many similarities with monolingual writing but has additional features or constraints not shared with monolingual writing. Neubert described the constraint of the ST on the TT production as “source-target tension” and referred to the ST wording as having “a strong grip” on the TT (Neubert 1997: 7), a claim which receives indirect support from Wikberg’s findings of a strong preference of retaining the ST metaphorical image in translations from English to Scandinavian languages (Wikberg 2004: 248). Whether or not the ST is regarded as a potential source of tension or rather a support as point of departure for the translator, it is an essential element distinguishing translation from monolingual writing.

Based on arguments by Schilperoord that “pauses in text production are behavioural reflections of the cognitive processes involved in changing attentional state” (Schilperoord 1996: 9), Dragsted posited that pauses before production of text units are indications of mental production of the text unit being produced immediately following a pause (Dragsted 2004: 87). In other words, cognitive effort is assumed to be invested in production of a text unit not only when the text unit is being typed but also immediately preceding text unit production (i.e., typing). In a study in which two translators’ reflections are recorded during a shared translation task, Kußmaul also interpreted pauses between production as signs of difficulties (Kußmaul 2007: 131). Differences in pause frequencies and durations and consequently also production time were assumed to be a result of differences in cognitive effort (Schilperoord 1996: 11).

Following this line of argument, any difference in pause length and frequency may then be attributed to a difference in the level of cognitive effort required for the production. This should

²⁰ Neubert used the Latin term *translatio* to refer to both translation and interpreting as the two modes of “bilingually mediated communication” (Neubert 1997: 4).

not be taken to mean that all cognitive effort related to the translation of a specific text unit takes place during the pause immediately preceding the unit as it must be assumed that at least some level of pre-production takes place during the reading of the ST, i.e., the comprehension process. As argued in section 3.2, the translation process can be regarded as either serial or parallel or as a combination of the two, i.e., with rapid changes between ST and TT. Because of this alternation, it was assumed that at least some level of overlap between the two processes can occur as illustrated in Figure 7. The assumption is that some level of pre-production (i.e., TT formulation) may take place during the comprehension stage, and that some level of comprehension processing may again take place in the pauses preceding production of a text unit.

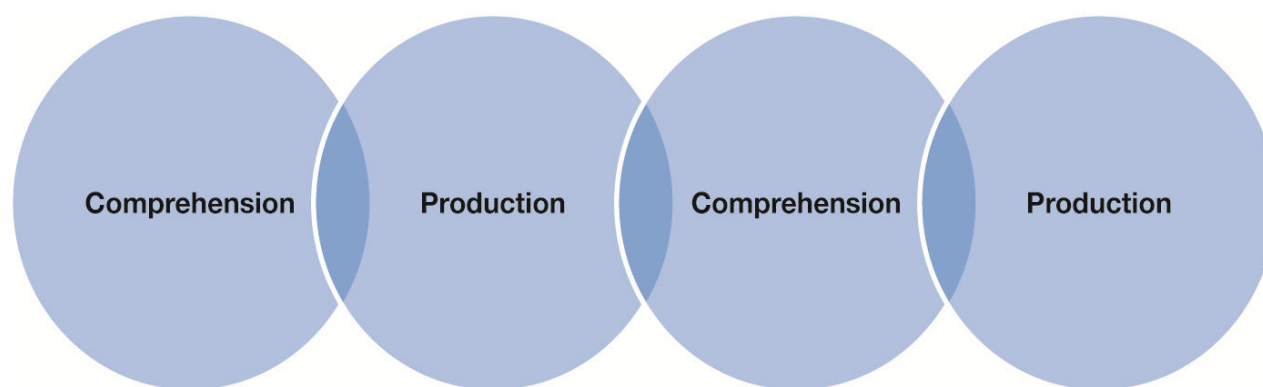


Figure 7: The translation process

Despite the assumption of overlap between the comprehension and production stages of the translation process, the overriding assumption behind the analyses reported in this thesis is that comprehension takes place mainly during reading and that the cognitive effort invested in the comprehension of the ST is manifested in the eye movements as investigated through the eye-tracking data. Production (both mental and manifested) is assumed to mainly take place immediately preceding and during production, i.e., immediately preceding typing activities and during typing, as investigated through the key-logging data.

As with reading in eye-tracking experiments, several textual factors are believed to have an effect on the production process. Schilperoord found that text locations, in particular paragraph

and also sentence boundaries, had a top-down decreasing effect on pause frequency and duration, meaning that paragraph and sentence boundaries were likely to generate longer pause durations in production than word boundaries (Schilperoord 1996: 89ff). Schilperoord's methodology was analysis of recordings with dictation of business letters and therefore may not be directly applicable to translation process research, but both dictation and translation can be viewed as special forms of text production. Dragsted found that the pause pattern differed for professional translators engaged in a translation task compared with the findings for monolingual text production by Schilperoord (Dragsted 2004: 219). More specifically, Dragsted found that professional translators tended to engage in more micro-planning activities (at word level) resulting in a higher proportion of long pauses at word level than at sentence and paragraph levels, which Dragsted argued is likely to indicate a high degree of problem-solving at lexical and syntactic levels whereas the macro-level is to some degree defined by the ST. Student translators were more similar to normal text production in their pause pattern (Dragsted 2004: 224).

In a closely related study, Immonen (2006) found support for Schilperoord's findings of increasing pause duration and length from word to paragraph level. Immonen asked professional translators to produce monolingual texts as well as translations, all typed and recorded in Translog (Immonen 2006: 315ff.) and, like Schilperoord, Immonen also found pause duration to be longest at paragraph level and to decrease in length at lower level textual categories across both monolingual and translation writing tasks (Immonen 2006: 332). There were manifestations of differences between the monolingual text production and translation task in that pause duration at sentence and paragraph levels were found to be significantly shorter in translation than in monolingual text production, but with longer pauses at clause level and lower. These findings seem plausible as translations generally tend to follow the overall layout of the ST, meaning that there is less need for macro-level planning in translation compared to normal text production. Longer pauses at word and clause levels in a translation task can be explained with decision-making regarding lexical and grammatical choices (Immonen 2006: 332).

The studies by Schilperoord, Dragsted, and Immonen all indicate that pause length is a relevant measure of cognitive effort in text production, of which translation can be regarded as a special form. And the findings of Immonen that pauses are longer at word level in a translation task than in a monolingual text production task would seem to indicate that key-logging (and the Translog application) is a useful methodology for investigating cognitive effort at word level in translation process research.

Similar to the main eye-tracking measure used in Analysis 1, *Total Fixation Time*, a comprehensive measure was preferred in the key-logging Analysis 4. Instead of only investigating pre-production pause length and frequency, it was decided that a measure of total production time would provide a better picture of any differences between the metaphor and the comparison AOIs as it was not deemed unlikely that hesitation would occur mid-production rather than pre-production. By focusing only on pre-production pauses, such hesitations would not have been included in the data. Furthermore, a number of the AOIs consisted of multiple words and by investigating total production time, any potential pauses between words in these units would be included in the data (see section 4.6.3 for a more in-depth description of *Production Time*). Differences in word length were taken into account by including character count as a control-oriented variable in the statistical analysis.

Longer production times in TT production were regarded as indirect signs of increases in cognitive effort required for translation of those specific AOI equivalents, and Analysis 4 thereby provided the possibility of comparing the cognitive effort invested in production with the cognitive effort invested in comprehension as found in analyses 1-3. By combining eye-tracking methodology with key-logging, two distinct stages of the translation process could not only be investigated separately with the methodology best suited to its distinct features (reading in comprehension, writing in production) but the two data streams could be regarded as a whole to offer a comprehensive overview of any potential differences in the processing of the two types of AOIs during the translation process from beginning to end.

3.3.3 Summary

Eye-tracking and key-logging were both regarded as relevant tools. Eye-tracking technology has been used to investigate cognitive effort in reading tasks for decades (see e.g., Rayner 1998, Rayner et al. 2006) following the eye-mind assumption that the mind processes what the eyes are fixating. In other words, eye-tracking offers an online insight into the cognitive processes different from the kind of verbal evidence obtained in TAPs. Research has shown that longer gaze times can reliably be interpreted as indicative of increased cognitive effort caused by some form of processing problem such as lexical difficulties or ambiguity. This is interpreted as support for the cognitive-control view of eye movements, meaning that eye movements and fixations are regarded as controlled by cognitive processes rather than a result of oculomotor control.

Research projects using eye-tracking technology have customarily reported a number of eye-tracking measures to ensure the most comprehensive view of the assumed underlying cognitive processes. Regressions have been a popular measure for primarily lexical and semantic ambiguity such as found in garden-path sentences as well as linguistic anomalies. As the view adopted in this thesis was that metaphors are neither ambiguous nor linguistic anomalies as also supported by early research by Inhoff et al (1984), other eye-tracking measures were found to be more relevant to this study. However, regressions were included in the more comprehensive measures used in the analysis, but were not analysed separately.

The eye-tracking methodology has been employed in translation process research in more recent years and has been employed in the investigation of differences between students and professionals (Jakobsen and Jensen 2008), differences in eye movements depending on the task (*ibid*), as well as investigation of the effect of syntactic differences between L1 and L2 in a translation task (Jensen et al. 2009). The experiment reported in this thesis also includes a comparison of the results from a reading and a translation task in order to verify whether any differences in the cognitive effort found in the metaphor AOIs compared with the non-metaphor AOIs could be argued to result from the translation aspect. The experimental methodology

therefore follows in the footsteps of earlier translation process research, but the online investigation of cognitive effort invested in metaphor translation has not been carried out before.

Research in writing and translation processes has found that pauses in production do not occur randomly but at distinct lexical and syntactic levels in the text (see Schilperoord 1996, Dragsted 2004, and Immonen 2006) and also indicate increased cognitive effort in the processing, similar to how increases in fixation times have been interpreted as indication of increased cognitive effort. Typing speed may of course differ between participants depending on their typing skills (part of Göpferich's psycho-motor competence as described in section 3.2.3). These potential differences were taken into account in the statistical analysis by including Participant as a random factor in the LMER model.

To obtain as comprehensive a key-logging analysis measure as possible, *Production Time* was chosen as the preferred measure. Production time not only investigates the difference in pause length before production of the TT AOI equivalent is initiated but is a temporal measure of the time from immediately after the last keystroke in the preceding word until immediately after the final character is typed in production of the TT AOI equivalent. By deciding on this comprehensive measure, all pauses, whether they take place pre-production or mid-production, are included in the analysis.

The collection of eye-tracking data was restricted to the STs as eye-tracking was deemed to be more relevant to ST comprehension than TT production. This view was based on the assumption that the cognitive processes taking place when a participant was looking at the TT would be related to the TT production and not ST comprehension. In other words, the ST eye-tracking data was assumed to mainly concern cognitive effort invested in the comprehension process, and production was assumed to mainly take place when attention was focused on the TT. Consequently, production was investigated through key-logging data, which was collected via the Translog application in log files. Though this discrepancy in data collection methodology resulted in a certain lack of comparability between the eye-tracking and key-logging analyses and therefore between the two stages of the translation process, this disadvantage was deemed to

be outweighed by the benefits of receiving a more comprehensive view of the translation process, which allowed for a greater range of measures to be analysed than if only eye-tracking measures had been investigated.

Chapter 4 Methodological Framework and Experimental setup

4.1 Equipment and Analysis Tools

The eye-tracking equipment used was a Tobii 1750 remote eye tracker, where the eye-tracking camera and infrared LED lights are built into the frame of the monitor and with no head fixation, providing for a more naturalistic research environment. The participants were seated in front of the eye tracker at a distance of approximately 55 cms from the monitor, which previous experiments had confirmed ensured the best eye-tracking quality. The eye-tracking software application ClearView, version 2.7.1., was used to collect the eye-tracking data. The eye-tracking and key-logging software application Translog, version 3.3.0.0, collected both eye-tracking and key-logging data, but only the key-logging data was used in the analysis. Calibration was done in both Translog and ClearView, the latter running in the background while the participants worked in Translog. Translog User presented the ST in the upper half of the application window while the TT appeared in the lower half as it was produced. For each participant, an eye-tracking recording was started in ClearView and the application minimised to operate unobtrusively in the background while the participant worked directly in the Translog User application window. AOIs, which can be either rectangular or polygonal, were defined in ClearView. AOIs were set around the words to be analysed and the Excel template included with the ClearView software extracted gaze data only from the defined AOIs, allowing the experimenter a better overview of the data. The borders of the AOIs in ClearView were defined to extend halfway into the space to the words on both sides of the individual AOI and also halfway to the lines above and below the line of the AOI to accommodate any inaccuracies in the eye-tracking system recording the eyes' location on the monitor.

The screenshot in Figure 8 shows the ClearView window in which the AOIs are defined. The ClearView application shows the content of the monitor as seen by the participant, which is why the Translog window is shown in ClearView. The experimenter is able to drag the AOI to surround the words to be included in the analysis, which can be done in both the ST and TT windows. The AOIs are defined in blue.

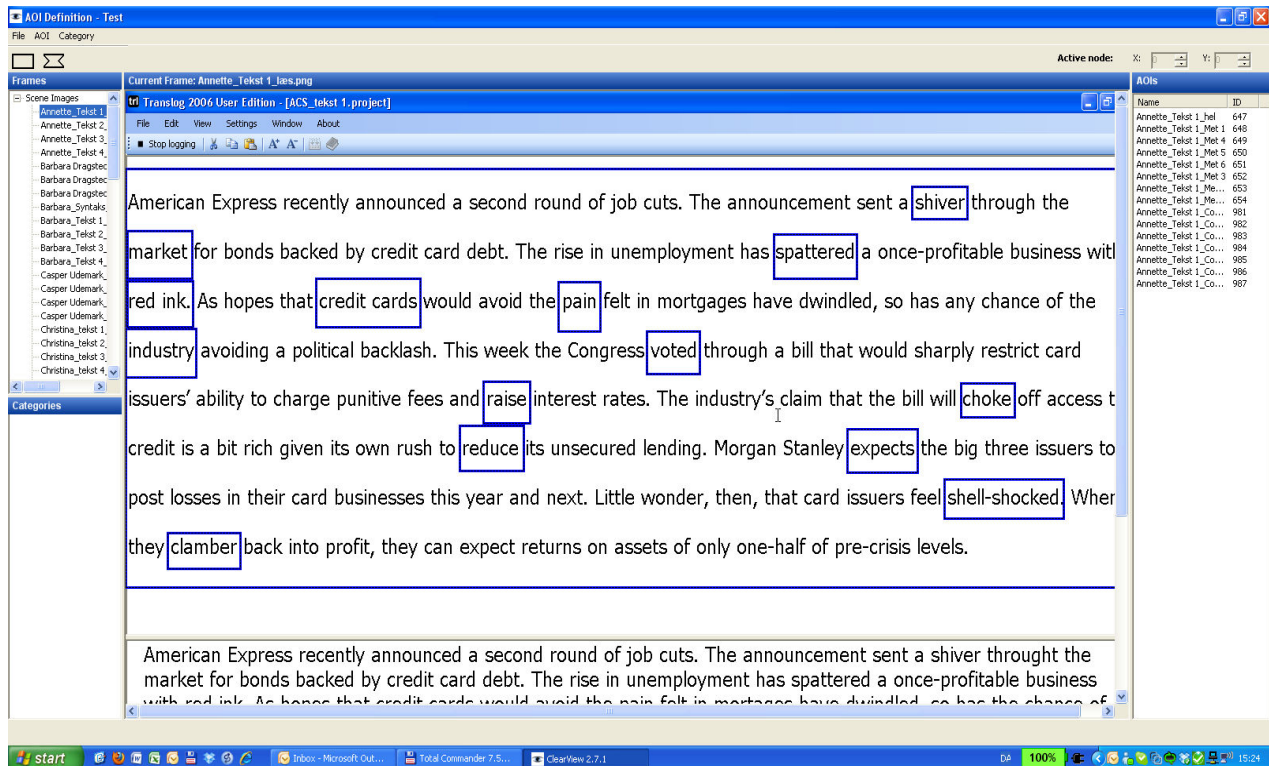


Figure 8: Screenshot of ClearView AOI Definition window

4.2 Participants

17 professional translators participated in the experiment. The participants for this study were all Danish translators with at least 12 months of professional experience. The majority of the participants worked or had worked full-time as professional translators while a few participants only translated part-time. The professional background of the participants varied in terms of the fields they normally work in, ranging from translation of literature to translation of medical texts. All participants except two were female.

4.3 Data Quality

Quality criteria were applied to the collected data to ensure that the results were not skewed by flawed data from the participants. Experience from previous experiments showed that numerous factors such as lighting and whether the participant wore glasses or contact lenses were found to have a potential effect on the quality of the gaze data. The participant's distance from the

monitor was in particular found to have an effect on the data quality and the participants were therefore required to sit no further than 55-60 cms from the monitor.

Two quality criteria were deemed sufficient to ensure that the data were of a sufficiently high quality to ensure that it would be possible to make assumptions on the cognitive processes underlying the gaze data without distortion from flawed data.²¹

The first quality criterion was average fixation duration. As previously mentioned, the average fixation lasts between 200 and 300 milliseconds (Rayner 1998: 373). Any participant recording with an average fixation duration below 180 ms was therefore to be excluded from the analysis. Although the average fixation duration varied greatly among participants, ranging from just below 200 to over 350 ms, none of the participants had an average fixation duration below the threshold of 180 ms or even below 190 ms. As a result, no recordings were discarded based on this quality criterion. It was speculated that the main reason for the high retention rate of the recordings was the relatively short distance at which the participants were placed from the monitor. The average fixation duration was calculated by ClearView, the eye-tracking software application used with the Tobii eye tracker. The average fixation duration was calculated for the fixations within an AOI covering the entire text window and not only the metaphor and comparison AOIs.

The second quality criterion was also adopted from Hvelplund's methodology (although slightly modified). Hvelplund called this criterion Gaze time on screen (GTS), and it is basically a calculation of the percentage of time spent gazing at the text during the translation production (Hvelplund 2011: 104). The assumption underlying this quality criterion was that the participant could reasonably be assumed to be looking at the text on the screen for the majority of the time during the translation task. If the percentage of GTS was low, this could mean that the eye tracker was unable to collect a satisfactory amount of eye-tracking data to provide a reliable image of the participant's actual gaze pattern. Hvelplund had a threshold level of approximately

²¹ The two selected quality criteria were adapted from Hvelplund's PhD thesis (2011) from section 5.1.2 on data quality. The selection process reported here is a simplified version of Hvelplund's as he implemented no fewer than three quality criteria. The two quality criteria implemented in this thesis were considered to be the main indicators, and Hvelplund's results indicated that low quality data were eliminated satisfactorily through the implementation of the first two quality criteria (Hvelplund 2011: 103ff).

30 per cent GTS for his participants, meaning that if a participant's GTS percentage was below approx. 30 per cent, the recording was not included in the analysis. Of all 17 participants reported in this thesis, only two had a GTS percentage of 49 for one text (both had higher percentages for the other text translated). All other participants were well above a threshold of 50 per cent with an average GTS percentage of 65. As Hvelplund's threshold level was around 30 per cent, it was not deemed necessary to exclude the two recordings with a GTS of 49 per cent, in particular as the participants both had higher GTS percentages for the other translation text. The relatively high GTS average of 65 per cent could be seen as another indication of satisfactory quality of the eye-tracking data.

To sum up, the data from all 17 participants were tested against these two relatively simple, yet essential indicators of data quality, and it was not found necessary to exclude any of the participants from the analysis.

4.4 Experimental Texts

To optimise the ecological validity of the data, the study used authentic texts shown in their entirety rather than presenting individual sentences one at a time. The four texts each consisted of approximately 150 words in English (the participants' L2). This was the maximum length of text which could fit into the upper half of the Translog window without text scrolling. The individual sentences for each text were extracted from an English news magazine article²² and combined into an abbreviated version of the original article. No further modifications were made to the sentences. By using authentic texts, it was sought to avoid the pitfalls claimed to be made often in metaphor research according to Goatly. Goatly claims that these pitfalls include using only class of metaphor (either novel or conventional) and using constructed or recycled examples of metaphors presented without context (Goatly 1997: 5).

²² The experimental texts (see Appendix 1) were based on articles from the following sources: Text 1 from The Economist, Text 2 from Time Magazine, Text 3 from Cnn.com, and Text 4 from The Economist. All four articles were published and accessed in 2009.

According to the Flesch reading ease index scores, the difficulty level of the four texts was comparable as can be seen from Table 4. The index score range is from 0-100; the higher the score, the easier the text (www.editcentral.com). Although the Flesch reading ease index was developed for English native readers, the professional background of the participants was deemed sufficiently similar to make it possible to apply the scores to the reading of texts for translation by L2 readers. As can be seen from the table, the measures are relatively crude and may not reflect the cognitive effort required for comprehension and translation, as the measures do not take such factors into account as coherence, topic, and culture specificity. However, the measures provided by Editcentral give an idea of the objective comparability of the texts at least. It should be noted that Editcentral's definition of complex words is a question of number of syllables rather than e.g., lexical frequency, which was instead controlled for in the statistical model.

Table 4 provides an overview of the objective characteristics of the four texts as identified by Editcentral.²³

Table 4: Properties of texts 1-4

Text	1	2	3	4
Flesch reading ease score	68.6	79.9	74	68.7
Complex words	15	10	21	16
Words	154	149	147	147
Sentences	9	10	9	7

As all four texts were abridged versions of longer texts, the curtailed versions were subjectively evaluated by a third party to ensure that they read as coherent text units. This evaluation was done by asking the evaluator to read the text and comment upon any abnormalities in the text and evaluate whether or not the text made sense and could be read fluently. The individual sentences were not altered, but several intermediate sentences were eliminated by me to keep the

²³ www.editcentral.com

text length at the maximum of approximately 150 words. Attention was given to ensuring that the contexts of the metaphors were clear from the onset of the text. The subject varied from text to text although all four texts were on financial topics as financial texts often contain many metaphors.

The texts contained 37 linguistic metaphors in total, constituting 37 AOIs, ranging from six metaphors in Text 2 to 13 metaphors in Text 4. For the purposes of this experiment, the boundaries of each individual metaphor were identified using the criterion that the constituents of the metaphorical expressions, i.e. the vehicle, must differ from the text in terms of semantic domain.

To illustrate what is meant by a different semantic domain, an example from one of the texts may be helpful: *But the **suitors** must first gain the approval of regulators, who are sure to supervise the **courtship** with care because of the size of the **dowry*** (Text 3, see Appendix 1). The subject of the text was the current high number of mergers between companies, and the overriding metaphorical semantic domain for the merger is marriage (and the parties and processes involved in a marriage). *Suitors* is used as a metaphor for the two companies involved in a specific merger, and as *suitors* differs in terms of semantic domain from the text's general semantic domain of business and mergers, *suitors* is identified as the linguistic metaphor in its entirety, and consequently constitutes the AOI to be analysed. The same applies to the other two metaphors in this sentence, namely *courtship* and *dowry*. This criterion is similar to Goatlys' vehicle (1997) in that the constituents of the individual AOI are deemed to be the core of a metaphor carrying the metaphorical meaning. Furthermore, as Janus and Bever (1985) emphasised, it is preferable to investigate the processing time when the metaphor is first encountered rather than investigate whole sentences or end of sentences because of other integration processes which may interfere. They argued that "the greatest cognitive demands" will be at the point in the sentence at which the metaphor is first encountered (Janus and Bever 1985: 478). In other words, any differences in cognitive effort for processing literal expressions compared with metaphorical expressions will be more likely to be registered at constituent unit level than sentence level.

The majority of the metaphors were single words, but a few metaphors consisted of multiple words, and word length was therefore taken into account as a variable in the statistical analysis

(see section 4.6.1). For this study, ecological validity, i.e. using authentic texts rather than constructed texts, received higher priority than exact text comparability in terms of word length, AOI position, word frequency and other variables, which were instead included as variables in the statistical analysis.

For comparison purposes, 37 non-metaphorical AOIs were selected. Although Lakoff and Johnson (1980) claimed that everything is understood metaphorically, the selection criterion for the comparison AOIs was that the words were within the semantic domain of the text's subject. In other words, the criterion was the opposite of the selection criterion for the metaphor AOIs. A few of the comparison AOIs such as "downturn" could perhaps be argued to be a conventional metaphor, but a lookup in a dictionary²⁴ confirms that the word has lost its metaphoricity to the point of having a lexicalised definition. It is therefore doubtful that the word would be interpreted metaphorically by the participants unless one takes the rather extreme views argued by Lakoff and Johnson.

The comparison AOIs were also chosen with a view to having a length comparable with the metaphor AOIs, and the single-word AOIs were all content words. Another selection criterion, applied to both types of AOIs, was the exclusion of start-of or end-of sentence AOIs, as research has indicated that gaze times may be longer for words at sentence-final positions caused by some form of wrap-up effect (Just and Carpenter 1980: 34) and it was assumed that sentence-initial positions could be influenced by some level of orientation taking place before the actual comprehension of the linguistic unit began. As the texts were authentic texts rather than constructed texts, it was not possible to have comparison AOIs which were directly comparable with the metaphor AOIs in terms of word length and frequency, which were instead taken into account as variables in the statistical analytical model (see section 4.6.1).

The metaphors were also rated for their familiarity by a group of four evaluators, which consisted of three professional translators and one highly experienced interpreter. As it would not be feasible to have the participants in the experiment also evaluating the metaphors in the texts, it was necessary to have another group of evaluators not participating in the experiment do

²⁴ www.dictionary.com

this. The professional profile of the evaluator group matched the professional profile of the participants as a group, which was important in order to be able to reasonably draw inferences from the familiarity ratings of the evaluator group to the assumed metaphor familiarity of the participant group. Sentences containing metaphors were extracted from all four texts and presented to the raters in randomised order. The metaphor vehicle, i.e., the AOI, was highlighted in red. If a sentence contained more than one metaphor, this sentence would be listed once for each individual metaphor and could therefore be listed up to three times. If a sentence contained more than one metaphor and was therefore listed more than once, these instances of the sentence would be grouped together to make the evaluator aware of the repetition. If the evaluator had encountered the same sentence again but after several other sentences, it is possible that s/he would have rated the metaphor as highly familiar because she had encountered the same sentence before in the evaluation. By grouping the instances of the sentences together and thereby making the evaluators aware of the repetition, any potential influence on the familiarity rating of each individual metaphor in the sentence was deemed minimal.

The evaluators were briefed that the metaphors were taken out of context and were asked to evaluate how familiar they perceived the individual metaphor to be on a scale from 1 to 7, 1 being not at all familiar and 7 being very familiar. The order of the sentences was different for each evaluator. An average was calculated for the ratings from all four evaluators (see Appendix 6) and included as a variable in the statistical model used for the inter-metaphor analyses 1.1 and 4.1.

The output of the reading and retyping task (see subsequent section) was not evaluated in any form as the product is identical to the ST with perhaps a few spelling mistakes. The output of the translation task, i.e., the TT, was not evaluated in terms of translation quality as this is very time-consuming and would merit its own study. Also, the focus of this thesis was not an investigation of metaphor translation quality or translation style. The produced TTs were analysed to determine the choice of translation options chosen for the metaphors. These translation choices were categorised according to Dobrzynska's classification scheme (1995): use of an exact equivalent of the original metaphor (M-M), choice of another metaphorical phrase with the same meaning as the ST metaphor (M1-M2) or paraphrase (M-P) (Dobrzynska 1995: 595). This classification was done subjectively, but the benefit of using Dobrzynska's classification scheme with only three categories, which are consequently quite comprehensive,

rather than a more elaborate classification scheme such as Newmark's (1981) was that there were only a few instances of translation choices which could be classified in either one or the other category. Dobrzynska's classification scheme is categorical and enables the experimenter to be more consistent in categorising the translation choices than with a more finely granulated classification scheme with more vague and overlapping definitions. Examples of translations from the experiment can be seen categorised in Table 5 to give an idea of the translations in each category.

Table 5: Examples of translations categorised by translation strategy

	Translation Strategy M-M	Translation Strategy M1-M2	Translation Strategy M-P
Source text (AOI in italic)	Securitization is <i>radioactive</i>	The market for securitization has <i>fallen off a cliff</i>	The on-again, off-again plans of Porsche and Volkswagen to <i>tie the knot ...</i>
Target text (AOI in italic)	Sekuritiseringer er <i>radioactive</i> [securitization is <i>radioactive</i>]	Markedet for sekuritisering er <i>kollapset</i> [the market for securitization has <i>collapsed</i>]	Porche og Volkswagens til tider vاكلende planer om en <i>sammenlægning</i> [Porche and Volkswagen's sometime shaky plans of a <i>merger</i>]

4.5 Task

Each participant was required to perform two tasks: first, they were asked to read and retype two texts in English. The presentation order of the two texts was interchanged among participants. The brief informed them that, after each text, they would be asked a few questions regarding the content of the text. These subsequent questions served the purpose of ensuring that the participants did not blindly retype the text without paying any attention to the meaning of the content. The purpose of the retyping element of the task was to achieve some level of comparability with the following translation task as the cognitive and physical effort of typing was expected to have an effect on the gaze time. The objective of this first task was to investigate if metaphor comprehension in L2 required increased cognitive effort compared with comprehension of literal expressions. As shown in section 3.1.4, there is an ongoing debate on whether or not metaphor comprehension requires an additional effort.

The main focus of the experiment reported here lies with the translation task in which the participants were asked to translate two texts from English into Danish (L2 into L1). The

presentation order of the two texts was interchanged among participants. The participants were told that they were free to review the translated text and to go back in the text to make revisions. They were informed that the target audience for the translation were readers of a Danish financial news magazine, i.e., an audience similar to the readership of the ST. The participants were also informed that they would be asked questions on comprehension and translation of the text afterwards in order to motivate them to work more carefully with the texts to ensure that the translation process resembled the process during an actual translation task in the participants' work life as closely as possible within the limitations of the experimental environment. After the translation of each text was completed, the participants were asked questions on potential comprehension difficulties, the content, and also on any potential translation difficulties they had identified. The questions were open-ended and were given in Danish to encourage answers given freely and spontaneously (for an English translation of the questions posed to the participants, see appendix 3).

No time constraints were imposed for either of the two tasks. No translation aids of any kind were available for either task. The text order was partially randomised for the two tasks reported here, meaning that the first 10 participants were presented with texts 1 and 2 in randomised order (1,2 or 2,1) for the retyping task and then texts 3 and 4 (also in randomised order, 3,4 or 4,3) for the translation task. The next 7 participants were presented with texts 3 and 4 (also in randomised order) for the first task and then texts 1 and 2 (in randomised order) for the second task.²⁵ All participants were presented with the retyping task before the translation task.

4.6 Data Analysis: Statistical Models

For linguistic research, one of the benefits of a regression model is that the model makes it possible to carry out experiments with authentic texts rather than texts constructed specifically for the purpose of an experiment. The differences in variables such as text length, word frequency and length may be taken into account in this type of statistical model, permitting the researcher to use a more ecologically valid experimental setup. A regression model offers the

²⁵ The initial expectation was to have 20 participants for the experiment, allowing for a higher degree of inter-text randomisation than possible with only 17 participants. It was not possible to meet this goal.

possibility to work with experimental data collected from a more naturalistic experiment because the statistical model is able to isolate effects from the individual variables. In other words, it enables investigation of each variable with all other variables being held constant (Balling 2012). Another benefit of the regression model is the possibility it offers to make generalisations over the population²⁶ based on inferences from the relatively limited sample in this experiment.

Mixed-effects regression models consist of both fixed and random factors. A fixed factor is a variable with a low number of levels such as Text (Texts 1-4) or Domain (Mixed or Same), and an important difference between a random and a fixed factor is that the latter is repeatable in that there may be more than one AOI belonging to the same text or more than one metaphor in a text with mixed metaphorical domains (the variables Text and Domain will be explained in more detail in the following) (Baayen 2008: 241ff, Balling 2008a: 95).

Random factors, on the other hand, are not repeatable and are assumed to have been selected randomly from any given population. Participant is a typical example of a random factor in that the participant is assumed to be representative of a given population and to have been selected randomly (Baayen 2008: 241ff).

More specifically, the statistical model used in this study was a linear mixed-effect regression model (LMER). One of the benefits of this type of statistical model is that it is able to take individual variations into account to allow for a more precise analysis. Examples of such individual variation could be differences in fixation length between participants or differences in typing speed. The adjustments for these individual variations are termed random intercepts (Baayen 2008: 247, Balling 2008b: 181, see also Baayen et al. 2008).

Two separate statistical models using the eye-tracking data and a third statistical model using the key-logging data will help investigate the research questions of the thesis. The first statistical model addresses research question One. This research question asks whether professional

²⁶ Here, population is used in the narrow sense to mean a particular group of people with a shared characteristic. In other words, inferences are made from the sample of translators participating in this experiment to the population of Danish professional translators.

translators will have longer gaze times, more fixations and longer first pass fixation times for metaphors when reading for translation compared with non-metaphors (analyses 1-3). A secondary part of this statistical analysis concerns the investigation of gaze times for metaphors versus non-metaphors in reading for comprehension (see task description in section 4.5).

Analysis 1.1 used a second statistical model and a subset of the same eye-tracking data to investigate what effect the choice of metaphor translation strategy in the TT has on the gaze times for the metaphor AOIs in the ST, and whether there was an effect of the metaphors being from mixed semantic domains or from one semantic domain. In other words, the second statistical model investigated potential inter-metaphor effects whereas the first and main statistical model concerned potential differences between gaze times for metaphor and literal AOIs. This model was also used for a subset of the key-logging data in Analysis 4.1 for a similar inter-metaphor analysis.

The independent and dependent variables included in the two statistical models for the eye-tracking data are to a large extent the same, but to achieve a more coherent overview, the variables are listed separately for the two models. The individual variables were fitted to the model one at the time, beginning with the more control-oriented variables and ending with the variables central to the research questions. By including and investigating the significance of the more control-oriented variables first, the effects of the variables more directly concerned with the research questions were more clearly discernible once all other variables were held constant. The variables are listed in the following section in the order in which they were included in the model in the open-source statistical tool R. Variables that turned out to be non-significant were removed before moving on in the analysis to ensure that non-significant variables did not obscure any potentially significant variables (Baayen 2008: 236, Balling 2008a: 99). This procedure also allows for a clearer interpretation of the analysis.

4.6.1 Analyses 1-3: Comprehension of Metaphor versus Non-metaphor in Reading and Translation

The following figure provides an overview of the statistical model used for the eye-tracking data, analyses 1-3 with the dependent variables *Total Fixation Time*, *Total Fixation Number*,

and *First Pass Fixation Time*. The model illustrates how the dependent variable is influenced by the independent variables. The model is read clock-wise, beginning at the top with AOI ID, with the more control-driven variables first and the more research question-driven variables ending the cycle. Of course, the model should not be interpreted to mean that the independent variables are all independent of each other, as some level of interaction between these variables was expected and also investigated in the analysis. The statistical model and the order in which the independent variable was introduced into the analysis were identical for all three analyses.

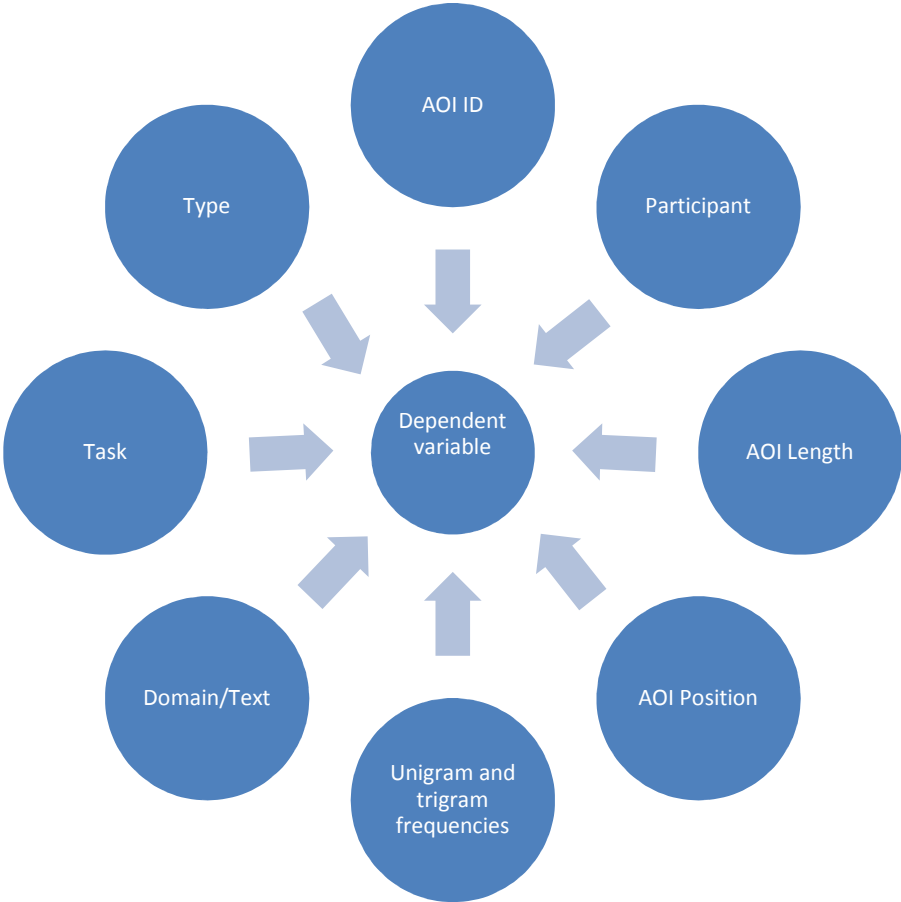


Figure 9: An overview of the dependent and independent variables for the eye-tracking analyses

Dependent variables

Total Fixation Time (Analysis 1): The gaze times for all metaphor AOIs and non-metaphor AOIs from all four texts are extracted for each participant and included in Analysis 1 as the dependent variable. The fixation time measure is the total gaze time measure of all fixations

within a specified AOI, including refixations, and is the most comprehensive gaze measure of all three measures.

Total Fixation Number (Analysis 2): The number of fixations for all metaphor AOI and non-metaphor AOIs from all four texts are extracted for each participant and included in Analysis 2 as the dependent variable. This measure includes all fixations within each AOI, and also includes refixations.

First Pass Fixation Time (Analysis 3): This is a measure of the total duration of all fixations up to the first fixation outside the area for all metaphor and non-metaphor AOIs across all four texts.

Independent variables: random effects

AOI ID: As the metaphors in the four texts occurred in natural texts, they varied in terms of length, whether they were single or multiple words, their degree of familiarity and in terms of whether or not they co-occurred with metaphors from the same or a different semantic domain. The same variability applied to the comparison AOIs chosen in the texts. AOI ID is a random factor because the AOI ID is unique and non-repeatable.

Participant: The variable Participant is classified as a random effect factor, because it was assumed that the participants were a random sample of a general population of translators although of course this randomness was restricted by the availability of participants fulfilling the criteria set for the population of the experiment. The LMER enables the experimenter to make generalisations on a population based on a sample with highly variable data as the model evens out the individual differences in its calculations.

Independent variables: Fixed effects

AOI Length: The length of the AOI was expected to affect the dependent variable as longer words generally receive longer fixations than shorter words.

AOI Position: The position of the AOI in the text was expected to have an effect on the participants' gaze behaviour as a fatigue effect might be expected the further the participant gets in the experiment.²⁷ This would be manifested in longer gaze times for AOIs later in the texts. On the other hand, a form of priming or facilitation effect could also be possible (cf. Jääskeläinen and Tirkkonen-Condit 1991), which would result in shorter gaze times for later AOI positions, i.e., AOIs that occur later in the text. Another possibility is a form of procedural priming effect in which an earlier translation strategy is retained for following metaphors as well, following Jääskeläinen and Tirkkonen-Condit's (1991) view on automated processes (see section 3.2.3).

Unigram Frequency: This variable represented the logarithmically transformed frequency of each word in the British National Corpus. In other words, this variable was a measure of the word frequency of the word(s) in the AOIs. The single-word frequency values of the Unigram Frequency enter into the calculation of the trigram probability value and the two variables are consequently highly correlated. The trigram was expected to be more relevant as it indexes the probability of the word in context.

Trigram Probability: Context has been identified by many researchers as having an important effect on the effort required for the comprehension of metaphors, and the trigram probability variable enables the experimenter to investigate the interaction between context and the cognitive effort required as evidenced by the dependent variable. The trigram probability value is a logarithmic value calculated on the basis of word frequency values from the British National Corpus. This variable offers a logarithmically transformed probability for any three consecutive words in a text appearing together in a specific order. The trigram probability variable enables the experimenter to take context into account at least to the extent that three consecutive words can be said to be a context. As Balling (2012a) explained, the trigram probability is a measure of the word frequency of the last word in a given three-word unit divided by the bigram frequency of the two preceding words. In other words, the trigram probability is a measure of the probability of a word appearing after the two preceding words and can therefore be regarded as

²⁷ Fatigue should not be understood in its traditional sense here, i.e. that the participant becomes tired. Fatigue is a term traditionally used in e.g. psycholinguistic experiments for when the participant slows down as the experiment progresses (see e.g. Balling 2008, Balling 2013).

an indirect indicator of word predictability. Word predictability was argued to be an indicator of processing effort by Frisson et al. (2005, see section 3.3.1.5). Metaphors with a high trigram probability were assumed to be more familiar as a high trigram probability value means that the metaphor has occurred within a similar context previously. For the AOIs containing multiple words, the value is an average of the trigram probabilities for each word in the AOI.

Domain: Dickins (2005) argued that mixed metaphors could present a “considerable problem” for the translator (Dickins 2005: 253). This claim was not, however, made on the basis of an empirical study of cognitive effort, but on the basis of a qualitative study of translations from Arabic to English.

For this study, it was speculated that if the individual metaphors in a text were all based in the same semantic domain, a priming effect might occur as the stylistic decision made for the first encountered metaphor could more easily be applied to subsequent metaphors if they were from the same semantic domain as the first metaphor. An example of what is meant by the same semantic domain is the following sentence from Text 3, “***The path from the altar is strewn with failed corporate marriages***” (see Appendix 1),²⁸ in which all metaphors are from the semantic domain of marriage in a text on corporate mergers. In contrast to this is the following sentence from Text 1, “*and the market for securitization [...] has **fallen off a cliff**. We’re now suffering a financial **Chernobyl** [...]*”, in which the metaphors are from a semantic domain of physical movement and toxic radiation. It was speculated that the uniformity of a single semantic metaphor domain would result in shorter gaze times for the metaphors in the texts in which the metaphors were from one specific semantic domain rather than mixed domains. Texts 1 and 2 were mixed whereas the metaphors in texts 3 and 4 each were from one specific domain.

Text: As all four texts were natural texts and not texts constructed specifically for the purpose of the experiment, the texts differed somewhat in length, overall lexical difficulty, number of metaphors, text topic, etc. For this reason, Text was included in the model as an independent variable or, more specifically, as a fixed factor. The fixed factor Text had four levels: Text 1 through to Text 4, as there were four different texts. This variable overlapped the Domain

²⁸ Metaphor AOIs in bold.

variable and therefore the two variables were tested separately. Only Domain was retained as a variable in the final statistical model.

Task: This independent variable was included in the model to investigate whether there are longer gaze times for reading for translation of metaphors than for reading for translation of non-metaphors (see chapter 2). Since part of the experiment included reading and retyping without translation, this independent variable made it possible to make observations on the reading for translation task alone. In this way, it was possible to answer several questions with one overall model. Translation of metaphor is the focal point of this thesis, but by including Task in the statistical model as a fixed factor with the two levels Translation and Reading, it was possible to investigate differences in the eye-tracking data between reading for comprehension and reading for translation.

As the main focus of this experiment was an investigation of the cognitive effort invested in translation of metaphors compared with translation of literal expressions, the interaction between the variables Task and Type was deemed essential to the research questions of this thesis.

Type: This variable was included in the statistical model as an independent variable, and it permitted investigation of the interaction between Task and Type. The factor had two levels: Metaphor and Comparison, and the interaction of these two levels with the above variable of Task and the effect on the dependent variable was of central importance to the experiment. In other words, was there any difference in the dependent variable when Type was Metaphor compared with when Type was Comparison, i.e., non-metaphor?

4.6.2 Analysis 1.1: Comprehension of Metaphor in Translation

In order to achieve a more finely granulated perspective on the process of metaphor translation, a secondary statistical model was fitted for the eye-tracking data which aimed at determining whether a specific translation strategy for metaphors required greater cognitive effort than other strategies as indicated by longer gaze times. Another point of interest was the question of

metaphor familiarity; it was speculated that translation of metaphors with a high familiarity rating may result in shorter gaze times compared with metaphors with low familiarity ratings.

The majority of the variables included in this secondary model were repetitions of the variables in the main statistical model, but they are repeated here to keep an overview of the constituents of this specific model. This statistical model used a subset of the same data used in the main statistical model described in the above section, or more specifically, the subset that consisted only of the data from translation of metaphor. This means that this model differs from the main model in that there is no comparison between metaphors and literal expressions and no comparison between reading and translation. This secondary model was a more finely granulated investigation of the interaction between various aspects of the nature of the individual metaphor and the potential effects on the dependent variable in the translation task.

The procedure used for fitting the main statistical model was repeated for the secondary model. The majority of the variables included in the second model used for Analysis 1.1 are identical to the variables in the model used for analyses 1-3 (see section 4.6.1). The variables that are unique for the second model will be described in the following.

Table 6: Identical variables in analyses 1-3 and 1.1

<i>Dependent variable</i>
<i>Total Fixation Time</i>
<i>Independent variables: Random effects</i>
AOI ID
Participant
<i>Independent variables: Fixed effects</i>
AOI Length
AOI Position
Unigram Frequency
Trigram Probability
Domain

Apart from the variables above, which were described above, two other variables were added specifically to this secondary model for inter-metaphor investigation.

The first element related to the subjective familiarity ratings by the four raters.

Mean Familiarity: This variable represented the means of the four raters' scores given to each metaphor in each text (see Appendix 6). The score ranged from 1 (not at all familiar) to 7 (very familiar) (see appendix 5 for an example of a presentation of the metaphor AOIs to the raters). To ensure that no inter-text priming effect occurred and influenced the raters' perceived familiarity with the metaphors, the metaphors were presented with the sentences in which they occurred in the texts but without the contextual information from the entire text. It was the aim to strike a balance between allowing the raters to receive enough contextual information to make sense of the metaphor without being influenced by the familiarity ratings given to metaphors previously in the text. The presentation order of the metaphor AOIs from all four texts was randomised across participants. The metaphor AOIs were highlighted in red as the task for the raters was not to identify the metaphor and its constituents but only to rate their own perceived familiarity with the metaphor.

The ratings were quite divergent, but the value included as an independent variable was a mean of all four ratings for each metaphor AOI.

Translation Strategy M-M: The second unique aspect of the secondary model investigated the interaction between the dependent variable of *Total Fixation Time* and translation strategy with relevance to research questions three and four. This interaction is investigated by fitting the two factors of Translation Strategy M-P and Translation Strategy M1-M2 to the model, using the Translation Strategy M-M as the basis of comparison. M-M was chosen as the basis of comparison (reference level) because this seemed to be the preferred choice of translation strategy for the majority of participants and because this translation strategy can be claimed to be more faithful to the ST than the other two strategies and was therefore assumed to be a more direct translation requiring less cognitive effort than the two other translation strategies, M-P and M1-M2 respectively.

Translation Strategy M-P: The factor Translation Strategy M-P, in which the original metaphor in the ST is paraphrased into a literal expression, was compared against the reference level, which was the translation strategy M-M in which the original metaphor in the ST is translated with the same image in the TT.

Translation Strategy M1-M2: The factor Translation Strategy M1-M2, in which the original metaphor in the ST is translated using a different metaphorical image in the TT, was compared against the reference level, which was the translation strategy M-M in which the original metaphor in the ST is translated with the same image in the TT.

4.6.3 Analysis 4: Production of Metaphor versus Non-metaphor in Translation

Analysis 4 concerns the key-logging data, i.e., an analysis of TT production, and is therefore not directly comparable to analyses 1-3, which analysed the eye-tracking data from the ST comprehension (*Total Fixation Time*, *Total Fixation Number*, and *First Pass Fixation Time*). The statistical model for Analysis 4 was constructed following the same principles as that used for the eye-tracking analyses, i.e., the more control-oriented independent variables were included in the model before the more research question-driven variables. The following figure, which should be read clock-wise beginning at the top with AOI ID, offers an overview of the variables:

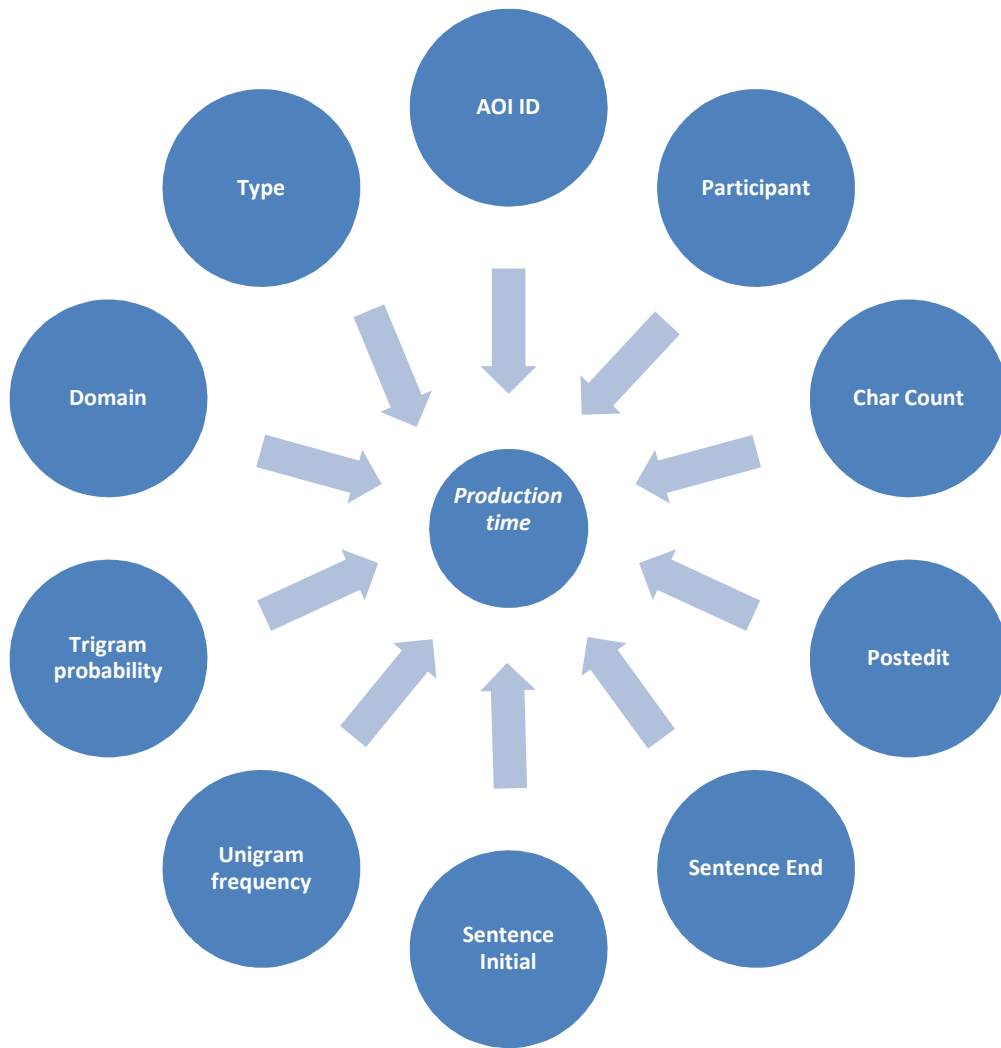


Figure 10: An overview of the dependent and independent variables for the key-logging analysis

The variables AOI ID, Participant, Unigram Frequency, Trigram Probability, Domain, and Type were all identical to the variables in the eye-tracking analyses and have been described earlier (in section 4.6.1).

Dependent variable

Production Time: This is a measure in milliseconds of the time spent on production of the translation of the ST AOI (both planning and actual typing of the translation). The time was measured from after the final keystroke of the word preceding the first TT word corresponding to the ST AOI, up to and including the final keystroke in the linguistic unit corresponding to the ST AOI.

The *Production Time* measurement method is illustrated in Figure 11. In the upper half of the window, the ST is shown with the ST AOI underlined in red. In the lower half of the window, Translog's linear representation of the TT is displayed. The TT equivalent to the ST AOI is underlined in green. The purpose of the figure is to show an example of the initial and final boundaries of the TT AOI equivalents. In the middle of the window, the dialog box Event info contains the time stamp for the location of the cursor, which is placed immediately after the full stop as the TT equivalent in this example is located at a sentence-initial position.

Any pauses preceding the AOI TT equivalents were included in the measure whereas any pauses immediately after the word were taken to be related to subsequent words. Pauses in mid-production of target word(s) were consequently also included in the measure. A few pauses immediately after a typed word may have been the result of revision of the word just typed, but in order to ensure a consistent methodology, it was decided that only pauses preceding a word would be included in the measure. This was in line with Dragsted, who stated that “the mental production of a TU [ed: translation unit] most often starts during the pause preceding the textual TU” (Dragsted 2004: 87). Because the measure was *Production Time* and not pause length, it was not deemed necessary to define a minimum threshold for pause length.

It should be noted that the temporal value of *Production Time* was logarithmically transformed to achieve a more homogenous dataset without any outlying values distorting the results. For the same reason, the statistical analysis removed any residual outliers from the dataset as these outliers would otherwise be given the same weight in the analysis as more standard values.

Independent variables: Random effects

See section 4.6.1 for a definition of the random effects AOI ID and Participant.

Independent variables: Fixed effects

Character Count: Just as the length of the word(s) in the ST AOI was assumed to have an effect on the dependent variables in the eye-tracking analyses, the number of characters typed to produce the equivalent TT AOI was assumed to have an effect on the dependent variable *Production Time* in the key-logging analysis. This measure is control-oriented as the character count was not assumed to be directly correlated with cognitive effort as the typing activity in itself must, to some extent, be regarded as an automated or routine activity. However, as pointed out by Göpferich, a translator with poor typing skills must be assumed to expend more cognitive effort on the typing activity than a skilled touch-typist and may also be likely to be slower (Göpferich 2009: 20). Character Count was therefore an essential independent variable in the statistical model for Analysis 4. An important distinction between final character count and the more comprehensive measure of temporary character count should be made as the participants would in several instances make typing errors or decide on a different translation choice mid-

production. In these cases, some character deletion would occur, and temporary character count will be higher than the final character count. However, the deleted characters will also have taken time to type (and delete) and, for this reason, the measure Character Count was in this model a total measure of all alphabetical characters typed during production of TT AOI equivalents, both deleted and final characters. Note that all other typing events such as pressing backspace, the space bar, and mouse clicks were not included in the variable Character Count as it was not feasible in all cases to determine if the action was related to the production of the TT AOI equivalent or another text unit.

Postedit: This independent variable with the levels Yes and No accounted for the effect of whether the TT AOI equivalent was edited again later in the translation process. The dependent variable *Production Time* measured the time of production from immediately after the preceding word to immediately after the last keystroke in the TT AOI equivalent, but in a few instances, the participant would go back and make minor revisions to the initial translation output. As it was not always possible to ascertain exactly when the postediting of a particular word or words was initiated, the time spent on postediting was not included in the dependent variable Production time. It was instead decided to define the initial and final boundaries of the TT AOI equivalents as previously described²⁹ (as illustrated by the beginning and end of the green line in Figure 11). It was then noted for each TT AOI equivalent translation unit whether or not any postediting was carried out.³⁰

Sentence End: The assumption behind this control-oriented variable was that the participants were likely to engage in sentence-final revision, which could perhaps have an effect on the frequency and duration of pauses as well as typing speed for translation units located at sentence-final positions. It was therefore noted for each AOI equivalent in the TT whether or not the translation was at a sentence-final position. This was dependent on the translation unit's

²⁹ The initial boundary immediately after the word preceding the first word of the target text equivalent and the final boundary immediately after the final keystroke in the final word of the target text AOI equivalent.

³⁰ If the entire translation of the AOI was deleted at a later stage in the translation process and replaced with a new translation, these two translations would be listed separately and the first would be marked as Final No and the second and final translation unit would be marked as Final Yes. There was no significant difference between metaphor AOIs and non-metaphor AOIs in the number of translation proposals (number of Final No's compared with Final Yes) (p -value > 0.05). Comparison AOIs had 18 Final No and 319 Final Yes translation proposals and the numbers were 26 and 314 for the metaphor AOIs.

position in the TT and not the position of the ST AOI. The levels were Yes and No, meaning that that the translation unit would either be listed as having a sentence-final position (Sentence End Yes) or not (Sentence End No).

Sentence Initial: Similarly to the variable Sentence End, it was assumed that the position of the translation unit could have an effect on the pause frequency and duration as well as typing speed. It was deemed likely that the participants would engage in more planning and deliberation activities when initiating production of a sentence resulting in longer pauses (as found by Schilperoord 1996 for monolingual text production), which could have an effect on the production time for translation units at this position. Dragsted (2004) found that professional translators were more likely to pause at word level than sentence level but as these potential pauses at word level are included in the dependent variable *Production Time*, it was deemed relevant to also take into account any potential effect from sentence-initial position. This was done in the same manner as for the variable Sentence End, i.e., by stating for each TT AOI equivalent whether or not it was located at a sentence-initial position (levels Yes and No). Immonen's findings of longer pause duration at paragraph level with decreasing durations for lower levels (Immonen 2006: 329) also indicated the necessity of controlling for sentence-initial positions when investigating *Production Time* as a measure including pauses.

See section 4.6.1 for a definition of the remaining variables Unigram Frequency, Trigram Probability, Domain, and Type.

4.6.4 Analysis 4.1 – Production of Metaphor in Translation

Analysis 4.1 is comparable to Analysis 1.1 in that the analysis used only a subset of the dataset, namely only the data for the metaphor AOIs equivalents in the TT. The purpose of this more finely granulated analysis was to investigate whether the participants' choice of translation strategy had an effect on the cognitive effort invested in the metaphor translation as measured by *Production Time*. In other words, in contrast to Analysis 4, Analysis 4.1 is a comparison of metaphor versus metaphor in terms of translation strategy and also metaphor familiarity.

The procedure used for fitting Analysis 4 was repeated for Analysis 4.1. The majority of the variables included in Analysis 4.1 are identical to the variables in the main Analysis 4, and they will not be described in detail again. Only the variables unique for Analysis 4.1 will be described in depth in the following.

Table 7: Identical variables in analyses 4 and 4.1

<i>Dependent variable</i>
<i>Production Time</i>
<i>Independent variables: Random effects</i>
AOI ID
Participant
<i>Independent variables: Fixed effects</i>
Character Count
Postedit
Sentence Initial
Sentence Final
Unigram Frequency
Trigram Probability
Domain

Apart from the above variables, which were described in detail in analyses 1 and 4, four other variables were added for inter-metaphor investigation. These variables were Mean Familiarity, Translation Strategy M-M, Translation Strategy M-P, and Translation Strategy M1-M2 (see section 4.6.2 for a definition of these independent variables).

Chapter 5 Eye-tracking Results: a Quantitative Analysis

Three different eye-tracking measures or predictors are reported here to provide a comprehensive analysis, which seeks to provide an account of the cognitive effort invested in the metaphor translation process. The measures reported in this chapter are *Total Fixation Time*, *Total Fixation Number*, and *First Pass Fixation Time* (see also section 4.6.1). Since ecological validity was prioritised highly, and since authentic texts were used, this study included both single and multiple-word AOIs. Because of this heterogeneity, a number of popular measures were not suited for the purposes of this analysis and other measures found to be equally informative, if less often used, were chosen. All three eye-tracking measures were analysed statistically within the same statistical framework, which means that the statistical model for each analysis was set up in the same order and the same independent variables were introduced.

With 17 participants and a total of 74 AOIs for all four texts, the data contained 1153 observations (zero gaze values were not included), but the final analysis was done for a total of 1138 observations in the main statistical model. The discrepancy relates to the fact that 15 observations were removed because they were considered outliers, which could potentially obscure the results (Baayen 2008: 237). For the results reported in the following, the statistical model had Translation as the basis of comparison (reference level) as this was the primary focus of the experiment.

The results will be discussed in order of relevance to the research questions, meaning that the variable Type relating to any differences between metaphor and comparison AOIs will be discussed first. Following this will be a discussion of any significant effect of any of the control-oriented variables followed by a brief summary of the non-significant control-oriented variables. Some of the results may appear trivial and not central to the research questions of the thesis, but as previously discussed, the control-oriented variables enabled a clearer investigation of the research questions without “noise” from uncontrolled factors.

Before any variables were fitted to the model, the distribution of gaze time values were investigated graphically to determine if it was necessary to remove any outliers and perhaps also make a logarithmic transformation of the dependent variable to achieve a more even and

meaningful distribution (Baayen 2008: 31). It was found that the logarithmically transformed data resulted in a more normally distributed data set, and the results reported here were therefore investigated with a logarithmic value for the dependent variable.

5.1 Analysis 1: Comprehension of Metaphor versus Non-Metaphor in Reading and Translation – Total Fixation Time

The eye-tracking data were used for investigation of the measure *Total Fixation Time*, and were analysed in two separate but related statistical models in which the second model (Analysis 1.1) used a subset of the data from the main model. The results will be reported here separately for each of the two analyses.³¹

Figure 12 illustrates the absolute values for *Total Fixation Time* in a simple comparison between the metaphor and non-metaphor AOIs. As can be seen from the illustration, the *Total Fixation Time* is markedly longer (700 seconds) for all metaphor AOIs combined compared with the comparison AOIs (500 seconds).

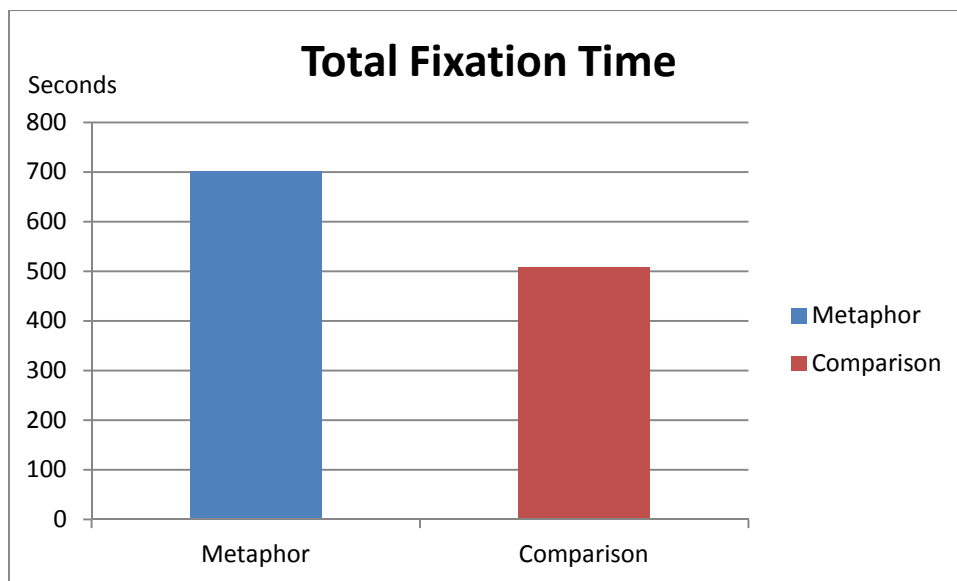


Figure 12: Total Fixation Time in absolute values for all metaphor AOIs compared with all comparison AOIs when read for translation.

The problem with this form of descriptive statistics is that it doesn't show us whether this difference between the two types of AOIs could be caused by any other factors, such as AOI length, word frequency, etc. The values have also not been logarithmically transformed, nor

³¹ The absolute values grouped by participant, task, and text can be seen in Appendix 7.

have any outliers been removed as has been done in Analysis 1 to ensure that no undue weight is given to any individual values.

Figure 12 only tells us that there is a difference, but we cannot be sure what this difference is really caused by. To be sure that the difference is caused by one type of AOIs being metaphors, we would either have to carry out highly controlled experiments in which all other aspects were equal between the metaphor and comparison AOIs, which would be difficult in a linguistic experiment such as this as well as cause a loss of ecological validity. Another possibility is to use inferential statistics such as the linear mixed-effects regression model reported here. This type of statistical analysis is able to take various systematic characteristics of the items into account as well as adjust for differences between individual participants and items (Balling 2008b: 183).

Table 8: Summary of the linear regression model for *Total Fixation Time*

	Estimate	MCMC mean	HPD95 lower	HPD95 upper	p-value
Intercept	6.3504	6.3501	6.0041	6.7285	0.0001
AOI Length	0.0899	0.0898	0.0750	0.1047	0.0001
AOI Position	-0.0092	-0.0091	-0.0185	0.0007	0.0618
I(AOI Pos²)³²	0.0001	0.0001	0.0000	0.0002	0.0422
Trigram Probability	-0.0558	-0.0550	-0.1103	-0.0016	0.0470
Domain (Same)	-0.1899	-0.1888	-0.3461	-0.0540	0.0102
Task (Reading)	-0.3190	-0.3148	-0.5023	-0.1244	0.0010
Type (Metaphor)	0.1185	0.1190	-0.0543	0.2847	0.1752
Interaction (Task:Type)	-0.2356	-0.2371	-0.4051	-0.0582	0.0084

The benefit of inferential statistics becomes clear when seeing the results reported in Table 8 compared with Figure 12. The left-hand column represents the variables included in the final model. The second column, *Estimate*, gives us the estimated effect size of the variables. The remaining columns are based on 10,000 Markov chain Monte Carlo (MCMC) simulations

³² This second row on AOI Position is included in the model because AOI Position is non-linear, and this second row is quadratic. The two variables must be plotted and interpreted together. The non-linear AOI Position alone would be potentially misleading.

(Baayen 2008: 248) run on the basis of the dataset and the model. As Balling (2013) states, the benefit of the MCMC-based values is that they offer precision for analysis of small datasets. The third column, *MCMC mean*, shows the mean values of the estimated effect size in the MCMC simulations. The columns *HPD95 lower* and *HPD95 upper* give us the interval within which 95% of the population are likely to lie (see also Baayen et al. 2008), i.e. showing how much the effect sizes vary around the estimate, which represents a mean effect size, and this indicating how systematic each effect is. The final column in grey is the one of most interest as it shows the p-values for the linear regression model. An effect is normally considered to be statistically significant when the p-value is below 0.05 (Baayen 2008: 68), and that is also the cut-off point chosen in this study.

The row Intercept states the value of the dependent variable (here *Total Fixation Time*) when numerical variables have a hypothetical value of 0 (Balling 2008b: 181) and for reference levels of factors. The reference level is the default level against which other factor levels are measured, i.e. the basis of comparison (see Baayen 2008: 102). As mentioned in section 4.6., a factor is a non-numerical variable, such as Type (Metaphor and Comparison), which has two categories, called levels (Baayen 2008: 9). The reference level is the intercept for factors. The text in parentheses shows the level analysed against the model's reference level.³³ For example, the row Domain (SAME) means that the variable Domain (as well as the other variables in the analysis) is analysed with the level Same against the reference level Different (not shown). The row Task (Reading) means that Reading for comprehension is compared to the reference level Reading for translation, etc. The values for the other variables in the column Estimate are relative to the value in Intercept.

Metaphor effect and its interaction with task

It is interesting to note that the interaction between the variables Type and Task has a significant effect as seen in the last row of Table 8. In other words, the effect of reading for comprehension versus reading for translation differs for metaphor compared with non-metaphor. Conversely,

³³ The reference level is the same for analyses 1-3.

the effect of metaphor versus non-metaphor differs for reading for comprehension compared with reading for translation.

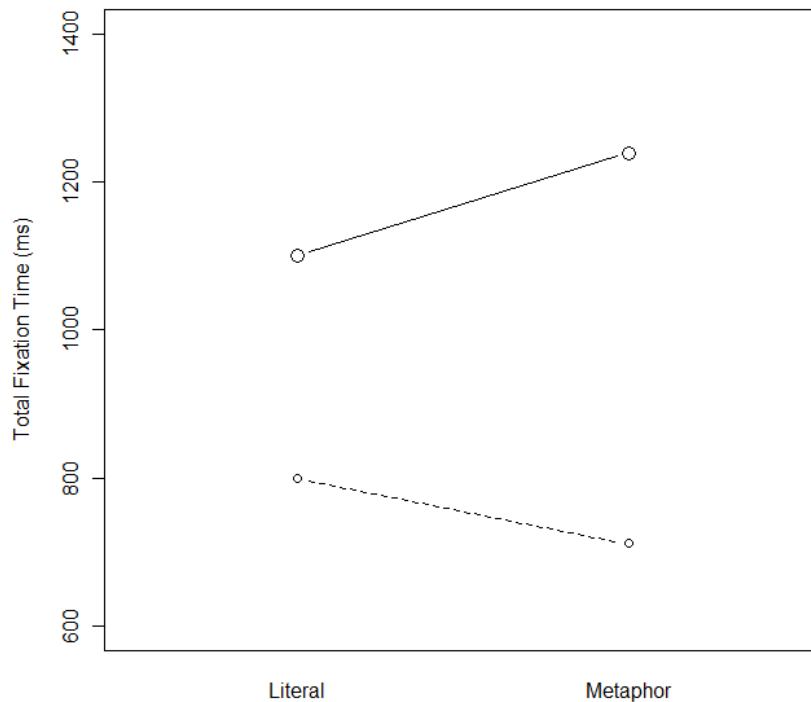


Figure 13: *Total Fixation Time* distribution for metaphor and literal AOIs, with the y-axis denoting milliseconds. The solid line illustrates the difference between literal and metaphor AOIs when reading for translation, with the dashed line illustrating the difference between literal and metaphor AOIs when reading for comprehension (and retyping).³⁴

This can also be seen in Figure 13 in which the dashed line illustrates *Total Fixation Time* for reading for comprehension. As the dashed line in Figure 13 shows, literal AOIs have longer total fixation times compared with metaphors when read for comprehension, although this difference was found to be non-significant. Conversely, when read for translation (represented by the solid line), metaphors have longer total fixation times, although this difference was also non-significant as shown by the p-value in the row Type. But, the important thing to take note of is

³⁴ The logarithmically transformed values are back-transformed from the logarithmic scale for ease of interpretation.

that this difference in tendency is in fact significant as shown by the significant effect of the variable interaction in the last row of Table 8. So, there is a significant difference in the metaphor effect between reading and translation, which is also apparent from Figure 13, but the effect of metaphor for reading for comprehension and reading for translation respectively does not reach significance.

Consequently, it is important to keep in mind that the variable Type, i.e. metaphor vs. non-metaphor, did not have a significant effect in itself. But it did enter into significant interaction with the variable Task. In other words, the effect of metaphor (i.e. the factor Type) was different depending on whether the task was reading for comprehension or reading for translation. It is this difference in effect that is significant, i.e. the interaction between the variables, rather than the effect of Type itself.

It would be interesting to follow up on this finding and determine whether this could be taken as support for the view that metaphors may in fact facilitate comprehension, which may also have been indicated by the findings of Noveck et al. (2001), who found a slightly higher number of correct responses after metaphoric references compared with literal references (Noveck et al. 2001: 118, see also section 3.1.4.).

Contrary to what Figure 12 indicates, there was nothing approaching a significant effect of the variable Type alone as shown in Table 8. In other words, the metaphor AOIs did not result in significantly longer gaze times compared with non-metaphor AOIs when read for translation, and the reason for the difference seen in Figure 12 must be explained by the significant effects of the other independent variables stated in the table.

This means that the data indicate that the answer to research question One based on the variable Type in Analysis 1 is that metaphors do not require a greater cognitive effort to read for translation than literal expressions, which is in direct opposition to the view of Dagut (1987) and Newmark, who regarded metaphors as a translation problem (Newmark 1988: 104). However, the significant interaction between the variables Type and Task suggests a tendency that metaphors are in fact more cognitively effortful to read for translation than literal expressions, but less cognitively effortful to read for comprehension only, which was illustrated in Figure 13. But because this tendency is not supported by any significant effect of Type alone, it would

require further investigation in a follow-up study. As can be seen from Figure 13, there seems to be a difference in *Total Fixation Time* between metaphor and non-metaphor, when read for translation, as illustrated by the solid line, but the statistical analysis reveals that this difference is not significant.³⁵

The data lend support to the view that metaphors are not more effortful to comprehend or process than literal expressions as argued by Glucksberg (2001) and Inhoff et al. (1984), as a secondary model with reading for comprehension as the reference level confirmed the findings of the main model. This secondary model investigated the potential differences between the metaphor AOIs and comparison AOIs with reading as the reference level, i.e., the effects of the other variables were analysed against the factor level of Reading (reading for comprehension and retyping task). There was still no significant effect from the Type variable, indicating that the comprehension of L2 metaphors and the comprehension of L2 literal expressions require the same amount of cognitive effort, regardless of whether the task was for reading for comprehension or reading for translation.

Significant control variables

As expected, the variable Task showed a significant effect ($p < 0.05$) with the level reading for comprehension against reading for translation. In other words, the participants' gaze times were significantly shorter when reading for comprehension (and retyping) compared with reading for translation as illustrated by the dashed line in Figure 13, which represents reading for comprehension. As can be seen in the figure, the dashed line is well below the solid line, which represents *Total Fixation Time* for reading for translation. This finding is in line with findings of Jakobsen and Jensen (2008), who found that participants had longer reading times in a translation task compared with a reading task (Jakobsen and Jensen 2008: 103 abstract).

³⁵ In Figure 13 as well as in the other figures in this chapter, the effects of all other variables are held constant.

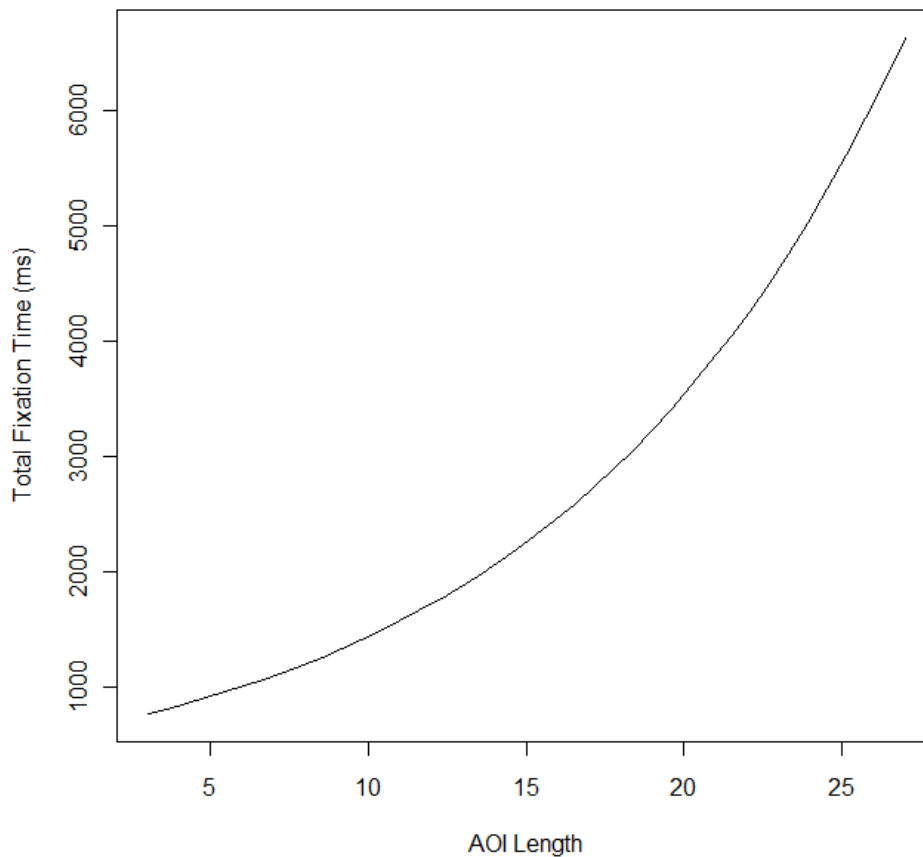


Figure 14: *Total Fixation Time* relative to AOI length, with character count on the x-axis and *Total Fixation Time* in milliseconds on the y-axis. Note that the scale on the y-axis differs from the other figures in this chapter because of the stronger effect of length on the dependent variable compared with the other independent variables

As illustrated in figure 14, there was also a significant effect of AOI Length on the dependent variable, *Total Fixation Time*. The longer the word or words in the AOI, the longer the gaze time. This means that the participants had longer fixations and/or more fixations on the AOIs containing long words or multiple words. This observation is consistent with observations of Rayner and others (see e.g., Rayner 1998: 387) and is non-controversial.

As previously discussed in section 4.6.1, both Unigram Frequency and Trigram Probability were investigated initially, but the two values were found to be strongly correlated, which is not surprising as the unigram value constitutes part of the trigram probability value. There was a significant effect of the Trigram Probability variable with shorter gaze times for AOIs with a high trigram probability, i.e. with a high level of contextual predictability, which is in line with

the findings of Frisson et al., who found shorter fixation times for predictable words compared with less predictable words (Frisson et al. 2005, see section 3.3.1.5).

The variance of the effect between participants was found to be quite high. In other words, for some participants, the effect of a high or low Trigram Probability had a strong effect on their fixation times and for other participants, the effect was much smaller. This variance was taken into account in the model as a random intercept, and the appropriateness of including the random intercept was tested, given the loss of degree of freedom, by a log likelihood ratio test, which tests whether the model with the additional random effect fits significantly better than the reduced model (Baayen et al. 2008: 393, Balling 2008b: 183ff), and it was found that it did. The significant effect of Trigram probability is illustrated in Figure 15.

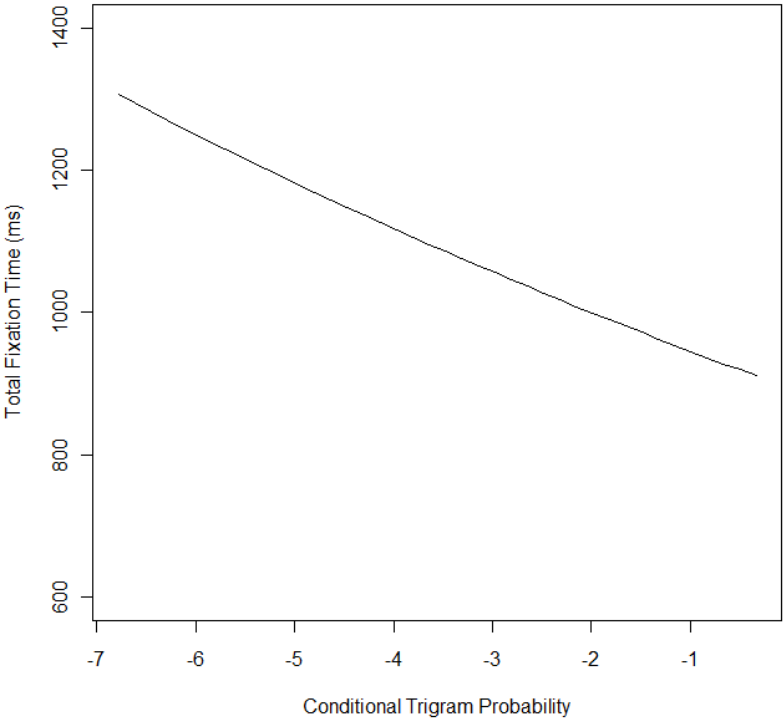


Figure 15: The effect of Trigram probability on *Total Fixation Time*, with the x-axis denoting the conditional trigram probability values. The higher the value, the higher the probability of the word co-occurring with the words on either side of it.

Visualisations of both the frequency (unigram) and probability (trigram) distributions for the metaphor AOIs versus the comparison AOIs illustrated that the metaphor AOIs had a slightly

lower word frequency rate as well as a slightly lower trigram probability, i.e., contextual predictability. Because of the limited number of words to choose from in the texts which could be assigned as comparison AOIs, it was not possible to achieve exact comparability between the two groups of AOIs. The importance of including Trigram Probability as a variable becomes obvious as any results relating to the difference in gaze time between the metaphor AOIs and the comparison AOIs might otherwise have been distorted and interpreted as being more significant than is really the case.

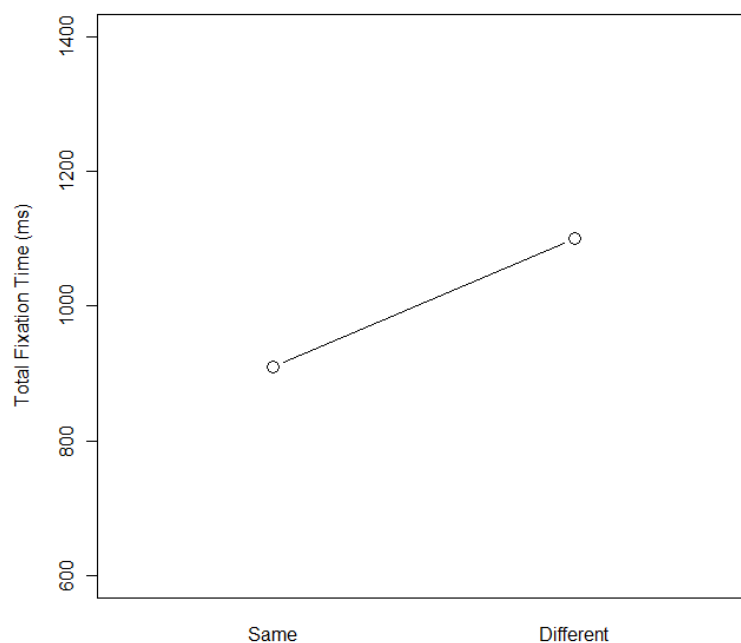


Figure 16: The effect of Domain on *Total Fixation Time*

There is also a significant effect from the variable Domain with the level Same. However, there does not seem to be any three-way interaction between Type, Task and Domain, which means that the effect must relate to other differences in the text than any form of metaphor priming effect because the metaphors in the text were all based in the same semantic domain. A cursory analysis of the differences between the texts revealed that Text 1 had significantly longer fixation times than the other three texts and that Text 4 had the shortest fixation times. As can be seen from Figure 16, there was a difference in milliseconds between texts with same domain metaphors compared with texts with different-domain metaphors, with AOIs from texts 3 and 4

having a *Total Fixation Time* around 750 ms compared with a *Total Fixation Time* of around 1100 ms for AOIs from texts 1 and 2. However, the statistical model showed that the difference was non-significant and caused by other variables than metaphor versus non-metaphor.

Non-significant control variables

Against expectations, there was found to be no significant effect of AOI Position on the dependent variable. In other words, there seems to be no priming or fatigue effect.

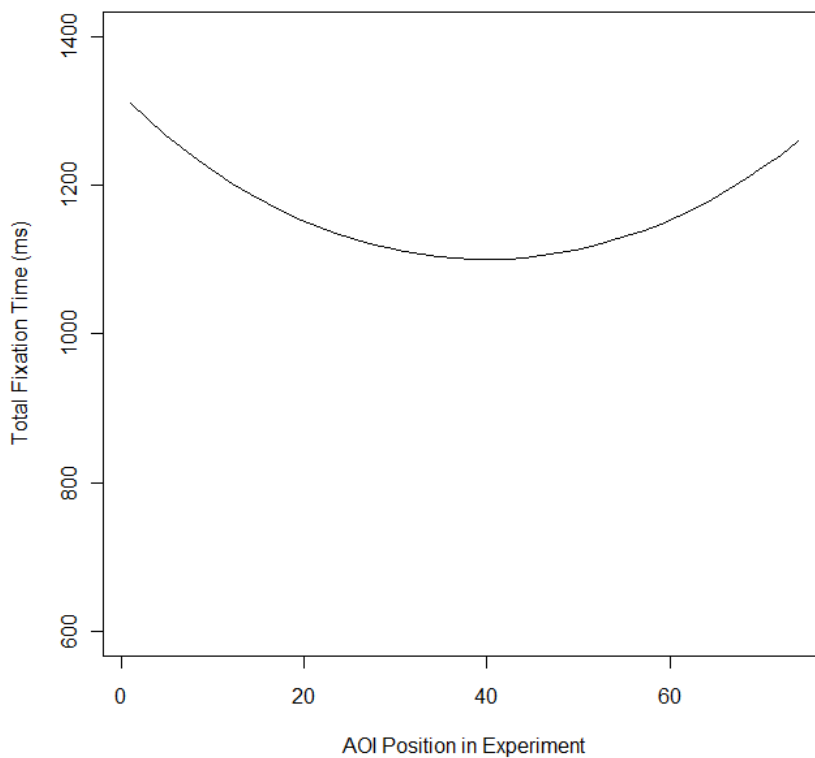


Figure 17: The effect of AOI position on *Total Fixation Time* across all four texts. The x-axis scale represents AOI ID numbers.

As Figure 17 illustrates, the partial effect of AOI position on *Total Fixation Time* is an inverted bell curve, which may perhaps be explained by a need for orientation at the beginning of the experiment as well as some form of review process at the end. Of course, it should be kept in mind that the effect of AOI position is investigated across all four texts and not for each text

individually. Nevertheless, there does seem to be some form of facilitation occurring in the middle of the experiment; however, this effect has been found to be non-significant.

There is no indication that the translation of a metaphor becomes easier further along in the experiment after having translated other metaphors. In other words, the data does not seem to support any automaticity or priming effect. This was investigated in more detail as the interaction between AOI position and metaphor was also analysed separately without the non-metaphorical AOIs, but still no significant effect was found.

5.1.2 Summary

The following table provides an overview of the findings of the above Analysis 1. The variables are listed in the same order in which they appear in the above section with any variables showing a significant effect ($p < 0.05$) marked in a darker shade of grey. As the table shows, the data showed no indication that reading of L2 metaphors for the purpose of translation is more effortful than reading of L2 non-metaphors according to the measure *Total Fixation Time*.

Table 9: Summary of independent variables in statistical Analysis 1.

Variable name	p-value
AOI Length	< 0.05 (0.001)
AOI Position	> 0.05
Trigram Probability	< 0.05
Domain	< 0.05
Task	< 0.05
Type	> 0.05
Interaction (Type and Task)	< 0.05

5.2 Analysis 1.1.: Comprehension of Metaphor in Translation – Total Fixation Time

It was assumed that a more granular analysis of the interaction between metaphor and translation was necessary in order to achieve a more in-depth understanding of the effort required in the metaphor translation process. For this reason, a second statistical model was created, which used a subset of the same data as the model described in section 4.6.1. The model in Analysis 1.1 investigated the dependent variable for the metaphor AOIs only without comparison to the non-metaphor AOIs. As previously stated, it was questioned whether specific aspects of the individual metaphors would result in more cognitive effort required than for other metaphors or whether specific translation strategies would be applied with more effort than others. It was assumed that any differences in cognitive effort invested in metaphor processing would emerge as differences in gaze times across the three translation strategies. These research questions could only be investigated in a model specifically designed to compare metaphors. The following Analysis 1.1 will report only on those variables, which are new or different compared with the variables reported in the main statistical model as used for Analysis 1 (see section 4.6.1).

Table 10: Summary of the linear regression model for Total Fixation Time for metaphor AOIs only

	Estimate	MCMC mean	HPD95 lower	HPD95 upper	p-value
Intercept	52.347	52.011	46.564	57.317	0.0001
Log Length	0.9493	0.9640	0.7265	11.950	0.0001
Translation Strategy M-P	0.1595	0.1945	-0.0298	0.4110	0.0826
Translation Strategy M1-M2	-0.0005	-0.0062	-0.2945	0.2745	0.9646

As can be seen from Table 10, the only variable showing any significant effect was the non-controversial variable of AOI length, for which reason none of the effects have been plotted.

The effect of translation strategy

Research question Three asked whether the task of moving from a metaphorical image to a literal translation would have required relatively more cognitive effort compared with a direct translation strategy (M-M), and the data indicated that this is not the case. The more direct translation strategy M-M was the basis of comparison in the analysis. There was no significant effect from the M-P translation strategy on the dependent variable.

There was also no significant effect of Translation Strategy M1-M2, indicating that preparing for translation of a metaphor with a different metaphorical image is not cognitively more demanding than a more direct translation of the metaphor or translation of a literal expression.

The direct translation strategy is by far the preferred translation strategy with the participants (207 M-M compared with 64 M-P translations and 36 M1-M2)³⁶, a finding which is in line with earlier findings by Wikberg (2004) (see section 3.2.4.1). To elaborate, this means that across all 17 participants, a total of 207 metaphor AOIs were translated with the direct M-M strategy compared with only 64 paraphrased or M-P translations and the even lower number of 36 new

³⁶ Because of the disparity in distribution of the three translation strategies, it was found that the absolute values would not be illustrative for which reason they have not been included in an appendix.

TT metaphorical images or M1-M2 produced. It is not clear if this strong preference for the M-M translation strategy was based on a strategic evaluation of the salience of the ST metaphorical image in the TT language or if it should be seen as support of Andersen's claim that translators lack the necessary metaphor translation competence to engage in a metaphor translation strategy at macro-level (Andersen 2004, see section 3.2.3.1).

To ensure that this disparity in the distribution of the translation strategies did not influence the statistical analysis, a comparison was also made between the direct metaphor translation strategy (M-M) and the indirect metaphor translation strategies combined (M-P and M1-M2). However, there was still no significant effect on the dependent variable.

Significant control variables

As mentioned above, the only control variable showing any significant effect was the non-controversial AIO Length.

Non-significant control variables

Contrary to expectations, the metaphors' mean familiarity rating had no effect on the dependent variable, which is counter to the findings of Gentili et al. (2008), who found significant differences in the processing of familiar versus non-familiar metaphors. It remains unclear whether the lack of significant difference in this experiment was because the metaphors were in the participants' L2, meaning that any differences in cognitive load caused by familiarity or lack thereof may have been masked by the cognitive load required for the comprehension of an L2 expression or the effect of translation. Because the variable had no significant effect, it was not included in the final statistical model reported here for reasons explained in section 4.6.

5.2.1 Summary

As with the above statistical Analysis 1, the more finely granulated Analysis 1.1 is summarised in the table below, which shows the lack of any significant effects to be found for the measure of *Total Fixation Time*. It should be noted that other independent variables not unique to Analysis 1.1. (i.e., identical to variables discussed in Analysis 1) were also investigated but not elaborated on in the above. However, only the logarithmically transformed AOI length was found to have an effect on the dependent variable.

Table 11: Summary of independent variables in statistical Analysis 1.1.

Variable name	p-value
Mean Familiarity	> 0.05
Translation Strategy M-P	> 0.05
Translation Strategy M1-M2	> 0.05

5.3 Analysis 2: Comprehension of Metaphor versus Non-Metaphor in Reading and Translation – Total Fixation Number

The second analysis reported in this section is for the measure *Total Fixation Number*.³⁷

Although the number of fixations within an AOI may not be as reflective of cognitive effort as the measures *Total Fixation Time* and *First Pass Fixation Time*, the measure *Total Fixation Number* should nevertheless be able to reveal any differences in the reading process not necessarily related to differences in cognitive load but perhaps more to differences in reading patterns related to e.g., the task (reading for comprehension or reading for translation). Rayner et al. (2006) found that the number of fixations was a strong predictor of perceived text difficulty. As Rayner et al. also emphasised, there is a natural strong correlation between fixation number and total fixation time (Rayner et al. 2006: 246ff.), but the two measures should nevertheless not be regarded as identical. The statistical model for Analysis 2 was set up using the same criteria as in the previous analysis, which means that the interaction between the individual independent variables and the dependent variable was examined to identify the best statistical model in which only variables with any significance for the results were included. In other words, Analysis 2 should not be seen as an independent analysis, but rather as a supplement to and a replication of Analysis 1.

As in Analysis 1, the absolute values illustrated in Figure 18 show us that there is a difference in *Total Fixation Number* depending on the type of AOI.

³⁷ The absolute values grouped by participant, task, and text can be seen in Appendix 8.

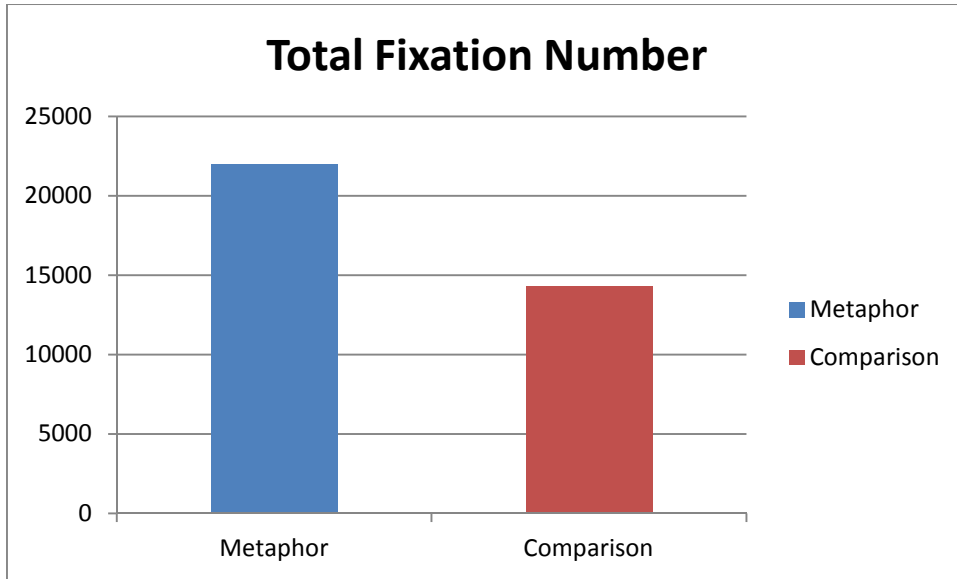


Figure 18: *Total Fixation Number* categorised by AOI type in absolute values.

Metaphor effect and its interaction with task

But as it was also the case in Analysis 1, once these values had been analysed in the linear mixed-effects regression model, it turned out that the difference seen in Figure 18 could not be assigned to the type of AOI, as AOI Type showed no significant effect in Table 12.

Table 12: Summary of the linear regression model for *Total Fixation Number*

	Estimate	MCMC mean	HPD95 lower	HPD95 upper	p-value
Intercept	0.8126	0.8132	0.5006	1.1312	0.0001
AOI Length	0.0870	0.0869	0.0739	0.0994	0.0001
AOI Position	-0.0056	-0.0055	-0.0135	0.0021	0.1688
I(AOI Pos ²)	0.0001	0.0001	0.0000	0.0002	0.0802
Trigram Probability	-0.0436	-0.0421	-0.0854	0.0009	0.0572
Domain (Same)	-0.0998	-0.0998	-0.2212	0.0238	0.1138
Task (Reading)	-0.5805	-0.5760	-0.7347	-0.4271	0.0001
Type (Metaphor)	0.0959	0.0950	-0.0491	0.2389	0.1922
Interaction (Task: Type)	-0.2131	-0.2112	-0.3519	-0.0734	0.0032

In other words, there was no significant difference in the number of fixations between metaphor AOIs and comparison AOIs when read for translation. The measure *Total Fixation Number*

confirmed the findings of Analysis 1, indicating that metaphors are not more cognitively effortful and do not involve more fixations to read for translation than non-metaphors, which was research question One (see chapter 2). However, Analysis 2 finds the same significant interaction between the variables Type and Task as was found in Analysis 1, indicating a certain facilitation effect of metaphor when reading for comprehension, although this effect is non-significant when looking at the effect of Type alone. In other words, the findings of Analysis 2 support the findings of Analysis 1, and therefore the findings of Analysis 2 were not plotted, as Analysis 2 should be regarded as supplementary to Analysis 1.

Control variables

Of the control variables, only Task and AOI Length showed a significant effect. The significant effect of AOI Length indicates that a longer AOI meant a higher number of fixations (as indicated by the positive value of Estimate). This was in line with Analysis 1. Longer words generally receive more fixations and AOIs with multiple words would also be expected to receive more fixations than single-word AOIs. As with the previous analyses, the values for AOI Length were logarithmically transformed.

As shown in Table 12, the Task variable has a significant effect on the dependent variable, meaning that the participants had fewer fixations in the reading for comprehension task compared with the reading for translation task as indicated by the negative value of Estimate because the reference level (i.e. basis of comparison) was Translation. This is in line with the findings of Jakobsen and Jensen (2008) (see section 3.3.1.7), who argued that the shifts between ST and TT cause more fixations because it becomes necessary to re-fixate the word fixated before a shift (Jakobsen and Jensen 2008: 118). Unlike the experiment conducted by Jakobsen and Jensen in which typing was only part of the translation task, this lack of comparability was not an issue in the current study.

Unigram Frequency was found to be closer to having a significant effect than Trigram Probability in Analysis 2 and was therefore included in the final statistical model. This finding is counter to the results of Analysis 1. However, the Unigram variable had no significant effect in the final results, whereas the Trigram variable was significant in Analysis 1. This could again indicate that *Total Fixation Number* is a less sensitive predictor than *Total Fixation Time*.

5.3.1 Summary

The following table provides an overview of Analysis 2. The variables are listed in the same order in which they have been discussed in this section with any variables showing a significant effect ($p < 0.05$) marked in dark grey. As the table shows, Analysis 2 indicates that the answer to research question One is that metaphors are not more cognitively effortful to process according to the measure *Total Fixation Number*.

Table 13: Summary of independent variables in Analysis 2.

Variable name	p-value
AOI Length	< 0.05 (p < 0.01)
AOI Position	> 0.05
Unigram	> 0.05
Domain	> 0.05
Task	< 0.05 (p < 0.01)
Type	> 0.05
Interaction (Task and Type)	< 0.05

5.4 Analysis 3: Comprehension of Metaphor versus Non-metaphor in Reading and Translation – First Pass Fixation Time

The measure reported in Analysis 3 is *First Pass Fixation Time*,³⁸ which in this analysis is taken to mean the value of all fixations within any given AOI up to and including the last fixation before the eyes leave the AOI, either to the left or right.³⁹ In other words, regressions back to the AOI are not included in this measure. Again, the statistical model was set up according to the same structure as defined in analyses 1 and 2 with the same independent variables introduced in the same order.

Table 14: Summary of the linear regression model for First Pass Fixation Time

	Estimate	MCMC mean	HPD95 lower	HPD95 upper	p-value
Intercept	5.5353	5.5334	5.4217	5.6427	0.0001
Domain (SAME)	-0.1509	-0.1498	-0.2304	-0.0729	0.0001
Task (Reading)	0.2480	0.2489	0.1488	0.3524	0.0001
Type (Metaphor)	0.1027	0.1036	0.0099	0.2060	0.0374
Interaction (Task: Type)	-0.1463	-0.1475	-0.2901	-0.0114	0.0408

Metaphor effect and its interaction with task

As can be seen from the right-hand column of Table 14, there is a significant effect of Type. That the estimate in the left-hand column is a positive value means that the *First Pass Fixation Time* is longer for metaphor AOIs compared with the reference level, which is non-metaphor AOIs. In other words, when read for the purpose of translation, metaphors have a significantly longer first pass fixation time than non-metaphors.

³⁸ Starr and Rayner use the term *first pass reading time* for analysis of units larger than a single word (Starr and Rayner 2001: 158). In Analysis 3, First Pass refers to both single and multiple word AOIs for ease of reference. Both single and multiple fixation values are included in the analysis.

³⁹ The absolute values grouped by participant, task, and text can be seen in Appendix 9.

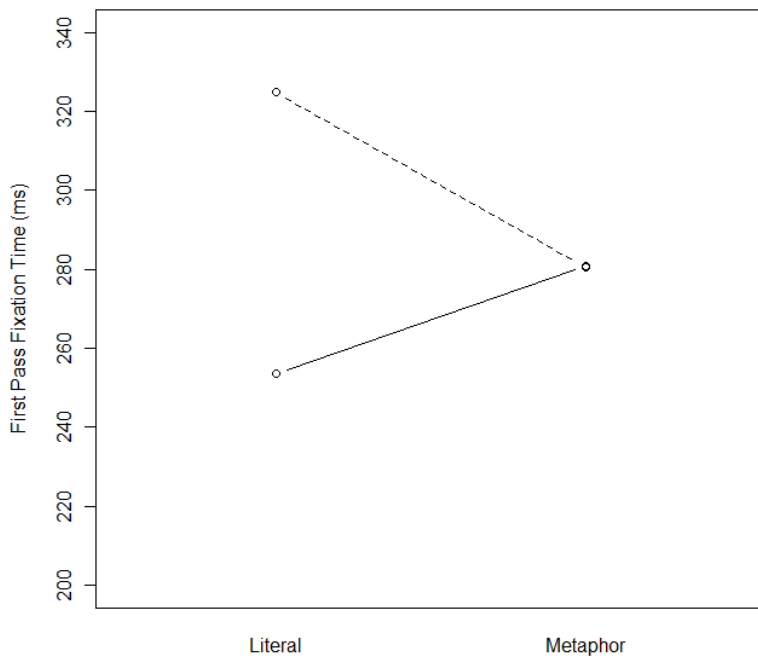


Figure 19: *First Pass Fixation Time*, with first pass fixation times in milliseconds on the y-axis. The solid line represents the first pass fixation times for reading for translation, with the dashed line illustrating first pass fixation times for reading for comprehension (and retyping).

As can be seen from the solid line in Figure 19, literal AOIs have a *First Pass Fixation Time* of around 255 ms compared with approx. 280 ms for metaphor AOIs when read for translation. This difference was found to be a significant effect of AOI Type.

That Type would have an effect on the dependent variable *First Pass Fixation Time* only, and not also on the more comprehensive *Total Fixation Time* in Analysis 1, can perhaps be explained by the lower predictability of the metaphors, which require more orientation than more predictable literal expressions. This would be in line with Frisson et al.'s (2005) findings that more predictable words resulted in shorter fixations (Frisson et al. 2005: 862). *First Pass Fixation Time* is perhaps a more sensitive predictor of this increase in orientation effort compared with *Total Fixation Time*, which may be more reflective of the total sum of cognitive effort. This is also supported by Demberg and Keller's observation that first pass reading times are indicative of early syntactic and semantic processing (Demberg and Keller 2008: 197).

The fact that an early measure such as *First Pass Fixation Time* shows a significant effect of Type could indicate that the effect of metaphor is somehow an effect of predictability beyond the word-in-context predictability which the variable Trigram Probability was assumed to account for. In other words, the unexpectedness of the metaphorical expression caused longer first pass fixation times, which were then compensated for somehow in total fixation times. However, this speculation would require further investigation to be claimed with any level of certainty. Whether or not this potential unexpectedness is a sign of lower saliency in the metaphor AOIs compared with the non-metaphor AOIs is unclear, and it was therefore not possible to find any evidence either for or against Giora's graded salience hypothesis (1997) (see section 3.1.5).

As in Analysis 1 and 2, there is also a significant interaction between the variables Type and Task for *First Pass Fixation Time*, meaning that the interaction of the effects of those two independent variables on the dependent variable was significant. As was also the case in Analysis 1, Figure 19 shows that there is some indication that metaphors result in faster first pass fixation times compared with literal expressions when read for comprehension and, conversely, in longer first pass fixation times when read for translation. Whereas the effect of metaphor alone was not significant in reading for translation alone in Analysis 1, this effect was found to be significant in Analysis 3, which also lends further support to the interpretation of the significant interaction found across all three analyses as indication that metaphors may facilitate comprehension, but not translation.

Significant control variables

As shown in Table 14, there is a significant effect of Task, such that first pass fixation times are significantly shorter for reading for translation than for reading for comprehension. This is also illustrated in Figure 19, with the solid line illustrating reading for translation being below the dashed line illustrating reading for comprehension, which is in contrast to the findings of Analysis 1. This is quite interesting as the expectation was longer first pass fixation times for the reading for translation task as reading for translation is considered more cognitively effortful than reading for comprehension.

However, a possible interpretation of the significant effect of Task could be that, when reading for translation, the participant performs more switches between ST and TT for orientation and revision purposes, resulting in shorter first pass fixation times. This would also explain why *Total Fixation Time* in Analysis 1 did not yield the same result because, overall, reading for translation results in longer fixation times, but with more switches between ST and TT. This explanation is supported by the results of a supplementary analysis of fixation duration (not reported) in which reading for translation had significantly shorter fixation durations compared with reading for comprehension.

As previously stated, the experimental setting was designed such that the reading task also included retyping of the ST in order to ensure a higher level of comparability with the translation task. In other words, the difference cannot be ascribed to the typing activity and its interference in the eye movements' focus on the monitor. However, it seems likely that the translator's need to switch attention between the processes of comprehension in the ST and reformulation in the TT is the cause behind the shorter first pass fixations and fixation durations. This is indirectly supported by Hvelplund (2011), who argued that it is very likely that attention will switch very quickly between ST comprehension and TT reformulation during reading for translation (Hvelplund 2011: 64). This view is an adaptation of the parallel view of translation, which states that ST comprehension and TT reformulation take place in parallel (see e.g., Mossop 2003, section 3.2.1), i.e., simultaneously. Hvelplund argued that constraints on the central executive in the reader's working memory (WM) makes it impossible for the WM to run two conscious processes in absolute parallel but that the allocation of cognitive resources will in fact alternate very rapidly between the two translation processes (Hvelplund 2011: 64). These rapid changes between ST comprehension and TT reformulation are perhaps evidenced by the significantly shorter first pass fixations in the reading for translation task compared with the reading for comprehension task as all other potential influences are equal in the two tasks.

However, this assumption would certainly require further investigation. It does receive some support from the findings in Analysis 2, in which the translation task involved a far higher number of fixations than the reading task. The effect of the translation task was therefore interpreted to a monitoring of own output, which did not take place during the reading (and retyping) task. The monitoring of own output resulted in more shifts between the ST and TT, leading to shorter first pass fixations in the translation task.

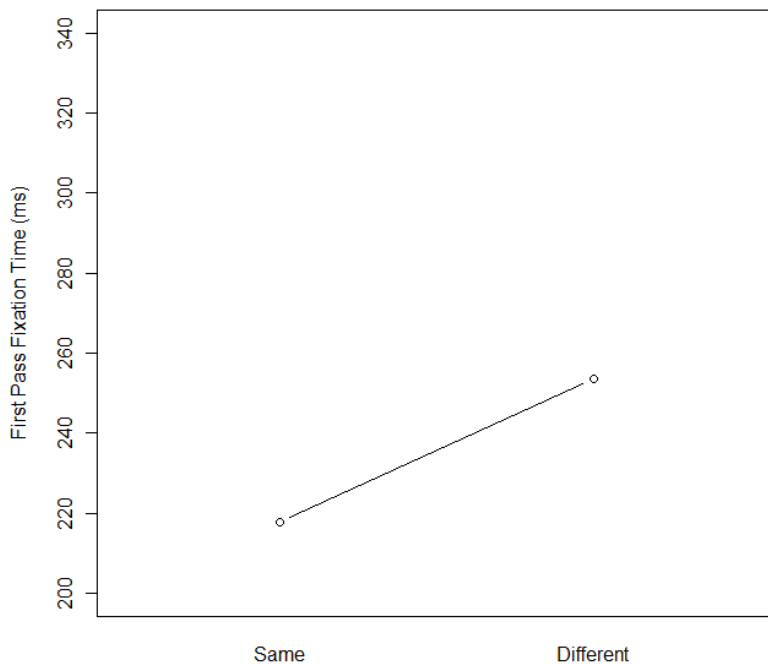


Figure 20: The partial effect of Domain on *First Pass Fixation Time*

As in Analysis 1, Domain was found to have a significant effect on the dependent variable, and as can be seen from Figure 20, experimental texts with metaphors from the same semantic domain (texts 3 and 4) resulted in first pass fixation times of approx 220 ms compared with first pass fixation times of around 255 ms for texts with metaphors from mixed semantic domains (texts 1 and 2). However, because Type did not have a significant effect in Analysis 1, it is not quite clear if the explanation of the significantly shorter first pass fixation times is to be found in some more general form of textual coherence in texts 3 and 4 rather than in the coherence within the metaphors only or if *First Pass Fixation Time* is simply a more sensitive predictor than *Total Fixation Time*.

Non-significant control variables

There was no significant effect of AOI length on the dependent variable. There seems to be some indication that word length has more effect on *Total Fixation Time* than on the individual fixations, which means that the number of fixations within an AOI must be affected by AOI

length. Otherwise, it is difficult to explain the discrepancies between analyses 1 and 2 compared with analyses 3 as there was a highly significant effect of AOI length in analyses 1 and 2.

There was no effect of AOI position on *First Pass Fixation Time*, in line with the results of Analysis 1. This was taken to mean that there was no form of either a fatigue effect nor a facilitation or priming effect taking place.

The findings of Analysis 3 are in concurrence with the findings of Analysis 2 but not with Analysis 1. There was no significant effect of either the unigram or trigram probabilities ($p > 0.05$) on *First Pass Fixation Time*, indicating that lexical frequency and word collocation probability are not optimal predictors for the first pass measure. This lack of significant effect in Analysis 3 is in line with the findings of McDonald and Shillcock that word frequency only affects total gaze durations and not first fixations or single fixation duration (McDonald and Shillcock 2003, see section 3.3.1.5).

5.4.1 Summary

The following table provides an overview of Analysis 3. The variables are listed in the same order in which they have been stated in this section with any variables showing a significant effect ($p < 0.05$) marked in dark grey. As the table shows, Analysis 3 with the measure *First Pass Fixation Time* offers a different answer to research question One than analyses 1 and 2, namely that there is a significant difference in the cognitive effort invested in processing of L2 metaphors compared with L2 non-metaphors whether reading for comprehension or for translation.

Table 15: Summary of independent variables in Analysis 3.

Variable name	p-value
AOI Length	> 0.05
AOI Position	> 0.05
Unigram and Trigram Probability	> 0.05
Domain	< 0.05
Task	< 0.05
Type	< 0.05
Interaction (Task and Type)	< 0.05

5.5 Discussion of Eye-tracking Results

Before discussing the results reported for the three eye-tracking measures, Table 16 provides a simple overview of the independent variables and the analyses in which the variables had a significant effect.

Table 16: Summary of analyses 1-3: eye-tracking measures

Variable name	<i>Total Fixation Time (1)</i>	<i>Total Fixation Number (2)</i>	<i>First Pass Fixation Time(3)</i>
AOI Length	X	X	
AOI Position			
Unigram Frequency and Trigram Probability	X		
Domain	X		X
Task	X	X	X
Type			X
Interaction between Task and Type	X	X	X

There are several interesting findings from the analyses of the eye-tracking data. Seen as a whole, the eye-tracking analyses do not offer an unambiguous reply to the question of whether or not metaphors are more cognitively effortful to translate than non-metaphors. However, the individual eye-tracking measures, in particular *Total Fixation Time* and *First Pass Fixation Time*, offer some important contributions to the fields of metaphor translation research and translation process research, and the divergent findings of these two measures are seen as indication that the measures are reflective of different stages of processing.

The most interesting finding of the eye-tracking analyses is the significant effect of Type (i.e. metaphor versus literal expression), when reading for translation, in Analysis 3 where the dependent variable was *First Pass Fixation Time*. Following Demberg and Keller's (2008) claim that the measure *First Pass Fixation Time* is a measure of early semantic (and syntactic processing), it makes sense that this measure would seem to be the most sensitive predictor of cognitive effort in metaphor comprehension when reading for translation compared with more comprehensive eye-tracking measures. Based on the findings of Analysis 3, the answer to Research Question One is that metaphors are in fact more cognitively demanding to process than literal expressions when read for the purpose of translation. This finding lends support to earlier non-empirical studies of metaphor translation in which the translation of metaphor has historically been viewed as a particular translation problem. Of course, the answer to Research Question One is not unambiguous as the answers from analyses 1 and 2 go in the opposite direction. There was no significant effect of Type alone on either *Total Fixation Time* or *Total Fixation Number*. However, all three eye-tracking analyses showed a significant interaction between the variables Type and Task, meaning that the effect of metaphor was significantly different depending on the reading task (i.e. reading for comprehension or reading for translation).

As previously stated, several researchers have argued that metaphor comprehension is not more cognitively effortful than comprehension of literal expressions and that a metaphorical interpretation is accessed directly and not only after a literal interpretation has been tested (Glucksberg 2001). The findings of analyses 1 and 2 would seem to indicate that this is in fact the case even when the comprehension is of an L2 metaphor and the reading is for translation purposes rather than only for comprehension. Perhaps the disparity of findings in the eye-tracking analyses should not be seen as indication that the eye-mind assumption does not hold, but rather as evidence that metaphors are not processed in the same way as literal expressions, even though they are not more cognitively effortful to process. Furthermore, the disparity could be seen as confirmation of the eye-mind assumption as the individual measures are regarded as being reflective of different stages of processing.

Katz and Ferretti's constraint satisfaction model (Katz and Ferretti 2001, see section 3.3.1.5) posits that interpretation of a given lexical unit will depend on constraints such as e.g. syntactical and lexical information as well as disambiguating contextual information. The

constraint satisfaction model perhaps offers the best explanation for the significantly longer first pass fixation times for metaphors as found in Analysis 3 contrasting with the lack of any significant difference between metaphors and literal expressions as investigated by the variable Type in Analysis 1, *Total Fixation Time*. It may be that the metaphor AOI initially requires more disambiguating information for comprehension compared with the non-metaphorical AOIs, but once this disambiguation has been achieved during first pass fixations, there is no overall significant difference in cognitive effort as evidenced by the lack of significant effect in *Total Fixation Time*.

It must be remembered that analyses 1-3 were assumed to primarily investigate the comprehension stage of the translation process. The eye-tracking data only contained information on gazes on the ST, which consequently can only be used to speculate on the comprehension stage. Hvelplund (2011) argued that working memory is only able to actively engage in one process at a time, meaning that, rather than parallel processes of comprehension and production, working memory will perform rapid switches between the two processes (Hvelplund 2011: 64). Following this line of thought, translation should not be regarded as either a sequential or a parallel process but rather a hybrid. However, although it is possible that some form of reformulation is taking place to some extent in the mind of the translator while reading and comprehending the ST, it seems highly likely that the majority of the cognitive effort is involved in the comprehension aspect when attention is on the ST. This is in continuation of Just and Carpenter's (1980) *eye-mind assumption* that the mind is processing what the eyes are fixating, and Hvelplund (2011) worked from the same premise in his research on allocation of cognitive resources in translation.

Not surprisingly, there was a significant effect of AOI length on *Total Fixation Time* and *Total Fixation Number* (see e.g., Rayner 1998: 375ff.). Following this observation, it may also be assumed that there was some effect of multiple-word AOIs although this effect was not controlled for. This independent variable was not controversial and will not be discussed any further, other than that it seems plausible that the lack of effect on the dependent variable *First Pass Fixation Time* is an indication that AOI length is not a relevant predictor of processing difficulty but rather has a more mechanical effect as the eyes and mind need to assimilate and process the information from the word (or words) in their entirety, which may well require

additional fixations and/or longer processing times for longer words (see e.g., Just and Carpenter 1980: 338).

The significant effect in Analysis 1 of word co-occurrence probability as investigated by the independent variable Trigram Probability is non-controversial in relation to *Total Fixation Time* as the effect of lexical frequency on reading time has been firmly established in earlier studies with less frequent words resulting in longer gaze times (see e.g., Rayner 1998: 376). Trigram Probability was found to be significant, which was not the case with Unigram, which is a value of lexical frequency whereas Trigram is a measure of probability of a word occurring in a specific collocation. The significant effect of Trigram Probability could be seen as indirect support of word predictability as an indicator of processing effort following Frisson et al. (2005, see section 3.3.1.5). Especially with regard to a metaphor study, word collocations must be a more meaningful measure, because metaphors can be said to be more unexpected, and since the unigram values are constituents in the trigram values, it was not regarded as any loss to the statistical model that only trigram values were investigated in analysis 1. The lack of significant effect from *Trigram Probability* in Analysis 3 is in line with the findings of McDonald and Shillcock who only found an effect of word frequency in total gaze durations and not on first fixations or single fixations. They interpreted these results to mean that word frequency only influences later stages of processing (McDonald and Shillcock 2003: 648, see also section 3.3.1.5).

Against expectations, there was no effect of AOI position on any of the dependent variables. As the texts were quite short (approx. 150 words), there was little expectation of a fatigue effect, which would have been evidenced by an increase in total fixation time, etc., for AOIs positioned later in the text compared with earlier AOIs. However, in continuation of Jääskeläinen and Tirkkonen-Condit's (1991) observations on some form of automaticity effect occurring for professional translators, it was assumed that later AOIs would have shorter fixation times, fewer fixations etc. because of a facilitation effect, meaning that the translation of later AOIs would be less cognitively effortful than the translation of earlier AOIs because the earlier translations would facilitate the translation of later AOIs. This was not confirmed by the data.

There was a significant effect of Domain on the dependent variables *Total Fixation Time* and *First Pass Fixation Time* with a negative correlation between reading times and fixation

durations and the level Domain Same, i.e., for texts 3 and 4 with metaphors based in the same semantic domain in each text. However, there was no significant interaction between the variables Type, Task, and Domain, meaning that any facilitation effect taking place in texts 3 and 4 was not a result of the metaphors in the texts.

It was expected that translation of metaphors in the texts 3 and 4 would require less cognitive effort because of some form of metaphor priming effect in which it would be easier to comprehend and translate subsequent metaphors in the individual texts because they were all connected within the same domain requiring no semantic shifts. However, the lack of significant effect from Domain could suggest that Kimmel (2010) is right when stating that mixed metaphors are no less comprehensible than non-mixed metaphors (Kimmel 2010: 97). Following Kimmel's arguments, the lack of significant interaction between the variables Type, Task, and Domain becomes more understandable. There would seem to be some support for his observation in the results reported here, as there is no suggestion that the metaphor AOIs from the texts with mixed domain metaphors (texts 1 and 2) required increased cognitive effort for the comprehension aspect of the translation process.

It is not clear what textual factors drive the increase in fixation time for texts 1 and 2 compared with the other two texts, but the explanation seems to lie outside any differences in the metaphors found in the individual text. A possible explanation could be familiarity with the topic of the text, which the participants were not asked about, however, in the subsequent interview. Of course, there is also the possible explanation that the topics and terminology of texts 1 and 2 could be said to be slightly more technical than texts 3 and 4 and that the reason for the differences between the texts should be found there although the Flesch reading ease index scores (see section 4.4) indicated that the texts were at comparable technical difficulty levels.

It is interesting to note, however, that texts 1 and 2 contained approximately half the number of metaphor AOIs compared with texts 3 and 4.⁴⁰ It could be speculated that the higher number of metaphors in texts 3 and 4 is part of the reason for the lesser cognitive effort, which would seem to be required for the comprehension of these two texts as a whole compared with texts 1 and 2.

⁴⁰ Text 1: 7 metaphor AOIs, Text 2: 6 metaphor AOIs, Text 3: 11 metaphor AOIs, Text 4: 13 metaphor AOIs

Perhaps metaphors facilitate overall textual coherence and consequently the comprehension process, which would be in continuation of the line of thought of Black (1981) and Koller (2004), who both argued that metaphors serve a purpose other than a decorative one. Perhaps the findings of this thesis confirm the tentative findings of Noveck et al. that metaphors have “the potential to yield benefits” (Noveck et al. 2001: 118, see section 3.1.4), which they found in the form of a slightly higher number of correct responses to questions after a metaphoric reference compared with after a literal reference.

This tentative claim is supported by the significant effect of Task on *First Pass Fixation Time* to the effect that, when reading for comprehension only, first pass fixation times were significantly longer for comparison AOIs compared with metaphor AOIs, which would seem to indicate a facilitation effect of the metaphors. This thought receives further support from the significant interaction found between the variables Task and Type in all three eye-tracking analyses. This significant interaction means that the effect of metaphor was different depending on whether the task was reading for comprehension or reading for translation. Furthermore, the effect of Task was different depending on whether Type was Metaphor or Comparison. The values were lower, i.e. faster, for the reading for comprehension task compared with the values for reading for translation, but even more so when Type was metaphor. In other words, there is some indication that metaphors facilitate comprehension, but not translation.

This finding also shows the scope of empirical translation process research, which may also contribute to a broader aspect of metaphor research. As previously mentioned, there is a broad portfolio of psycholinguistic research on monolingual metaphor comprehension, but the range of empirical research in metaphor translation, and in particular in metaphor translation process research, has been relatively limited so far. It is hoped that the findings of this thesis may help bridge the gap.

The eye-tracking data did reveal some surprising findings regarding the differences in reading patterns depending on the task. As expected, Analysis 1 revealed longer total fixation times for reading for translation compared with reading for comprehension (and retyping). This correlated well with the findings of Analysis 2, confirming a far higher number of fixations in the translation task. What is more interesting is that the difference in *Total Fixation Time* appears to come only from the difference in number of fixations and not also from longer fixation durations

or first pass durations as these were in fact significantly shorter for the translation task. However, this finding fits well with the observations by Hvelplund (2011) that the translation process should perhaps not be viewed as either strictly sequential or parallel but rather as a hybrid form, consisting of rapid shifts, which are too short for processing to be concluded as the sequential processing model would suggest while the high number of fixations seems to run counter to a strictly parallel processing model. These rapid changes were assumed to be a result of the need for monitoring own output in the TT. These assumptions require further investigation but are offered here as a possible explanation for seemingly contradictory data.

Analysis 1.1 represented a more finely granulated investigation of the metaphor comprehension process in a translation task. Here, the focus of the analysis was not a comparison between metaphors and literal expressions but between metaphor and metaphor. This allowed for additional independent variables to be introduced into the statistical model, which applied solely to the metaphor AOIs. These independent variables were metaphor familiarity and translation strategy. However, contrary to expectations, none of the new independent variables showed any significant effect on the dependent variable, which was the same as in Analysis 1, *Total Fixation Time*.

It was assumed that familiarity would be a better indicator of processing difficulty than conventionality. Although conventionality is often discussed in relation to metaphor research, very often the concept is not defined formally or operationalised. Familiarity was also expected to have the further advantage as being a more subjective indicator and therefore perhaps more likely to show an effect because the measure was more specifically designed for this particular group of participants with their particular professional background. However, there was no significant effect from the variable Familiarity, which is counter to the findings of Gentili et al. (2008), who found significant differences in the processing of familiar versus non-familiar metaphors. Perhaps the lack of significant effect of metaphor familiarity is indirect support of Giora's (1997) graded salience hypothesis, arguing that it is an expression's salience rather than frequency, familiarity or metaphoricity, which determines the cognitive effort required for comprehension.

There are, however, also other reasons which should be considered as explanations for the lack of significant effect from the variable Familiarity.

First of all, the metaphors were all rated out of context, i.e., they were presented within the sentence but without the supporting context of the entire text or paragraph. This was done to be able to randomise the order in which the evaluators rated the metaphors as there was expected to be a risk that metaphors presented later in the rating sequence could receive higher ratings because of a priming or warm-up effect. However, this does present the problem that the raters were presented with the metaphors in a different manner than the participants and without the context in which the participants read and translated the metaphors. The procedure for the familiarity rating conflicts with the priority of ecological validity as one of the key arguments for using authentic texts in the experiment was to enable presentation of the metaphors within context. However, it was a matter of choosing the lesser of two evils as the concern for the lack of context was outweighed by the priority of randomisation.

It could be speculated that the reason for the lack of effect from the mean familiarity rating on the dependent variable is that it is not possible to give a realistic evaluation of a person's familiarity with a metaphor when reading the metaphor out of context. And as the context of a metaphor will almost certainly be unique each time, the experience of familiarity with a metaphor may in fact be influenced by the similarity of the contexts in which the metaphor appeared. For this reason, it is possible that the mean familiarity rating of the metaphors without context cannot be assumed to be comparable to the participant's experience of familiarity with the metaphors in context. On the other hand, Blasko and Connine argued that not only direct experience with a metaphor but also "less direct experience with a class of metaphors may serve to clarify the intended meaning so that later comprehension is facilitated" (Blasko and Connine 1993: 305). Following Blasko and Connine's argument, it would not be necessary for the rater (and the participant) to have encountered the exact same metaphor in the same specific context in order to experience some level of familiarity with the metaphor.

Secondly and perhaps more importantly, the familiarity ratings were not done by the participants themselves as it was not deemed desirable to present the participants with the metaphors before the retyping and translation tasks. This was assumed to have resulted in some form of warm-up effect, and after the retyping and translation tasks, the familiarity ratings would have been likely to have been influenced by the participants' recent exposure to the texts.

A third explanation is that the effect of familiarity was obscured by the even larger effect of the cognitive effort required for L2 metaphor comprehension and translation. In other words, measures which are found to have an effect in monolingual metaphor studies may not necessarily be equally relevant in L2 metaphor studies.

Another variable which showed no significant effect in Analysis 1.1 was Translation Strategy. If ST gaze data primarily reveals information about comprehension and not production, this might explain why there was no significant effect from the three individual translation strategy variables (M-M, M1-M2, M-P) in interaction with the dependent variable. It would also explain why there were no significant differences between the individual strategies. However, this latter lack of effect could also be caused by too few data points in the statistical analysis as the translation strategy M-M was by far the dominant one.

Of course, the lack of any significant effect from the translation strategies could also be because professional translators do not spend more cognitive effort on choosing and working with a specific translation strategy, as part of their translation expertise consists of strong problem-solving capabilities, which is developed and strengthened throughout their work life (Shreve 2006: 32).

Although all participants in the current experiment were professional translators, the participants' translation expertise and general problem-solving skills were not evaluated. The random factor Participant revealed strong individual differences, but it was not investigated whether there was any correlation between the amount of cognitive effort invested by the participant and years of experience, translation quality or field of expertise. In future experiments, it would be relevant to investigate the participants' background in further detail and include this as a variable in the analysis. A short qualitative analysis of some of the different choices made by the participants is presented in section 7.2.

There is also the possibility that the participants did not make any deliberate choice of translation strategy but instead just used the first translation idea that came into their minds, which in most cases seemed to be the direct transfer strategy (M-M). Although the experiment was designed to simulate an authentic translation assignment to the widest extent possible, there were limitations. The participants were not paid for their translation services, and no translation

aids were available, which seemed to be the difference from an authentic assignment that the participants felt the most. The brief instructed the participants on the intended target audience for the text in order to promote strategic decision-making from the participants but it is obvious that the experimental setting did not allow for a realistic translation process to be fully replicated.

To summarise, the results of the analyses of the eye-tracking data indicated that the answer to Research Question One is not an unequivocal answer. *First Pass Fixation Time* had significantly higher values for the metaphor AOIs compared with the literal comparison AOIs, indicating an increase in cognitive effort when reading for translation purposes. However, the more comprehensive measure, *Total Fixation Time*, did not show any significant effect of Type in the analysis, although in absolute values, total fixation times were longer for metaphor AOIs compared with literal AOIs. It may be speculated that *First Pass Fixation Time* is a more sensitive measure than *Total Fixation Time*, reflecting early semantic processing, which would account for the different results, but the findings should be followed up before any conclusions can be made with more certainty. The findings of Analysis 2, *Total Fixation Number*, were in overall concurrence with the findings of Analysis 1, which was not surprising as Analysis 2 was regarded as a supplementary analysis to Analysis 1.

The conclusion to be made on the basis of analyses 1-3 is that metaphors may be more unexpected than non-metaphors, as reflected in the longer first pass fixation times, but the effect of the unexpectedness disappears when looking at a more comprehensive measure such as *Total Fixation Time*.

The eye-tracking analyses mainly investigated the comprehension process as the data was only collected from eye movements in the STs, and the following section will therefore focus on the production process as analysed through key-logging data.

Chapter 6 Key-logging Results: a Quantitative Analysis

Chapter 5 on the analysis of the eye-tracking data showed a significant difference in only one of the measures between the metaphor and literal AOIs, namely *First Pass Fixation Time*. The other eye-tracking measures showed no significant effect of Type.

This section will report on the key-logging analysis, Analysis 4 and Analysis 4.1, which were done with the data collected with Translog. The underlying assumption was that, overall, cognitive effort related to the production of the TT metaphors would be present when attention was allocated to the TT, i.e., during typing, whereas cognitive effort related to comprehension of the ST metaphors would be present when attention was allocated to the ST, i.e., during reading of the ST.

Although the eye-tracking analysis reported in chapter 5 and the key-logging analysis reported here in chapter 6 are not directly comparable for a number of reasons, which will be discussed in more detail below, the two analyses combined offer an in-depth and comprehensive overview of where cognitive effort is invested in the process of metaphor translation. As stated in section 4.6, the statistical model used for analysis of the key-logging data was constructed following the same principles as applied in the statistical model for the eye-tracking data. Again, an LMER model was fitted, and the independent variables were introduced individually and removed again if they showed no statistical significance. This provided a clearer picture of the effect of the individual variable. Identical to the procedure used in the eye-tracking analyses, the more control-oriented variables were introduced first with the more research question-driven variable introduced last (also in this case the variable Type with the levels Metaphor and Comparison). Again, the variables central to the research questions were not removed if non-significant in order to allow for discussion of the results relevant to the research questions.

The findings from Analysis 4 cannot be directly correlated with the findings from the eye-tracking analyses because the two types of analyses concerned two different stages of the translation process, i.e., production and comprehension. Another reason for the lack of comparability was that the data for the eye-tracking analyses were extracted on a uniform basis as the AOIs were identical for all participants and only fixations within the AOIs were included.

The data for the key-logging analysis had to be extracted on a case-by-case basis as the participants naturally did not all choose identical translations for the ST AOIs. It was therefore necessary to identify the boundaries of the TT AOI equivalents individually for each text by each participant.

In some cases, this was made more difficult by issues such as different constituent order in English and Danish, which was not taken into account in the selection of the texts and the AOIs. In a few cases, this resulted in TT words not linked to the ST AOI occurring between constituents in the TT AOI equivalent. To exemplify this, AOI ID 25 in Text 4 was the metaphor “*donned their white coats*”.⁴¹ In Danish, when the main clause is preceded by another constituent such as an adverbial or subordinate clause, as was the case here, the finite verb precedes the subject (Jensen et al. 2009: 320) thus **“donned the central bank’s senior consultants their white coats”*. As the subject was not included in the ST AOI, it would either be necessary to include more than was in the ST AOI or to exclude the finite verb from the TT AOI equivalent, which was the preferred procedure. The difference in word order led to this specific TT AOI equivalent to include fewer constituents than in the original ST AOI as it was deemed better not to include the subject in the TT AOI equivalent because of the relatively complex compound expression it consisted of. It was not investigated if the missing finite verb had any effect on the final results but as this was only one AOI equivalent in one text, it was assumed to not skew the results. However, it is an example of the complexities of mapping ST AOIs to TT AOI equivalents with some degree of accuracy and conformity across participants.

Another issue concerning the identification of the TT AOI equivalents was the instances in which the participant had chosen to paraphrase the metaphor. This often made it quite difficult to identify the boundaries of the TT AOI equivalent and, in some instances, meant that it was deemed more prudent not to include the TT AOI equivalent in the data set. This was done in instances where it was not possible to determine the boundaries with a satisfactory level of certainty. Although those instances were few, they added another concern about the conformity with which the boundaries of the TT AOI equivalents were identified as it was a priority to keep

⁴¹ The full sentence read “*As the economic downturn became a full-blown collapse late last year, the central bank’s senior consultants donned their white coats and got to work*” (see appendix 1).

the data selection criteria as objective and uniform as possible to keep the level of comparability to the eye-tracking analyses as high as possible. This issue could be avoided in a follow-up study with sentence-based AOIs comparing sentences with or without metaphors.

6.1 Analysis 4: Production of Metaphor versus Non-metaphor in Translation – Production Time

The assumptions behind the independent variables and their characteristics have been described in depth in the methodology section (section 4.6) and the following will describe the effect, if any, the independent variables had on the dependent variable of *Production Time*. As described in more detail in section 4.6.3, *Production Time* is a temporal value expressed in milliseconds, which extends from the time immediately after the final keystroke in the word preceding the first word in the TT AOI equivalent until immediately after the final keystroke in the TT AOI. By including any time before actual production of the TT AOI equivalent is initiated, the measure also included any pauses which may occur before production and which could be interpreted as a sign of increased cognitive effort. Production was assumed to have been initiated mentally before actual physical manifestation of the translation was produced through typing events. Therefore, any preceding pauses (as included in *Production Time*) were assumed to be related to the mental production of the following translation unit.⁴²

By investigating the effect on *Production Time* of the more comprehensive temporary character count rather than the character count of the final TT AOI equivalents, the analysis took a more process-oriented approach by using a measure of characters typed during the process rather than a measure of characters in the final product. The independent variables Domain, Unigram Frequency, Trigram Probability, and Type related to the STs whereas the rest of the independent variables concerned the TTs. Character Count, for example, could also have been a count of characters in the ST AOIs, to take into account any difference in elaboration considered necessary for the metaphor TT AOI equivalents compared with the comparison TT AOI equivalents. However, a character count reflective of the process of producing the TT AOI equivalents was deemed to be more relevant to the investigation of *Production Time* and to the amount of cognitive effort involved in the production process.

⁴² The absolute values grouped by participant and text can be seen in Appendix 10.

The following will outline the main results from Analysis 4. Although some of the independent variables were left out of the final version of the statistical analysis because of lack of significant effect, they are still discussed here because it was decided that a lack of significant effect could be as interesting or surprising as a significant effect.

Table 17: Summary of the linear regression model for *Production Time*

	Estimate	MCMC mean	HPD95 lower	HPD95 upper	p-value
(Intercept)	6.9536	6.9410	6.7886	7.1019	0.0001
Character Count	0.0772	0.0784	0.0689	0.0875	0.0001
Type (Metaphor)	0.1814	0.1779	0.0227	0.3251	0.0198

Metaphor effect

As can be seen from the right-hand column of Table 17, there was a significant effect of Type on *Production Time*. In other words, the participants took longer to produce the translation of the ST metaphor AOIs than the comparison AOIs. Following Schilperoord (1996) and Immonen (2006), slower production speed can be indication of a more cognitively effortful translation unit, which means that the answer to Research Question Two is that, based on the key-logging data reported here, metaphors have been found to be more cognitively effortful to translate than literal expressions.

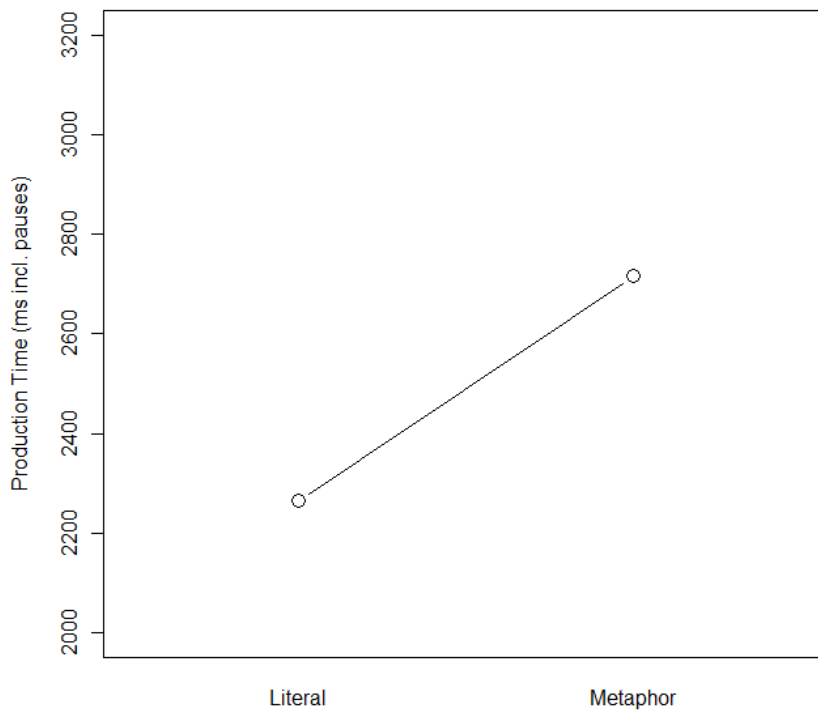


Figure 21: Production Times for comparison and metaphor AOIs in the TTs

This difference is illustrated in Figure 21, which shows that the translation of comparisons AOIs have a total production time of around 2200 ms compared with production times around 2700 ms for translation of the metaphor AOIs, a temporal difference which has been shown to be significant.

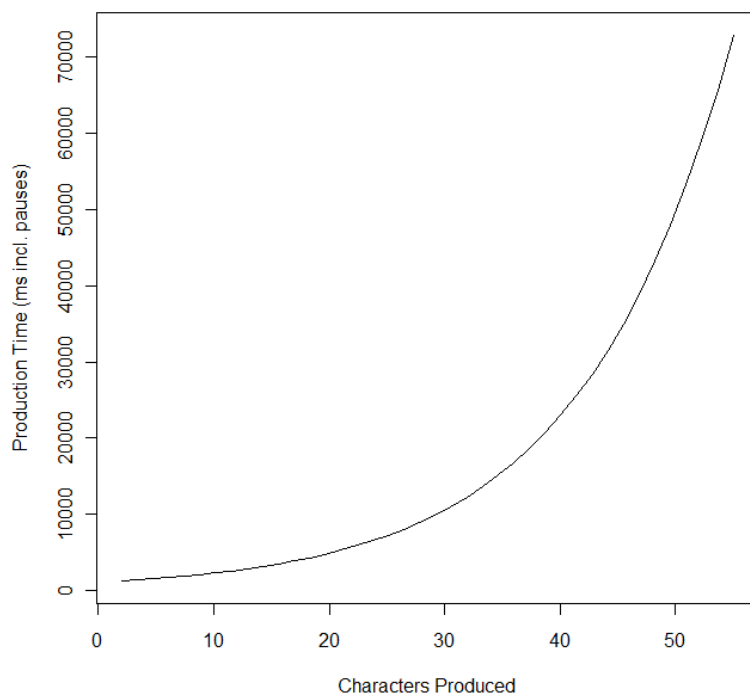
This finding offers an important contribution to earlier non-empirical research on metaphor translation and lends support to the claim that metaphor does present a particular problem in translation (see e.g. Dagut 1987), as the increase in production time for the metaphor AOIs is interpreted to mean that the translation of these metaphors was more cognitively effortful than the translation of the non-metaphorical AOIs. Conversely, the results do not support the claim put forth by Mason (1982) that the problems of metaphor translation are not specific of metaphors, but rather of translation in general, as the metaphor AOIs reported here were compared with non-metaphor AOIs from the same texts. Following Shreve and Diamond (Shreve and Diamond 1997, see section 3.2.2), it would seem that activation of the mental representations of the L2 metaphor and the corresponding (or lack thereof) L1 metaphor is more

cognitively demanding than activation of mental representations of literal expressions in the L2 lexicon and the L1 lexicon.

The results of Analysis 4 are supported by the findings of Analysis 3 in which first pass fixation times were significantly longer for the metaphor AOIs in the STs. The fact that both the eye-tracking and key-logging data show a significant effect of metaphor, but only when the task is for translation and not only comprehension,⁴³ indicates that it is the transfer from L2 into L1 that poses the most cognitively demanding task rather than the comprehension of the metaphor by itself.

Significant control variables

There was a strong and significant effect of Character Count on *Production Time* as illustrated in Figure 22.



⁴³ Or put more precisely for the eye-tracking data, when reading for translation purposes compared with reading for comprehension.

Figure 22: The partial effect of Character Count on *Production Time*. Please note the different scale on the y-axis compared with the other figures because of the stronger effect of Character Count.

In other words, the number of characters needed to produce a translation equivalent of the ST AOI, including typos and mid-production change of words, affected the time it took to produce the final result. This effect was as expected and indicated that Character Count was an essential independent variable comparable to the independent variable AOI Length in the eye-tracking analyses.

Non-significant control variables

The independent variable Postedit with the levels Yes and No investigated whether the fact that a number of the TT AOI equivalents were postedited had an effect on *Production Time*. There was no significant effect of this variable ($p\text{-value} > 0.05$), which was in line with expectations. This expectation of no effect was based on the low number of translations which were in fact postedited as well as the observation that the postediting mainly resulted in very minor changes to the original translations. This indicates that the postediting was not caused by a need for major changes in unsatisfactory original translations.

The variable Sentence End (levels Yes/No) investigated whether there was an effect on *Production Time* from the translation units' sentence-final position. This assumption was based on findings from eye-tracking indicating some form of wrap-up or revision effect when reading words located at the end of sentences. This wrap-up effect was assumed to be equally likely in both a production task and a comprehension task. Also, the findings from Schilperoord (1996) and Immonen (2006) on pause frequency and duration suggest that pauses are more likely to occur and to be of a longer duration at sentence breaks than at mid-sentence. However, contrary to expectations, there was no significant effect of a sentence-final position on *Production Time* ($p\text{-value} > 0.05$).

The variable Sentence Initial (levels Yes/No) was identical to the variable Sentence End apart from the difference that this variable investigated if there was any effect of the TT AOI equivalents being located at a sentence-initial position. The findings from Schilperoord (1996), Dragsted (2004), and Immonen (2006) on the frequency and duration of pauses varying

according to lexical and syntactic level were assumed to apply equally to sentence-initial and sentence-final positions in the experiment reported here. Furthermore, it was hypothesised that some form of orientation may occur when production of a new sentence is initiated, and it was assumed that this would have an effect on the amount of cognitive effort required to produce the initial words in a sentence, resulting in longer *Production Time* for words at this position. However, this was not the case in this experiment as there was no significant effect from a sentence-initial position on *Production Time* (p-value > 0.05).

The frequency values of the word(s) in the ST AOIs had no significant effect (p-value > 0.05) on the dependent variable *Production Time*. This was not entirely surprising as the word frequency values applied to the ST AOIs, and the words chosen by the translator for the TT AOI equivalents were retrieved from the translator's mental lexicon as no translation aids were available. In other words, the translator would have to be familiar with the words she chose for the translation.

The results were a little less clear-cut for the independent variable Trigram Probability. The variable had a significant effect on *Production Time* and was therefore included in the statistical analysis. However, once Type was included as an independent variable as well, the effect of Trigram Probability became non-significant (p-value > 0.05). The results from the eye-tracking Analysis 1 showed a significant effect from Trigram Probability and showed that the metaphor AOIs had lower probability values than the comparison AOIs, and the results from the key-logging analysis seem to indicate that the effect from this difference is carried over into the production in the TT.

Contrary to expectations, there was no significant effect of Domain on *Production Time* (p-value > 0.05). The expectation was that metaphors stemming from the same semantic domain would require less cognitive effort to translate than metaphors from mixed domains as a result of facilitation or automaticity following Jäaskeläinen and Tirkkonen-Condit (1991, see section 3.2.3). The priming effect expected in the eye-tracking analysis investigating cognitive effort in comprehension was assumed to be stronger in production, as development of translation automaticity was expected. This assumption was based on the arguments of Jäaskeläinen and Tirkkonen-Condit that earlier stylistic decisions would to some extent automatise later stylistic

choices (Jäskeläinen and Tirkkonen-Condit 1991: 98ff). However, this assumption was not confirmed by the key-logging data.

6.1.2 Summary

The following table provides an overview of Analysis 4. The variables are listed in the same order in which they have been discussed in this section with any variables showing a significant effect ($p < 0.05$) marked in a darker shade of grey. As the table shows, the data indicated that metaphors are more cognitively effortful to translate than literal expressions according to the measure *Production Time*.

Table 18: Summary of independent variables in Analysis 4.

Variable name	p-value
Character Count	< 0.05
Postedit	> 0.05
Sentence Final	> 0.05
Sentence Initial	> 0.05
Unigram Frequency	> 0.05
Trigram Probability	> 0.05
Domain	> 0.05
Type	< 0.05

6.2 Analysis 4.1 – Production of Metaphor in Translation – Production Time

As with Analysis 1.1, this analysis investigated a subset of the key-logging data in which only the metaphor AOI equivalents in the TTs were analysed. This allowed for a more finely granulated analysis in which the effects of metaphor familiarity and translation strategy on the cognitive effort invested in the translation task could be analysed. The measure of cognitive effort was the same as that used in Analysis 4, i.e., *Production Time*.

Analysis 1.1 investigated the effects of metaphor familiarity and translation strategies on the comprehension process and found no significant effect of either metaphor familiarity or translation strategy. The direct translation strategy M-M was not found to be less cognitively effortful in the comprehension process than the indirect translation strategies M-P and M1-M2. However, it was speculated that any potential effects would be more likely to be found in an analysis of production data rather than comprehension data, and Analysis 4.1 investigated the cognitive effort invested in the production process. The control-oriented independent variables included in Analysis 4 were also investigated in Analysis 4.1 with the addition of the variables Metaphor Familiarity and Translation Strategy.

In the following, focus will be on a discussion of the effects from Metaphor Familiarity and Translation Strategy, which are unique to Analysis 4.1 compared with Analysis 4. The results of the independent variables repeated in Analysis 4.1 were in line with the findings from Analysis 4, i.e., no significant effect with the exception of Character Count and Trigram Probability, and will therefore not be discussed in detail again.

The translation strategy M-M, i.e. a direct transfer of the ST metaphorical image, was by far the preferred translation strategy (217 M-M compared with 55 M-P and 44 M1-M2),⁴⁴ which is in line with Wikberg's findings that "innovative metaphors" were mainly translated with the equivalent metaphorical image (Wikberg 2004: 248), and this translation strategy was therefore chosen as the basis of comparison or reference level against which the effect of the other two

⁴⁴ These numbers differ slightly from the numbers used in Analysis 1.1, as a few of the target text metaphor translations were found to have been categorized inaccurately in Analysis 1.1 upon closer inspection. The changes were minor and had no effect on the results of Analysis 1.1.

translation strategies was investigated. Any significant difference in *Production Time* for the other two translation strategies was therefore a difference compared with translation strategy M-M, which was also assumed to be the less cognitively effortful translation strategy, as it involved a direct transfer of the metaphorical ST image.

Table 19: Summary of the linear regression model for *Production Time* for Analysis 4.1

	Estimate	MCMC mean	HPD95 lower	HPD95 upper	p-value
Intercept	7.2415	7.2084	6.9565	7.4710	0.0001
Character Count	0.0698	0.0712	0.0628	0.0790	0.0001
Trigram Probability	0.0129	0.0116	-0.0332	0.0568	0.6048
Translation Strategy M-P	0.0816	0.0976	-0.0578	0.2490	0.2132
Translation Strategy M1-M2	0.1639	0.1900	0.0214	0.3661	0.0308

The effect of translation strategy

The translation strategy M1-M2, i.e. reproducing the ST metaphorical image with a new metaphorical image in the TT, was the least frequently used translation strategy (only 44 instances compared with 217 M-M instances across all participants and texts)⁴⁵ and research question Four asked whether this strategy would be more cognitively effortful than the direct translation strategy M-M, which was the reference level in the statistical model. Based on the findings of Analysis 4.1, the answer to research question Four is yes, as the analysis showed a significant effect of translation strategy M1-M2 with a positive Estimate, indicating slower production times for this strategy compared with production times for the M-M translation strategy (the reference level). This significant effect is illustrated in Figure 23.

⁴⁵ Because of the disparity in distribution of the three translation strategies, it was found that the absolute values would not be illustrative for which reason they have not been included in an appendix.

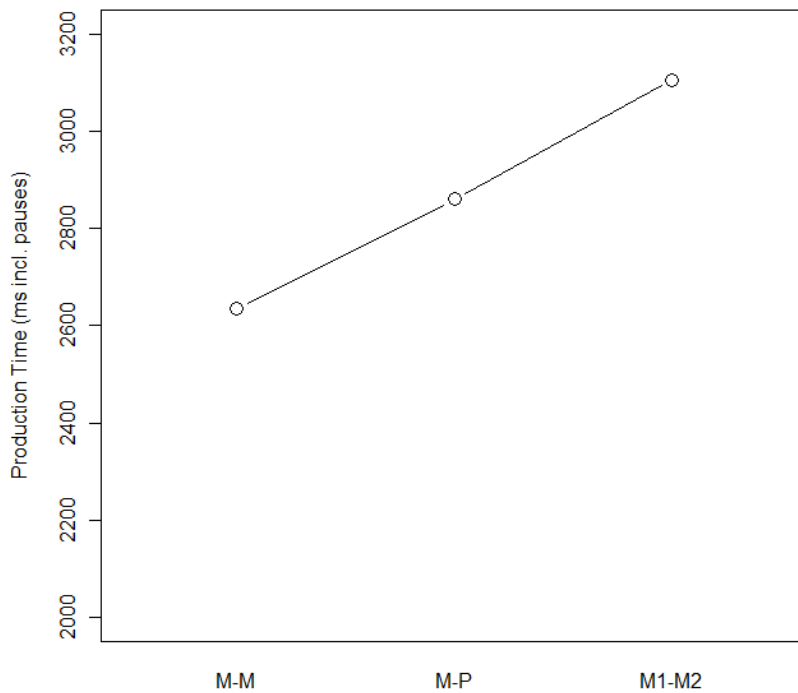


Figure 23: Partial effect of Translation Strategy on *Production Time*

This result would seem to confirm Dagut's claim that metaphor translation is most challenging when a TT equivalent cannot be found to the ST metaphorical image (Dagut 1987: 78). A possible explanation for this result could be that the M1-M2 strategy not only includes the processes of recognition of the ST metaphor and search for an appropriate equivalent in the TT, as do all three translation strategies; it also includes the extra element of having to discard the ST metaphor image, which is also the case in the process of using the M-P strategy. Most importantly, the strategy M1-M2 includes the element of having to produce a new metaphorical image, assumed to be drawn either from a mental lexicon in which the TT metaphor image was stored or produced from scratch. Even though the two language cultures English and Danish may share some cognitive grounding, the linguistic metaphors used to express meaning can still be different as also illustrated by Trim (2007) (see Figure 1 in section 3.1.2). The search for the TT equivalent and production of the new image has been shown in Analysis 4.1 to be more cognitively effortful than a direct transfer of the metaphorical image. The increase in cognitive effort as indicated by the longer *Production Time* was assumed to be a result of the duality of this translation strategy.

Unfortunately, we do not know the reasoning behind the participants' choice of translation strategy or if the choice of the M1-M2 translation strategy was because a TT equivalent could not be found. It is therefore not possible to claim with any certainty that Dagut's claim is confirmed, nor whether the metaphors translated with M1-M2 did in fact have a lower level of translatability because of their cultural specificity (cf. Trim 2007 in section 3.2.4.1). It is also not possible to verify if the choice of the M1-M2 translation strategy was a result of a more sense-oriented translation approach, an approach characteristic of professional translators according to Lörcher (Lörcher 1992, see section 3.2). In other words, within the experimental design reported here, it is not possible to verify if the translation choices were made as a result of strategic decision-making or simply ad-hoc decisions, a difficulty in translation research also pointed out by Schäffner (Schäffner 2005, see also section 3.2).

In some cases, it seemed as if the participant had searched for a metaphor in the target language with which she was familiar and then applied it to the translation even if it was not directly comparable to the ST metaphor. An example of this was participant 12's translation of AOI ID 36 in Text 2, "*fallen off a cliff*", which was translated with the new metaphorical image "*collapsed*" (author's translation), which could perhaps be argued to be less dramatic and at least more conventional and therefore likely to be more familiar to the participant, perhaps leading her to regard this as a safer choice. However, AOI ID 36, "*fallen off a cliff*", did receive a relatively high mean familiarity rating of 5 (7 indicates the highest familiarity), which would seem to be counter to this assumption and could perhaps raise doubt about the suitability of familiarity as an independent variable. Perhaps, the preference for "*collapsed*" was rather a matter of aptness or perhaps metaphorical strength with the participant preferring a metaphor translation, which could perhaps be said to be more conservative than the ST metaphor – a tendency which was seen repeatedly across participants (discussed in more detail in section 7.2).

It remains unclear if the M1-M2 translation strategy was the least used translation strategy because it was more effortful or because the participants only used this strategy in cases where they were less certain of the optimal translation, which is perhaps the more likely explanation. Following Wilss (2001), the participants may have been aware that the ST metaphor was not equally suitable in the TT but did not have the necessary problem-solving skills to find the optimal translation solution. This could perhaps explain why a few of the M1-M2 translation

choices could be argued to be less apt than the ST metaphors. Another possibility is that the ST metaphor was deemed to have less language-specific salience in the TT, following Trim's (2007) terminology, or that the ST metaphor was less salient in more general terms in the target language, following Giora's (1997) terminology.

The exchange of the ST metaphorical image with a different TT metaphorical image can reasonably be argued to be the least direct of all three translation strategies, and it is possible to speculate that the participants had compelling reasons to choose this strategy over a direct transfer or paraphrase.⁴⁶ Such reasons could perhaps be unfamiliarity with the ST metaphor or deeming it unsuited for the target language and culture but still wishing to keep the expression metaphorical. It would be relevant to replicate this study, but with a far more comprehensive and in-depth retrospective interview of the participants.

There was no statistically significant effect of the M-P translation strategy on *Production Time*, although there was an absolute difference in production time compared with the M-M translation strategy as shown in Figure 23. In other words, it must be concluded that the indirect translation strategy of paraphrasing was not significantly more cognitively effortful than a direct translation strategy (M-M). Research question Three asked whether the choice to paraphrase the ST metaphor into a literal expression in the TT would be more cognitively effortful than a direct transfer of the ST metaphor image into a TT metaphor with the same image, as evidenced by an increase in *Production Time*. An example of such a paraphrase was the translation of AOI ID 6 in Text 3, "*The path from the altar is strewn*", which participant 3 paraphrased into "*There are plenty of examples*" (author's translation). Another example is participant 4's paraphrase of AOI ID "[to] wed" into "[to] merge" (author's translation).

The findings of analyses 1.1 and 4.1 lead to the same conclusion, namely that the indirect translation strategy M-P is not more cognitively effortful than a direct translation strategy (M-M) in either the comprehension or the production stage.

⁴⁶ An analysis was also carried out comparing the direct M-M against the two indirect strategies M-P and M1-M2 combined, but no significant difference was found in this comparison of direct versus indirect translation strategies.

Significant control variables

The only control variable which showed any significant effect was Character count, which was in line with the findings of Analysis 4 and is non-controversial. This finding will not be discussed any further.

Non-significant control variables

There was also no significant effect of Metaphor Familiarity ($p\text{-value} > 0.05$), as in Analysis 1.1, which could be an indication that the effect of metaphor familiarity found in monolingual metaphor research does not always apply to L2 metaphor comprehension where other more cognitively effortful factors may take over, such as the effort of L2 comprehension and transfer to L1 when reading for translation. Another possibility is that, by having the experimental metaphors rated by others than the participants themselves, the results were skewed and not reflective of the participant group's familiarity with the metaphors.

Following the views of Mason (1982) and Nida (2001), the lack of significant effect of Metaphor Familiarity may also be due to problems with generalising about metaphor translation as each occurrence of metaphor translation is unique and cannot be generalised. In other words, an objective familiarity rating will have less effect than the particular circumstances surrounding each particular instance of metaphor translation (see section 3.2.4.2). However, this speculation cannot be directly confirmed by the data and therefore remains speculation.

Also in line with the findings of Analysis 4 was the lack of significant effect of Trigram Probability, which was not surprising as these values relate to the ST words.

6.2.1 Summary

Analysis 4.1 showed a significant effect of the independent variable Translation Strategy M1-M2. The results indicated that there was a significant difference between the reference level of translation strategy M-M and the M1-M2 translation strategy, resulting in longer production times for the M1-M2 translations. This significant effect was regarded as indication that replacing the ST metaphorical image with a new TT metaphorical image was more cognitively effortful than a direct transfer of the ST metaphor or a literal paraphrase. A possible explanation for the increased cognitive effort could be the task of finding a more salient metaphorical image in the target language if the participant deemed the ST metaphorical image to be less salient in the target language.

6.3 Discussion of Key-logging Results

The majority of process-oriented metaphor research has focused on the cognitive processes involved in monolingual metaphor comprehension and production. Research on metaphor translation has been of a more didactic nature and less empirically oriented than the experiment reported in this thesis. The purpose of the triangulation of data was to ensure a more complete picture of the cognitive effort invested in metaphor comprehension and production from a translation perspective. The conclusion drawn on the basis of the eye-tracking analyses was ambiguous as *First Pass Fixation Time* indicated a significant effect of Type (metaphor versus non-metaphor) whereas *Total Fixation Time* did not. In the following, the results of the key-logging results, as summarised in Table 20, will be discussed and parallels will be drawn to the eye-tracking analyses where relevant.

Table 20: Summary of analyses 4 and 4.1: key-logging data (the effects of translation strategy and metaphor familiarity were only investigated in Analysis 4.1)

Variable name	<i>Production Time (4)</i>	<i>Production Time (4.1)</i>
Character Count	X	X
Trigram Probability		X
Sentence Initial Position		
Sentence Final Position		
Translation Strategy M-P	NA	
Translation Strategy M1-M2	NA	X
Metaphor Familiarity	NA	
Type	X	NA

Whereas the eye-tracking analyses investigated cognitive effort in L2 metaphor comprehension mainly, the key-logging analysis investigated cognitive effort in L2 metaphor translation into L1. The translation process was not regarded as made up of distinct and separate stages of comprehension and production but rather as a flow of overlapping sequences, in which either comprehension or production was the main activity. The production of the TT was therefore regarded as a result of cognitive effort invested in this production process and, parallel to fixation time as a measure of cognitive effort in comprehension, production time was regarded as indicative of cognitive effort in production.

The conclusion to be drawn on the basis of Analysis 4 is that metaphors are in fact more cognitively effortful to produce as indicated by the longer production times. As this claim is made on a direct comparison of metaphors and literal expressions occurring in the same texts, it would also seem to refute Mason's claim that metaphor represents the same potential translation problem as any other translation unit (Mason 1982, see section 3.2.4.2). Rather, this study offers empirical evidence in support of the claims of Dagut (1987) and Newmark (1988) that metaphor is a particularly challenging problem in the field of translation.

In order to ensure some level of comparability with the eye-tracking analyses, the statistical model used for analysis of the key-logging data involved some of the same independent variables. Experience both from eye-tracking research and research by Schilperoord, Dragsted, and Immonen suggested that the position of the words in the TT could have an influence on the frequency and duration of pauses, which would consequently have an effect on the production time, as this measure was a combined value of preceding pauses and typing speed. The statistical analysis therefore investigated the effect of final and initial positions on the production time, but no significant effect from these independent variables was found. It might be questioned whether this lack of effect was because these positions truly did not have any effect on production time or whether it was because the number of data points was insufficient to achieve an accurate analysis of the effect. This question could perhaps be answered by a follow-up study in which the focus would be to investigate any potential differences in cognitive effort related to the translation units' position in the sentences and text as well as any effect from having entire sentences as AOIs.

As the independent variable Trigram Probability was found to have a significant effect in Analysis 1 of the eye-tracking data, it was considered necessary to include this variable in the key-logging analysis as well. Any correlation between the word-in-context probability value and *Production Time* was expected to be less direct than the correlation found in Analysis 1 as the trigram values were for the AOIs in the ST and the *Production Time* was measured for the TT AOI equivalents produced in the target language. This expectation was confirmed by the lack of significant effect of *Trigram Probability* on Production Time in Analysis 4.

The subanalysis 4.1 was comparable to Analysis 1.1 in that it was a comparison of metaphor versus metaphor. In other words, Analysis 4.1 investigated the potential effect of Metaphor Familiarity and Translation Strategy on the cognitive effort invested in metaphor translation as manifested as differences in *Production Time*. The analysis shared the same dependent variable and several independent variables as Analysis 4, which were therefore not discussed again. The new elements were Metaphor Familiarity and Translation Strategy.

It was assumed that the more familiar metaphors would mean faster production times, because the metaphor had been processed before on previous occasions, leading to stronger networks or mappings between the stored expressions in the L1 and L2 lexicons. However, there was no significant effect of metaphor familiarity on *Production Time*, as was also the case in Analysis 1.1, and perhaps the ratings were not reflective of the participant group's familiarity with the metaphors as the ratings were done by a separate group of raters with the same professional background as the participants. Another possibility is that familiarity was less relevant to the level of cognitive effort required compared with other factors such as salience, which was argued by Giora (1997) to be a stronger predictor of cognitive effort than familiarity or compared to the effect of L2 processing and translation.

The second element of Analysis 4.1 was an investigation of the effect of translation strategy on *Production Time*, as it was speculated whether a direct transfer of the metaphorical image (M-M) would be less cognitively effortful than an indirect translation strategy (M-P or M1-M2). The analysis found that there was a significant effect of translation strategy M1-M2 resulting in slower production times compared with translation strategy M-M, which was used as the reference level as this direct translation strategy was about four times as frequent as the indirect translation strategies, a finding in line with earlier findings by Wikberg (Wikberg 2004). It was

speculated that the duality of the M1-M2 strategy, i.e., not only processing and discarding the ST image but also producing a new TT image, was the cause of the increase in cognitive effort.

The M1-M2 translation strategy was the least preferred of all three translation strategies with only 44 instances, and a few of the translations produced with this strategy suggested that the M1-M2 strategy was preferred for the translation of ST metaphors, which the participant felt contained a too strong metaphorical image or that a more conventional or familiar metaphor was more suited for the TT. It remains unclear whether the increase in *Production Time* was because the participant was having trouble deciding on a translation strategy before choosing M1-M2 or because it simply takes longer to choose a new metaphorical image. Perhaps the explanation is a hybrid: that the participant found it difficult to determine the suitability of the ST metaphor image in the TT, but still wished to keep a metaphorical image to keep the stylistic element of the ST in the translation. The participant therefore decided to produce a new metaphorical image in the TT. Although outside the scope of this thesis, it would be interesting to do a later qualitative analysis of the translation quality of the M1-M2 translations in terms of aptness and target language suitability and compare these values with those of the original ST images to investigate if the increased cognitive effort resulted in better translations more suited for the target language than the original metaphors. It is possible to speculate that the translator chose to discard the original ST metaphor image because it was found to be less salient in the target language following Trim (2007) and Giora (1997) and that the translator deemed a different metaphor image to be more salient in the target language while expressing the same concept as the original ST metaphor.

Chapter 7 Translation Results: a Qualitative Analysis

Whereas the previous section highlighted the benefits of a quantitative analysis with as many objective factors as possible taken into account, this section takes a different perspective. Many translation studies take a qualitative approach by discussing e.g., translation quality and recommended procedures. The current study sought to move away from a purely qualitative study, as it was anticipated that an experimental methodology and data analysis would uncover cognitive mechanisms that are characteristic of the way translators manage metaphor translation. It was not a primary aim to try to connect such mechanisms either with good or bad quality in the translational outcome or in any detailed way to translators' subjective statements about their experience of translating metaphors.

However, qualitative methodology was employed to a limited extent in short retrospective interviews conducted immediately after each task had been completed. The qualitative data elicited in these sessions offers leeway for discussion of details such as why one participant may have preferred one translation strategy over another, based on the participants' subjective responses in the retrospective session.

A full analysis of the translation quality produced by the participants will not be given as this is outside the scope of the thesis. Nor will it be an exhaustive analysis of all the potential qualitative elements available for discussion. The aim of this chapter is to complement the quantitative analyses in chapters 5 and 6 with examples from the participants' output, either in the form of responses or solutions which bring up questions concerning quality potentially connected with cognitive processing.

7.1 Retrospective Interview: Questions and Responses

None of the participants provided elaborate answers to the questions posed to them after completion of each text (for an English translation of the questions posed, see appendix 3). This is very likely due to a flawed methodology rather than a lack of responsiveness on the part of the participants. Although the questions posed were given after each text rather than after completion of all four texts, there were clear indications that the participants did not remember

many details of the text immediately upon completion. This was not only the case with the reading and retyping task but also with the translation tasks, in which the participants must be assumed to have become more immersed in the details of the text in order to be able to produce a translation. The participants all demonstrated that they had understood the texts by producing correct responses to the control questions concerning the topic of the text, e.g., whether or not it was a good or bad time for the credit card industry in the case of text number 1. However, when asked if they remembered any specific terms or phrases which had been particularly difficult to understand or translate, the answer was almost universally no. Of course, as the texts' levels of lexical difficulty were not that high, it may simply be that no particular words had presented any problems. It could be speculated, however, that the participants were simply unable to remember specific lexical items, even when the eye-tracking data showed several prolonged fixations in several instances, fixations as often as not on words outside the AOIs.

One reason for this general perceived lack of experiencing lexical difficulty could either be because the participants were unable to remember any perceived difficulties or perhaps it was because professional translators do in fact focus more on a macro level of a text, as posited by Jääskeläinen and Tirkkonen-Condit (1991), than on a micro level of single lexical units. This speculation may perhaps have been answered more easily if the participants had been exposed to cued retrospection by replaying the eye-tracking recordings and perhaps even the key-logging files to the participant to see if the replay would trigger any recollections. This approach was considered but was eventually rejected because it was time-consuming, and there was a limit to the amount of time one could reasonably expect the participants to contribute. In retrospect, the replaying of the recordings could perhaps have elicited important offline information from the participants on any conscious decisions or perceived difficulties. They may have had a better chance of remembering their thought process when seeing their own production processes replayed. However, there is of course still the possibility that the participants perceived no difficulties and no salient problems, leaving little of interest to report.

Out of 17 participants, 11 commented on the metaphorical images in the retrospective interview following the translation tasks.⁴⁷ These comments could be interpreted as signs of perceived salience or increased effort required for the translation of the metaphorical images, relating to the findings of the quantitative Analysis 4, *ProductionTime*. Another explanation is that the high number of metaphors in the relatively short texts prompted the participants to take more note of the expressions than they would have if the metaphors had been embedded in longer units of text. As previously mentioned, whereas texts 1 and 2 had only 7 and 6 metaphors respectively, texts 3 and 4 had 11 and 13 respectively. As many of the metaphors were quite colourful and creative, it is perhaps not surprising that the participants noted the expressions enough to remember them in the retrospective interviews. Examples of memorable metaphors include a financial Chernobyl (Text 2) and central bank consultants using a syringe to inject money into the economy (Text 4). With regard to Text 4 on the ailing British economy, one of the participants who happened to have many years of experience in translating financial texts commented on the image of the economy as a patient, which she had recognised as a well-known metaphor often used and equally appropriate across cultures. Not surprisingly, the participant chose to transfer the metaphorical images directly into the translation using the M-M translation strategy.

This specific participant was probably the most experienced translator with this specific type of text and not representative of the participants as a group. The example with this participant's comments should therefore be taken as illustrative of the span of the participants' level of reflection on their translation and general metaphor competence, where this specific participant could be regarded as being at the top end of an imaginary scale of competence for this translation task. Other participants who voiced no reflections on the metaphors in the retrospective interviews were not necessarily less competent in their translations but perhaps less deliberate in their translation choices.

Another participant with a very different background as she was more specialised in literary translation observed that she found Text 1 difficult to translate because of the many metaphors.

⁴⁷ This number constitutes all instances in which the participant remarked on metaphors, images or idioms in either one or both translation tasks.

She found them difficult to transfer because she regarded economic metaphors to be less appropriate in Danish and therefore chose to use a different image in some instances (M1-M2) and to paraphrase in others (M-P). She felt that the serious tone of the text would otherwise have been affected, indicating a general belief that metaphors are less appropriate in Danish specialised texts. The participant, who also worked as a proof reader, furthermore added that she and her colleagues tended to remove as much as 25 per cent of all metaphors in a Danish translation as Danes tended to react quite strongly to metaphors. It is worth considering that this participant was not specialised in financial texts as the previous participant but in literary translation, which one would initially assume would provide a certain level of metaphor competence as well. Although the two participants were commenting on two different texts, it is still interesting that the participant familiar with economic texts felt that the metaphors were equally appropriate in the target language whereas the other participant felt a need to remove or alter the metaphors. At a glance, both participants seemed to deliver equally satisfactory translations. Perhaps, it is possible to argue that metaphor competence in this case could be regarded as a level of familiarity with and knowledge of metaphor use within a specific domain, in which case the first participant could be regarded as having a higher level of metaphor competence in relation to these specific texts.

The above comments elicited from the retrospective interviews show that although only very few of the participants made any elaborate remarks or comments, it was still possible to gain insight into considerations made by a few participants, which would not be immediately available through the online data collected in the eye-tracking and key-logging files. There is no doubt that cued retrospective interviews would have elicited even more insight into the participants' minds, but there is still enough response material to show the soundness of triangulating offline and online data. The retrospective interviews showed that at least some of the participants recognised the presence of metaphors in the text and considered the appropriate translation strategy for the metaphorical images' translation into the participants' L1. This awareness of the linguistic metaphors could not have been observed directly in the quantitative analyses, which are strengthened by the knowledge that the participants recognised the metaphors for what they were and showed that, at least for some participants, the cognitive effort invested in the translation process was a result of a deliberate decision-making process.

7.2 The Translations

This section aims to provide a few illustrative examples of some of the more interesting translation choices made by the participants and offer a discussion of the differences in the choices made by the translators.

As analyses 1.1 and 4.1 demonstrated, the majority of the metaphor translations were direct transfers of the metaphorical images in the ST (M-M). It can only be speculated whether the reason for this preference was that the translators evaluated the metaphors to be equally appropriate in the target language and culture or whether they chose the direct transfer approach because they did not consider or were aware of other translation options. Future studies would benefit from having interviews aimed at identifying deliberate translation strategies after the experiment.

Irrespective of the reasons for the majority of M-M translations, it is interesting to have a closer look at the choices made and the solutions produced when the participants chose not to transfer the ST image directly. A few examples of other translation choices will also be discussed. Although it is only possible to speculate on the reasoning behind the participants' choices, highlighting a few of the less obvious translation choices may still add to a more comprehensive depiction of the translator's decision-making process.

It could be claimed that there is a certain tendency in Danish to use less elaborate and perhaps more conventional metaphors than in English. Such a claim is not contradicted by the translations produced by the participants. In the instances of other translation strategies than M-M, there does seem to be a certain tendency towards downplaying the imagery in the ST metaphor slightly. An example of this could be the translation of AOI IDs 28 and 29 in Text 1, in which the whole sentence reads “*The rise in unemployment has **spattered** a once-profitable business with **red ink***” (Appendix 1) (AOI IDs 28 and 29 are marked in bold). It could be speculated that participant 12 felt that this imagery was too elaborate for the Danish audience as she decided on changing the imagery in AOI ID 29 into a partial paraphrase. The direct back-translation of her Danish translation would be “*The increase in the number of unemployed people has **stained** a once-profitable business with **red results***”. Although nothing was

mentioned in the retrospective interview, it would seem that participant 12 decided to downplay the rather forceful, very concrete imagery of the ST metaphors by choosing a verb in AOI ID 28 with a slightly more passive connotation and by paraphrasing AOI ID 29 although keeping the image of red colour. However, by trying to lessen the metaphorical strength of the TT metaphors, the participant ended up with what could be said to be a less than successful result as it is not entirely clear how “*red results*” can stain. Red ink can stain, but red results? The phrase “*red numbers*” is often used in relation to company accounts but not “*red results*”, and it could be guessed that the participant’s focus was on lessening the metaphorical strength and not so much on finding the appropriate colloquial expression in the target language, or perhaps she was simply unable to recollect the correct expression in the target language.

A second example which could be interpreted as an attempt to downplay the strength of the metaphorical image slightly in the TT was the translation of AOI ID 36 in Text 2 in which the sentence read “*the market for securitization [...] has **fallen off a cliff***” and for which the back-translation from participant 11 would be “*the market for securitization [...] has **collapsed***” (see Appendix 1). Of course, it is only possible to conjecture why the participant would choose to replace the original metaphorical image in the ST with a different metaphorical image in the TT, but it could be speculated that the motivation was similar to the motivation in the first example. In other words, the participant felt that it was preferable to choose a more conventional metaphor. To refer to markets as “*collapsing*” is so conventional that it may be regarded as a dead metaphor and this applies to both source and target languages and by choosing this conventional metaphor over the less familiar “*fallen off a cliff*”, it is very likely that the participant felt that she made a safer choice.

A third and even more convincing example of a participant deciding that the ST metaphor was too unfamiliar or creative to be appropriate in the target language was participant 3’s paraphrase of AOI ID 19 and 20 in Text 3. The original sentence read “***The path from the altar is strewn with failed corporate marriages***” and the back-translation of the TT is “*There are plenty of examples of failed mergers between companies*”. The ST metaphor was quite elaborate and the participant actually commented in the retrospective interview that she did not believe that the marriage metaphor was used in Danish. In other words, the participant regarded the metaphor as having a lower language-specific saliency in the target language. She wanted to retain some metaphorical expressions but did not wish to use the term *marriage* and therefore preferred to

paraphrase with *merger*. Therefore, the participant paraphrased AOI ID 19 and 20 but transferred some of the other ST metaphors directly into the TT. It is less relevant whether or not the participant was correct in stating that the marriage metaphor is not used in Danish, but more interesting that she had deliberated on the differences in metaphor use in the source and target language cultures and chose her translation strategy accordingly.

The above examples are by no means exhaustive, but the aim of this section was merely to provide a few illustrations of the choices made by the participants, which showed that the decisions made were by no means all more or less automatic or random despite the strong preference for the M-M translation strategy.

There also seemed to be some inclination to downplay the more creative or strong ST metaphors in the TTs. The English and Danish cultures and languages have many similarities but, based on this quick qualitative inspection, there would seem to be some distinct differences in the nature of the metaphors used with a preference for more conventional and less creative metaphors in Danish. Perhaps this tendency is not language-specific, and metaphors may tend to be less creative and/or more conventional in any translation or into translation into L1 as part of the normalisation or levelling-out that has been claimed to be a translation universal (Baker 1993, 1996: 176ff, and Halverson 2010: 350ff).

As a high number of the ST metaphors in the texts could be said to be quite creative or powerful in their imagery, it could be assumed that the deliberation of how to adapt these images to the target language would require an increased cognitive effort compared with literal expressions. This assumption was supported by the findings in Analysis 4, *Production Time*, in which metaphor AOIs had statistically significant longer production times than literal AOIs. This was the case even though the majority of the metaphors were still translated with the direct M-M strategy, indicating that any cultural gaps between the source and target languages were in fact not as wide as the qualitative analysis would seem to indicate.

Chapter 8 Potential Issues

The purpose of this section is to discuss potential weaknesses of the research design and their potential effect on the findings of this thesis.

The divergence of the findings from eye-tracking analyses 1-3 were interpreted as indication that the individual measures were reflective of various stages of cognitive processing. But there is of course also another potential explanation, which is that the eye-tracking method used was flawed.

Very few researchers have used eye-tracking for metaphor research, and there may be a good reason for this: it is difficult to formalise a definition for a metaphor's boundaries, and, furthermore, many metaphors are multiple-word units. The metaphors in the texts in this thesis consisted of both single-word and multiple-word metaphors. Multiple-word units can pose a problem in eye-tracking experiments in which it is preferable that the defined AOIs do not go beyond a line break, which may be difficult to avoid with multiple-word units. This difficulty could be one reason why many researchers have chosen to focus on metonymy rather than metaphors in eye-tracking experiments as metonymic expressions often are single-word units.

In going through the participants' key-logging files on an individual basis, there were indications that perhaps the definition of the AOI boundaries for the ST metaphors (and the comparison AOIs) was too restrictive. In one example, there was a considerable pause before the modal verb preceding a TT AOI equivalent (in this case, a metaphor),⁴⁸ but as the ST AOI did not include the modal verb, meaning that the eye-tracking analyses would not include any fixations on the modal verbs, it was decided that the key-logging data should not include the modal verbs either for reasons of comparability. But it does not seem unlikely that some form of pre-processing of the AOI would have taken place during the reading (and consequent production) of the modal verbs, and the key-logging data contained several examples which led to the concern that perhaps the original AOIs as defined in ClearView for the eye-tracking analyses were too restrictive by not including modal verbs or articles. The motivation for this

⁴⁸ AOI ID 9, "*wooing*", preceded by "*have been*" in experimental Text 3 (see Appendix 1).

was the assumption that the heaviest part of the cognitive effort would be found at the ‘core’ of the metaphor as defined in the methodology section (see section 4.4).

A possible explanation for the lack of a significant effect in Analysis 1 and 2 from Type alone (metaphor and comparison) could lie in the formalised criterion for the constituents of the AOI in the experiment. The AOI contained the metaphor vehicle (cf. Goatly’s definition in 3.1.1) as this unit was assumed to have the highest level of metaphoricity of the whole metaphor and therefore to be the unit most likely to produce clear results in the eye-tracking experiment. However, it is worth to consider if perhaps the results would have been different or if the findings of the eye-tracking analyses would have been more homogenous if the entire metaphor, not only the vehicle, was included in the AOI. In the current experiment, the cognitive effort related to metaphor comprehension was speculated to be more marked in the metaphor vehicle, but perhaps it is not possible to achieve any insight in metaphor comprehension (in this case for a reading for translation task) unless the metaphor is considered in its entirety.

It would be relevant to carry out a follow-up study in which the definition of the AOI boundaries was less restrictive to see if the indications from the significant interaction between the variables Type and Task found across all three eye-tracking analyses would perhaps also show up in a significant effect of Type alone, which was not the case in analyses 1 and 2 in this study, but only for Analysis 3. Such an analysis could also attempt to replicate the findings of Analysis 4, *Production Time*, which showed a significant effect of Type. A further benefit of such a study with less restrictive AOI definitions would be the opportunity to take the potential spill-over effects into account, which are regarded by some as a concern in eye-tracking studies, i.e. whether the effect of processing difficult words spill over onto subsequent words (Reichle 2011: 769).

However, Janus and Bever (1985) argued that the cognitive effort would be greatest at the point when the word is first encountered, which would suggest that a larger AOI, such as the entire sentence, may not be reflective of cognitive effort in metaphor processing. For an eye-tracking experiment, it would furthermore pose a number of issues if not only the metaphor vehicle but the entire sentence should be included in the AOI. This would mean that non-metaphorical words would be present in the AOI, and the gaze time for that particular AOI would then include non-metaphor gaze time. This would make it difficult to make any claims on metaphor

processing as the non-metaphorical words in the AOI must be assumed to have some effect on the results. By having the entire sentence as the AOI, it may not be possible to make any claims on the process of metaphor comprehension, but rather on sentences containing metaphoric expressions, which may be a more diffuse or vague concept. An investigation of metaphors embedded in sentences would have the benefit of analysis of the microproposition of the sentence. It may not be feasible to extract the processing of the metaphorical expression from the processing of the logical structure in which it is embedded. However, by investigating entire sentences, it would be necessary to take into account a host of other linguistic factors, which may influence the sentence processing. The problem of AOIs across line breaks would also be present.

Another potential issue is that the extent to which it was possible to simulate an authentic translation work environment can be questioned. Even though the ecological validity of the experiment was a priority in the experimental setup, there were still several elements which may have led the participants to take the translation task less seriously than they would have if the task had been an actual translation assignment by a paying customer. These elements included a lack of translation aids such as dictionaries and Internet-based resources. Several participants said that they would normally have looked up a word or investigated its meaning further and it does not seem unlikely to assume that a few of the participants would have made online searches to investigate the number of hits before deciding on a particular metaphor translation. This was not possible in this experiment and may have led to a more casual approach to the task as the work procedure was not typical. On the other hand, the participants knew that their translations would be scrutinised, which may have ensured that their professional pride was still keeping the translations up to the participants' usual standards.

Eye-tracking and key-logging analyses enable inferences to be made on the basis of indirect indications of cognitive effort. Without any direct verbalisations of perceived difficulties by the participants, any conclusions drawn are based on these indirect inferences. For example with regard to the inter-metaphor analyses and the qualitative analysis, it was only possible to speculate on the motivation behind the choice of translation strategy. For future research, it would be helpful to have cued retrospective interviews with the participants to perhaps learn more about their motivation for their translation choices as the choice of the M1-M2 translation

strategy could also be based in a fear of using too creative metaphors and preferring more conventional metaphors.

Although the issues discussed in this chapter indicate potential weaknesses in the experimental methodology, none of the issues were regarded as sufficient to cast the conclusions made from the analyses into doubt. Although the findings of analyses 1-3 were not uniform, the quality criteria placed on the eye-tracking data helped ensure a certain level of credibility to the results. That the key-logging data used in Analysis 4 showed that metaphors are more cognitively effortful to produce, when this was not uniformly confirmed by the eye-tracking analyses, was interpreted as indication that it is the actual production of the metaphors which are more cognitively demanding, rather than the comprehension, even for L2 metaphors.

However, the potential weaknesses in the experimental methodology also show the need for this study to be followed up with studies addressing these potential issues, to see if the findings can still be replicated.

Chapter 9 Conclusion

The aim of this thesis was to investigate cognitive effort invested in metaphor translation. Glucksberg (2001) and Inhoff et al. (1984) stated that metaphors are not ambiguous and do not require more cognitive effort to process than literal expressions. However, these statements were based on monolingual studies, and Dagut (1987) and Newmark (1988) claimed that metaphors should be regarded as a particular translation problem. However, their viewpoints were not verified empirically, and this thesis sought to shed light on the various views on metaphor in both comprehension and production, but always from a translation perspective.

Because of the opposing views on metaphor processing and production, research questions were preferred over hypotheses as the point of departure for the thesis' investigation. The research questions asked whether or not it required more cognitive effort to translate metaphors compared with literal expressions. The methodology was a quantitative study in which 17 professional translators were asked to translate two texts from English (L2) into Danish (L1). Their eye movements were recorded in ClearView during the translation process and their typing activities logged in Translog. The translation process was regarded as a fundamentally horizontal process with rapid vertical shifts between the source and target texts following the arguments of Mossop (2003) and Hvelplund (2011). Comprehension was assumed to be the main process taking place when attention was on the source text as evidenced by eye movements, whereas the main process was assumed to be production when attention was on the target text as evidenced by typing activity.

Based on Goatly's (1997) definition of the vehicle, the boundary defined for the AOIs was the word(s) in the metaphorical expression different from the text in general in terms of semantic domain. A number of non-metaphorical expressions were chosen to serve as comparison AOIs in the statistical analyses. The statistical analyses were done using an LMER model allowing for more ecological validity in terms of the experimental texts, which made it possible to control for various textual differences between the AOIs such as length, word frequency and word-co-occurrence probability.

Underlying the eye-tracking analyses was the eye-mind assumption (Just and Carpenter 1980), stating that the mind is processing what the eyes are currently focused on. Following this assumption, differences in gaze measures between the metaphor and comparison AOIs were taken as indication of differences in cognitive effort. In other words, a difference in *Total Fixation Time* as investigated in Analysis 1 would be interpreted as a difference in cognitive effort invested in the processing of the word(s) within the AOI in question.

Following standard practices in eye-tracking research, no less than three gaze measures were reported (analyses 1-3), in which differences between metaphor and comparison AOIs were investigated. Analysis 1 was the most comprehensive measure, *Total Fixation Time*. Analysis 2 investigated differences in *Total Fixation Number*, which was regarded as a supplementary measure to Analysis 1. Analysis 3 investigated *First Pass Fixation Time*. A subanalysis (Analysis 1.1) was an investigation of inter-metaphor differences with *Total Fixation Time* as the measure of cognitive effort.

There was no significant effect of Type, i.e. metaphor or non-metaphor, in analyses 1 and 2, but there was a significant interaction between the variables Type and Task, i.e. reading for comprehension or reading for translation, which was found across all three eye-tracking analyses. This interaction meant that there was a significant difference in the effect of Type depending on the task, reading for comprehension or translation. In other words, there was no significant effect of Type alone in analyses 1 and 2, but it did enter into a significant interaction. As illustrated by Figure 13 for *Total Fixation Time* and Figure 19 for *First Pass Fixation Time* respectively, this difference in effect suggested that metaphors resulted in shorter fixation times when the task was reading for comprehension, but conversely resulted in longer fixation times when the task was reading for translation. In other words, Analysis 1 and 2 offer support for the direct processing model and the claims of Glucksberg (2001) and Inhoff et al. (1984) that, when presented in context, metaphors are not more cognitively effortful to comprehend than non-metaphors. The findings could also be regarded as support for the tentative findings of Noveck et al. (2001) that metaphors facilitated comprehension.

However, because this tendency was not confirmed by a significant effect of the variable Type alone in analyses 1 and 2, but only in Analysis 3, this claim would have to be verified by further

studies, perhaps with larger samples and perhaps with less restrictive AOI definitions as discussed in Chapter 8.

But the significant effect of Type found in Analysis 3, *First Pass Fixation Time*, does offer some support for the assumption that metaphors are more cognitively effortful to process in a translation task than literal expressions as first pass fixation times were significantly longer for metaphor AOIs compared with non-metaphor AOIs. However, as the difference between the two types of AOIs was only significant in Analysis 3, it was concluded that the significant effect of metaphor was caused by some form of unexpectedness or surprise, which could not be accounted for by the word-in-context probability values in the variable Trigram Probability. This effect disappeared in the more comprehensive measure, *Total Fixation Time*. In other words, metaphors are perhaps more unexpected, but not necessarily more cognitively effortful to comprehend than literal expressions. It is important to remember that this is even though the metaphors were in the participants' L2 and the task was reading for translation.

A secondary finding of Analysis 3 was that first pass fixation times were significantly shorter when reading for translation than for reading for comprehension. This finding was counter to Jakobsen and Jensen's (2008) findings of longer fixations in a translation task compared with a reading for comprehension task, but the results were interpreted as support of Hvelplund's (2011) view of the translation process as neither strictly horizontal or vertical, but rather as a series of rapid attention shifts between the ST and TT, i.e., between comprehension and production. These shifts did not take place to the same extent in the reading for comprehension task in which the participants were required to retype the ST to ensure a certain level of comparability with the translation task. Although the ST was being reproduced, the participants did not monitor the output as was the case when translating, suggesting that the typing was automated to a certain extent. In other words, the effect of the translation task was an increase in shifts between ST and TT, which was interpreted as indication of the need for monitoring own output in the TT against the ST.

The inter-metaphor investigation in Analysis 1.1. did not find any significant effect from the variable *Metaphor Familiarity*, which suggests that familiarity was not a strong predictor of cognitive effort in L2 metaphor comprehension counter to expectations based on the arguments of Gentili et al. (2008) and Danks and Griffin (1997). Although not investigated directly, the

lack of effect from *Metaphor Familiarity* could be interpreted as indirect support for Giora's (1997) graded salience hypothesis, stating that saliency takes precedence over metaphoricity, conventionality, and frequency as a predictor of cognitive effort in processing linguistic structures. Following this line of thought, metaphors should be regarded as no different from any other linguistic unit. However, as saliency was not investigated directly, it remains unclear whether saliency does in fact take precedence over metaphoricity.

Following Dobrzynska (1995) and Schäffner (2005), the translation strategies available for metaphor translation were divided into three categories, either a direct transfer of the ST image (M-M), paraphrasing (M-P) or replacing the ST image with a new image (M1-M2). Research questions 3 and 4 queried whether a translation strategy of paraphrasing or replacing the ST image with a new image in the TT would be more cognitively effortful than a direct transfer of the ST image. The answers to these research questions were sought in Analysis 1.1., which investigated whether or not there was any significant effect on the dependent variable, *Total Fixation Time*, from *Translation Strategy*. The analysis used the direct translation strategy M-M as the basis of comparison against which the effect of the remaining two variables was measured. However, no significant effect was found for either M-P or M1-M2 in Analysis 1.1, which was taken to mean that any differences in the cognitive effort of choosing and implementing a translation strategy would be present in the production data, i.e., the key-logging data, and not the comprehension data. In other words, the participants were assumed to spend cognitive effort on translation strategy immediately before production and not during comprehension.

The production stage of the translation process was investigated in Analysis 4 in which the log files from Translog were analysed. The dependent variable in Analysis 4 was *Production Time*, a measure including preceding and inter-word pauses, and the regions analysed were the AOI equivalents in the TTs. Research question Two queried if translation of metaphorical expressions into L1 would require more cognitive effort than the translation of literal expressions. If Dagut (1987) and Newmark (1988) were correct that metaphors are a translation problem, then this should have been evidenced through longer production times compared with literal expressions.

As production times were indeed found to be significantly longer for the metaphor AOI equivalents in the TT compared with the non-metaphor AOI equivalents, the view of metaphor as a translation problem is confirmed by Analysis 4. Conversely, the claims of Mason (1982) that the problems of metaphor translation are not specific to metaphors but rather to translation in general would seem to be disproved as the metaphors in question in this study were compared directly with non-metaphors from the same texts.

The focus of research questions Three and Four was any possible difference in cognitive effort linked to the choice of translation strategy, following the categorization of Dobrzynska (1995) and Schäffner (2005). This was investigated in Analysis 4.1, which was an inter-metaphor analysis comparable to Analysis 1.1. The majority of metaphor AOIs was translated into the same image (M-M), in line with earlier findings by Wikberg (2004), with far fewer translations into paraphrase (M-P) and even fewer into a new image (M1-M2). The retrospective interviews carried out after each translation were not able to clarify whether this preference for a direct transfer of the metaphorical image was because it was deemed to be equally salient in the target language following Trim's (2007) terminology or because the participants lacked the necessary problem-solving skills to find the most suitable translation strategy (Wilss 2001). It was speculated that the translators' had a default direct transfer strategy, which was only replaced by an indirect translation strategy when the translator found it necessary.

Regardless of the motivations for the translation choices, the indirect translation strategy M1-M2 was found to result in significantly longer production times than the direct translation strategy M-M. It was argued that the increased cognitive effort could be due to the duality of the M1-M2 translation strategy in which the participant must not only interpret and discard the ST metaphor as suitable in the TT, but she must find a target language metaphor which expresses the same meaning but which has a higher language-specific saliency than the ST metaphor, i.e. is more suitable to the target language. The data did not reveal whether the M1-M2 translation strategy was the least preferred because it was more cognitively effortful to use or if it was more cognitively effortful because it was used less frequently.

The brief qualitative analysis in section 7 discussed a few of the more interesting translation choices made by the participants as well as the comments made by the participants during the retrospective interviews. The retrospective interviews were able to reveal that the metaphors

were identified as metaphorical by at least some of the participants. None remarked on the metaphors as being difficult to translate, but a few commented on deliberate considerations on the appropriateness of transferring the ST metaphor image into the TT. In hindsight, cued retrospective interviews might have elicited more elaborate responses. Another aspect, which would help shed light on the findings in a replication of this study, would be in-depth information about the professional competence and experience of each individual participant, in particular information about metaphor translation experience.

By looking at the translations produced by the participants, it was concluded that there seemed to be a tendency to downplay some of the more elaborate or creative metaphorical images in the ST with a more conventional metaphor in the TT, a tendency which is frequently regarded as a translation universal.

To summarise the findings of the thesis, there was some indication that metaphors may facilitate comprehension, but not translation. However, both of these claims require further investigation. The significant effect of Type found in Analysis 3 suggested that the metaphorical expressions may be more unexpected than literal expressions. The actual production of the TT metaphors was found to be more cognitively effortful than production of literal expressions as found by the significant effect of Type in Analysis 4.

Furthermore, the results showed that there was a difference in cognitive effort depending on the chosen translation strategy, which may be related to the nature of the ST metaphor or be an artefact of the translation strategy of replacing the ST image with a new TT image. The results could be interpreted as indication that the translator will choose the path of least resistance, i.e. a direct transfer translation strategy. In other words, she will prioritise her cognitive resources and not spend more cognitive effort on a translation strategy than necessary.

Historically, there has been little, if any, empirical research in metaphor from a translation process perspective, and the aim of this thesis was to combine the more traditional qualitative translation analysis with quantitative analyses, using the methodologies best suited for investigation of the two stages in the translation process, comprehension and production, which were investigated individually. That the findings are not homogenous is not regarded as a weakness, but rather interpreted as confirmation that the different data streams reflect different

stages of cognitive processing and shows the applicability of quantitative research in metaphor translation as well as the need for more research in this field. The application of a linear mixed-effects regression model in translation research showed the potential for experimental methodology with a relatively high degree of ecological validity while still being able to control for a number of potential effects. The findings of this study also show the need for further studies within the fields of both metaphor translation and translation process research.

9.1 Future Avenues of Research

As discussed in chapter 8, there was some concern that the delimitation of the ST AOIs and the corresponding TT AOI equivalents was too restrictive. It would be a relevant follow-up study to use the same experimental texts but with more comprehensive AOIs, perhaps covering entire sentences. This would enable investigation of the metaphor embedded in its microproposition, i.e. the sentence, which may be processed as one semantic unit, as metaphor processing is dependent on supporting context. This would, however, present other problems such as wrap-up effects at end of sentences as well as effects from other constituents in the texts. Therefore, such a study should not be regarded as a stand-alone study but as a complement to the study presented here in this thesis.

Another complementary study could be a replication of the current study carried out with a different language pair with a wider linguistic and cultural gap in which it would be less appropriate or possible to transfer the ST metaphors directly into the TT to see if this would result in a reduced proportion of the M-M translation strategy. Another relevant replication of the current study would entail a brief in which the participants were instructed that the translation quality would be assessed. This could perhaps prompt the participants to be more deliberate in their choice of translation strategy, in which case the direct transfer translation strategy may perhaps become less frequent.

It would also be highly relevant to follow up the inter-metaphor analyses 1.1 and 4.1 with a study in which the translators received training in metaphor translation before the experiment and were made aware of the underlying conceptual structures often found in e.g. financial texts to investigate if this acquired knowledge would provide a different result than the one reported here in which the M-M strategy was by far the most frequent. Crerar-Bromelow argued for the

necessity of making the translator familiar with the underlying conceptual metaphors in order to move away from “mere word-for-word equivalence” (Crerar-Bromelow 2008: 89).

For both complementary studies, cued retrospective interviews could be of great value. After the translation of each text, the participant should be presented with a replay of her own translation process as recorded in ClearView. This would be assumed to elicit more detailed responses from the participant as she would be able to see a replay of where she may have paused or backtracked when reading and typing. As such cued retrospective interviews are quite time consuming, it may not be realistic to expect all participants to be available for such an extensive interview. But the cued retrospective interviews could be carried out with a smaller group of the participants with the remaining participants only subjected to the less time consuming standard interview.

This thesis has taken the first step into an empirically oriented investigation of the cognitive effort of metaphor translation, and the findings of this thesis constitute a first contribution to a niche in translation process research and translation studies in general.

Dansk resumé

Denne afhandling med titlen *Cognitive Effort in Metaphor Translation – an eye-tracking and key-logging study* er en empirisk undersøgelse af professionelle oversætteres kognitive belastning under oversættelse af metaforer. Metaforer er billedlige udtryk, hvor et koncept bruges til at karakterisere et andet koncept såsom *Peter er en ulv*, hvor ulvens karakteristiske egenskaber overføres på Peter. Afhandlingen tager udgangspunkt i *direct access*-synet på metaforer, hvor metaforer betragtes som værende utvetydige udtryk, der fortolkes direkte som metaforiske.

Metaforer har primært været genstand for forskning i monolinguale studier, hvor blandt andre Glucksberg (2001) og Inhoff m.fl. (1984) undersøgte, hvordan metaforer processeres samt hvilken kognitiv belastning, der er forbundet med denne processering. Konklusionen på deres undersøgelser var, at metaforer ikke udgør nogen særlig kognitiv belastning i forståelsesprocessen, og at metaforer grundlæggende ikke er mere tvetydige end bogstavelige udtryk.

Dagut (1987) og Newmark (1985, 1988) har beskæftiget sig med metaforer ud fra et oversættelsesperspektiv, og de betragtede metaforer som et særligt problem inden for oversættelse. Trim (2007) hævdede, at metaforers oversættelighed var afhængig af deres sprogspecifikke *saliency*.

Hverken Dagut, Newmark eller Trim anvendte empiriske metoder i deres undersøgelser, og formålet med denne afhandling er at bygge bro mellem de empiriske metoder anvendt inden for forskning i metaforforståelse og de mere kvalitative metoder anvendt inden for forskning i metaforoversættelse.

17 danske oversættere deltog i undersøgelsen. Deres L1 var dansk og deres L2 var engelsk. De blev bedt om at afskrive to korte tekster, og derefter blev forsøgspersonerne bedt om at oversætte to tekster fra engelsk til dansk. Efter hver enkelt tekst blev forsøgspersonerne bedt om at besvare enkelte spørgsmål om teksterne og processen. Deres øjenbevægelser og

tasteaktiviteter blev registreret i programmerne ClearView og Translog, og disse data ligger til grundlag for analyserne i afhandlingen.

Grundet de modstridende synspunkter om metaforforståelse blev det foretrukket at arbejde ud fra åbne forskningsspørgsmål frem for hypoteser. Der blev formuleret fire forskningsspørgsmål som grundlag for undersøgelse. Forskningsspørgsmål Et gik på, hvorvidt *forståelse* af L2-metaforer ville udgøre en større kognitiv belastning end forståelse af L2-bogstavelige udtryk. Forskningsspørgsmål To gik på, hvorvidt *oversættelse* af L2-metaforer til L1 ville udgøre en større kognitiv belastning end oversættelse af L2-bogstavelige udtryk.

Disse to forskningsspørgsmål blev suppleret af to yderligere forskningsspørgsmål, der udelukkende vedrørte metaforoversættelse. Forskningsspørgsmål Tre gik på, hvorvidt oversættelse af en metafor med en parafrase udgjorde en større kognitiv belastning end oversættelse med en direkte overførsel af det metaforiske billede i kildeteksten.

Forskningsspørgsmål Fire gik på, hvorvidt oversættelse af en metafor med en anden metafor udgjorde en større kognitiv belastning end oversættelse med en direkte overførsel af det metaforiske billede i kildeteksten.

Programmet ClearView registrerede forsøgspersonernes øjenbevægelser under læsning af kildeteksterne, og disse data blev analyseret i fire separate statistiske analyser, der alle var opbygget ud fra den samme model i inferentiel statistik, en såkaldt *linear mixed-effects regression model*. Den grundlæggende antagelse bag analysen af øjenbevægelserne var Just og Carpenters (1980) *eye-mind assumption*, der antager, at hjernen processerer, hvad øjnene fikserer. Der blev både undersøgt forskelle på læsning og oversættelse, forskelle mellem metaforer og ikke-metaforer samt forskelle mellem metaforer. Analyse 1, *Total Fixation Time*, og Analyse 2, *Total Fixation Number*, fandt ingen signifikant forskel mellem metaforer og ikke-metaforer, når de blev læst med henblik på oversættelse, hvorimod Analyse 3, *First Pass Fixation Time*, fandt en signifikant forskel mellem de to typer. Der var desuden en signifikant interaktion mellem variablerne Type og Task i alle tre analyser, der antydede en vis forståelsesfacilitering af metaforer, men ikke facilitering af oversættelse. Denne interaktion kræver dog videre undersøgelse.

Programmet Translog registrerede forsøgspersonernes tasteaktiviteter under oversættelsen af kildeteksterne, og disse data blev analyseret i en hovedanalyse (Analyse 4) samt en underanalyse (Analyse 4.1.) med sammenligning af metafor med metafor. Analyse 4 undersøgte forskelle i *Production Time* som et udtryk for forskelle i kognitiv belastning under oversættelse af metaforer sammenlignet med ikke-metaforer. Konklusionen var, at oversættelse af metaforer var signifikant langsommere at oversætte sammenlignet med ikke-metaforer, hvilket støtter Newmarks syn på metaforer som et oversættelsesproblem. Analyse 4.1 undersøgte forskelle i kognitiv belastning afhængig af forsøgspersonernes bekendthedsgrad med de enkelte metaforer samt den valgte oversættelsesstrategi i en intermetaforisk analyse. Konklusionen, der besvarede forskningsspørgsmål Tre og Fire, var, at der ikke var nogen signifikant forskel i den kognitive belastning forbundet med at vælge en parafrase som oversættelsesstrategi sammenlignet med en direkte overførsel af det metaforiske billede i kildeteksten. Derimod indikerede resultaterne, at en oversættelsesstrategi, hvor det metaforiske billede i kildeteksten erstattes af et nyt metaforisk billede i måltekten, er mere kognitivt belastende end en direkte overførselsstrategi.

En kortere kvalitativ analyse af forsøgspersonernes svar i de retrospektive interviews samt af oversættelsesprodukterne afslørede, at oversætterne var bevidste om de metaforiske udtryk, men ikke betragtede dem som værende problematiske. Der var dog forskel på, i hvor høj grad forsøgspersonerne gav udtryk for deres overvejelser vedrørende oversættelsesstrategier. Forsøgspersonernes oversættelser viste en udpræget præference for en direkte overførsel af det metaforiske billede fra kildeteksten, og i de tilfælde, hvor en anden oversættelsesstrategi blev valgt, var det ikke altid tydeligt, at dette var et bedre løsningsforslag.

Kombinationen af både kvantitative og kvalitative data gav mulighed for en bredere synsvinkel på metaforoversættelse fra et procesorienteret perspektiv, og især de kvantitative analyser har grebet den primært intuitive opfattelse af metaforer som et oversættelsesproblem an fra en ny vinkel og dermed bidraget til et bredere perspektiv.

Abstract

This thesis, titled *Cognitive effort in metaphor translation – an eye-tracking and key-logging study*, is an empirical investigation of professional translators' cognitive effort during metaphor translation. Metaphors are defined as expressions in which one concept is used to characterise another concept, such as *Peter is a wolf* in which the characteristics of the wolf are used to define Peter. As a point of departure, the thesis adopts the direct access view of metaphors in which metaphors are regarded as unambiguous expressions which are interpreted as metaphors directly.

Metaphors have primarily been researched in monolingual studies such as Glucksberg (2001) and Inhoff et al. (1984), who investigated how metaphors are processed and the cognitive effort required for this processing compared with literal expressions. The conclusion to their studies was that metaphors were not more cognitively effortful to process than literal expressions and that they were not necessarily more ambiguous either.

Dagut (1987) and Newmark (1985, 1988) discussed metaphors from a translation perspective in which they regarded metaphors as a particular translation problem. Trim (2007) argued that the translatability of metaphors was related to their language-specific saliency.

Neither Dagut, Newmark or Trim was empirical in his methodology, and the purpose of this thesis was to bridge the gap between the empirical methodology used in metaphor comprehension research and the more qualitative methodology used in metaphor translation research.

17 Danish professional translators were participants. Their L1 was Danish and their L2 English. The participants were asked to retype two short texts and afterwards to translate two texts from English to Danish. The participants were asked a few questions about the text after each individual text. Their eye movements and typing activities were registered in the programs ClearView and Translog, and these data streams were used in the analyses reported in the thesis.

As a result of the many opposing views of metaphor processing, research questions were preferred over hypotheses. Four research questions were formulated to serve as the basis for the investigation. Research question One asked whether L2 metaphor *comprehension* would be more cognitively effortful than comprehension of L2 literal expressions. Research question Two asked whether L2 metaphor *translation* would be more cognitively effortful than translation of L2 literal expressions.

These two research questions were supplemented by two additional research questions, which only pertained to metaphor translation. Research question Three asked whether a paraphrase translation strategy would be more cognitively effortful than a direct transfer translation strategy. Similarly, research question Four asked whether translation of the source text metaphor with a different metaphor would be more cognitively effortful than a direct transfer translation strategy.

The program ClearView registered the participants' eye movements during reading of the source texts, and these data were analysed in five separate statistical analyses. All five analyses were based on the same model in inferential statistics, a *linear mixed-effects regression* model. The underlying assumption behind the analyses was Just and Carpenter's (1980) *eye-mind assumption*, stating that the mind will process what the eyes are fixating. Comparisons were made between reading for comprehension and reading for translation, metaphor versus non-metaphor as well as inter-metaphor. Analysis 1, *Total Fixation Time*, and Analysis 2, *Total Fixation Number*, found no significant difference between metaphor and non-metaphor AOIs whereas there was a significant difference in Analysis 3, *First Pass Fixation Time*. However, there was a significant interaction between the variables Type and Task found across all three eye-tracking analyses, which would seem to suggest that metaphors facilitate comprehension, but not translation. However, this assumption requires further investigation.

Translog registered the participants' typing activities during translation of the source texts, and these data were analysed in Analysis 4 as well as a subanalysis (Analysis 4.1.), which was an inter-metaphor comparison. Analysis 4 investigated differences in *Production Time*, which were taken to indicate differences in cognitive effort during translation of metaphors compared with non-metaphors. The conclusion made on the basis of the data was that metaphors are indeed more cognitively effortful to translate than non-metaphors, which supports the claims of Dagut

(1987) and Newmark (1988) that metaphor is a particular translation problem. The inter-metaphor Analysis 4.1 investigated differences in cognitive effort relative to the participants' familiarity with the metaphors as well as their chosen translation strategies. The conclusion and reply to research question Three was that it is not significantly more cognitively effortful to paraphrase the source text metaphor rather than use a direct transfer translation strategy. However, the results indicated that it was significantly more cognitively effortful to translate the source text metaphor with a different metaphorical image, which answered research question Three.

A brief qualitative analysis of the responses made by the participants in the retrospective interviews as well as the translations revealed that the participants were aware of the metaphors in the source texts, but that they were not considered problematic. However, there were quite a few differences in the extent to which the participants expressed their considerations concerning translation strategy. The produced translations showed a marked preference for the direct transfer translation strategy, and in the few instances in which a different translation strategy was chosen, it was not always clear whether this was in fact a better choice of translation.

The combination of quantitative and qualitative data enabled a broader view of metaphor translation from a process-oriented perspective, and the quantitative analyses in particular have investigated the somewhat intuitive persuasion that metaphors constitute a translation problem from a new angle and thereby contributed to a broader perspective.

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Appendices

Appendix 1: Experimental texts

Experimental Text 1

American Express recently announced a second round of job cuts. The announcement sent a shiver through the market for bonds backed by credit card debt. The rise in unemployment has spattered a once-profitable business with red ink. As hopes that credit cards would avoid the pain felt in mortgages have dwindled, so has any chance of the industry avoiding a political backlash. This week the Congress voted through a bill that would sharply restrict card issuers' ability to charge punitive fees and raise interest rates. The industry's claim that the bill will choke off access to credit is a bit rich given its own rush to reduce its unsecured lending. Morgan Stanley expects the big three issuers to post losses in their card businesses this year and next. Little wonder, then, that card issuers feel shell-shocked. When they clamber back into profit, they can expect returns on assets of only one-half of pre-crisis levels.

Experimental Text 2

Say you go to a bank to get a loan. The bank lends you money. Then it packages your loan with a bunch of others into a bond. Investors buy the bond because they like the steady stream of cash that comes from people slowly paying off their debt. This goes on for a long while. Then one day, you need another loan. But this time, there is no money to lend because the global financial system has turned upside down, and the market for securitization - the process of packaging loans into bonds and freeing up cash for more lending - has fallen off a cliff. We're now suffering a financial Chernobyl, and securitization is radioactive. It enabled us to gorge on money, which is what got us into this mess. The task now is to find the proper role for securitization so that it doesn't detonate again.

Experimental Text 3

Every time you look around, it seems like companies are trying to hook up. The proposed marriage of Air France-KLM and Delta Air Lines is the latest to make the rounds. But the suitors must first gain the approval of regulators, who are sure to supervise the courtship with care because of the size of the dowry. The path from the altar is strewn with failed corporate marriages. Still, the matchmaking continues apace. British Airways and Spanish carrier Iberia have been wooing one another for the better part of a year. In March, pharmaceutical giants Merck and Plough-Schering announced their intention to wed. Fiat has ambitious plans to merge with Chrysler and the European operations of General Motors to spin off into a new car company. And the on-again, off-again plans of Porsche and Volkswagen to tie the knot have been dominating the business pages for months.

Experimental Text 4

The Bank of England's home in Threadneedle Street may not look like a hospital but for the past few months it has been acting like one. As the economic downturn became a full-blown collapse late last year, the central bank's senior consultants donned their white coats and got to work. First they put their scalpel to interest rates, slicing them from 5% in early October to an all-time low of 0.5% in March. Not content with that, they switched at once from scalpel to syringe and started to inject money into the economy by buying assets with freshly created central-bank money. As with the preceding rate cuts, the new treatment has been administered in big doses. However, a swift return to economic health is highly unlikely after the financial and economic convulsions of the past two years. A prolonged convalescence is the best that can be expected.

Appendix 2: Translation brief and instructions

(Translation of original brief in Danish)

You will be presented with 4 texts in English. The texts are each approximately 150 words. You will have the same task for the first two texts and another task for the last two texts. There is no time pressure and also no aids.

Task One: Please read the text to make sure you understand it and retype the text in the bottom half of the window. You will subsequently be asked to answer a few questions about the content of the text (you will not be asked to recollect numbers and other details). Please do not just copy and paste the text from the top half window.

Task Two: This time you must translate the text in the lower half of the window. You are free to edit the text during and after production. There are no translation tools and no time pressure. You will subsequently be asked a few questions about the content of the text and your considerations regarding the translation. The target group for the translation are the readers of a Danish financial magazine.

Appendix 3: Retrospective interview

Comprehension questions

Text 1: Good or bad time for the credit card industry?

Text 2: What is securitization?

Text 3: Are there few or many mergers at the moment?

Text 4: What did Bank of England do to the interest rate?

Questions for reading task x 2

- 1) Difficult to understand?
- 2) Any specific terms or phrases that were difficult to understand?

Questions for translation task x 2

- 1) Difficult to understand?
- 2) Any specific terms or phrases that were difficult to understand?
- 3) Any words or phrases that were difficult to translate?

Appendix 4: List of AOIs

AOI ID	Word(s)	Text	Type
1	Hook up	3	Met
2	Marriage	3	Met
3	Suitors	3	Met
4	Courtship	3	Met
5	Dowry	3	Met
6	The path from the altar is strewn	3	Met
7	marriages	3	Met
8	Matchmaking	3	Met
9	Wooing	3	Met
10	Wed	3	Met
11	Tie the knot	3	Met
13	Collapse	4	Met
14	Scalpel	4	Met
15	Slicing	4	Met
16	Scalpel	4	Met
17	Syringe	4	Met
18	Inject	4	Met
19	Treatment	4	Met
20	Administered	4	Met
21	Doses	4	Met
22	Health	4	Met
23	Convulsions	4	Met
24	Convalescence	4	Met
25	Donned their white coats	4	Met
27	Shiver	1	Met
28	Spattered	1	Met
29	Red ink	1	Met
30	Pain	1	Met
31	Choke	1	Met
32	Shell-shocked	1	Met
33	Clamber	1	Met
35	Turned upside down	2	Met
36	Fallen off a cliff	2	Met
37	Chernobyl	2	Met
38	Radioactive	2	Met
39	Gorge	2	Met

40	Detonate	2	Met
42	market	1	Comp
43	credit cards	1	Comp
44	industry	1	Comp
45	voted	1	Comp
46	raise	1	Comp
47	reduce	1	Comp
48	expects	1	Comp
49	packages your loan	2	Comp
50	investors	2	Comp
51	paying off their debt	2	Comp
52	freeing	2	Comp
53	proper	2	Comp
54	money	2	Comp
55	look around	3	Comp
56	approval	3	Comp
57	regulators	3	Comp
58	supervise	3	Comp
59	care	3	Comp
60	year	3	Comp
61	announced	3	Comp
62	has ambitious plans to merge	3	Comp
63	operations	3	Comp
64	company	3	Comp
65	dominating	3	Comp
66	home	4	Comp
67	months	4	Comp
68	has been acting	4	Comp
69	downturn	4	Comp
70	year	4	Comp
71	october	4	Comp
72	economy	4	Comp
73	buying	4	Comp
74	assets	4	Comp
75	created	4	Comp
76	money	4	Comp
77	rate cuts	4	Comp
78	return	4	Comp

Appendix 5: Presentation of metaphor AOIs to rater group

The metaphors were presented within the sentence but without further contextual support. The presentation order of the metaphors was randomised between the participants and this table represents only one of the presented orders. The metaphor AOIs are highlighted in red as they also were when presented to the raters.

Please rate each metaphor on how familiar the metaphor seems to you	1 = not at all familiar and 7 = very highly familiar
A prolonged convalescence is the best that can be expected	
And the on-again, off-again plans of Porsche and Volkswagen to tie the knot have been dominating the business pages for months	
As hopes that credit cards would avoid the pain felt in mortgages have dwindled, so has any chance of the industry avoiding a political backlash	
As the economic downturn became a full-blown collapse late last year, the central bank’s senior consultants donned their white coats and got to work	
As the economic downturn became a full-blown collapse late last year, the central bank’s senior consultants donned their white coats and got to work	
As with the preceding rate cuts, the new treatment has been administered in big doses	
As with the preceding rate cuts, the new treatment has been administered in big doses	
As with the preceding rate cuts, the new treatment has been administered in big doses	
British Airways and Spanish carrier Iberia have been wooing one another for the better part of a year	
But the suitors must first gain the approval of regulators, who are sure to supervise the courtship with care because of the size of the dowry	
But the suitors must first gain the approval of regulators, who are sure to supervise the courtship with care because of the	

size of the dowry

But the suitors must first gain the approval of regulators, who are sure to supervise the courtship with care because of the size of the **dowry**

But this time, there is no money to lend because the global financial system has **turned upside down**, and the market for securitization - the process of packaging loans into bonds and freeing up cash for more lending - has fallen off a cliff

Please rate each metaphor on how familiar the metaphor seems to you

1 = not at all familiar and 7 = very highly familiar

But this time, there is no money to lend because the global financial system has turned upside down, and the market for securitization - the process of packaging loans into bonds and freeing up cash for more lending - has **fallen off a cliff**

First they put their **scalpel** to interest rates, slicing them from 5% in early October to an all-time low of 0.5% in March

First they put their scalpel to interest rates, **slicing** them from 5% in early October to an all-time low of 0.5% in March

However, a swift return to economic **health** is highly unlikely after the financial and economic convulsions of the past two years

However, a swift return to economic health is highly unlikely after the financial and economic **convulsions** of the past two years

In March, pharmaceutical giants Merck and Plough-Schering announced their intention to **wed**

It enabled us to **gorge** on money, which is what got us into this mess

Little wonder, then, that card issuers feel **shell-shocked**

Not content with that, they switched at once from **scalpel** to syringe and started to inject money into the economy by buying assets with freshly created central-bank money

Not content with that, they switched at once from scalpel to **syringe** and started to inject money into the economy by buying assets with freshly created central-bank money

Not content with that, they switched at once from scalpel to syringe and started to **inject** money into the economy by buying assets with freshly created central-bank money

Still, the matchmaking continues apace	
The announcement sent a shiver through the market for bonds backed by credit card debt	
The industry's claim that the bill will choke off access to credit is a bit rich given its own rush to reduce its unsecured lending	
Please rate each metaphor on how familiar the metaphor seems to you	1 = not at all familiar and 7 = very highly familiar
The path from the altar is strewn with failed corporate marriages	
The path from the altar is strewn with failed corporate marriages	
The proposed marriage of Air France-KLM and Delta Air Lines is the latest to make the rounds	
The rise in unemployment has spattered a once-profitable business with red ink	
The rise in unemployment has spattered a once-profitable business with red ink	
The task now is to find the proper role for securitization so that it doesn't detonate again	
We're now suffering a financial Chernobyl , and securitization is radioactive	
We're now suffering a financial Chernobyl, and securitization is radioactive	
When they clamber back into profit, they can expect returns on assets of only one-half of pre-crisis levels	
Every time you look around, it seems like companies are trying to hook up	

Appendix 6: Metaphor familiarity ratings

AOI ID	Word	Rater1	Rater2	Rater3	Rater4	Average
1	Hook up	7	5	1	1	3.5
2	Marriage	5	2	6	7	5
3	Suitors	7	6	4	7	6
4	Courtship	6	2	4	7	4.75
5	Dowry	7	7	2	7	5.75
6	The path from the altar is strewn	7	1	2	7	4.25
7	marriages	4	2	5	7	4.5
8	Matchmaking	6	7	3	7	5.75
9	Wooring	7	6	4	7	6
10	Wed	7	1	3	7	4.5
11	Tie the knot	7	6	5	7	6.25
13	Collapse	7	7	7	7	7
14	Scalpel	6	3	1	1	2.75
15	Slicing	7	4	3	1	3.75
16	Scalpel	6	3	1	1	2.75
17	Syringe	6	3	3	1	3.25
18	Inject	7	7	5	7	6.5
19	Treatment	7	7	5	7	6.5
20	Administered	6	7	6	7	6.5
21	Doses	6	7	6	7	6.5
22	Health	7	7	7	7	7
23	Convulsions	6	3	2	1	3
24	Convalescence	7	3	1	7	4.5
25	Donned their white coats	3	1	2	4	2.5
27	Shiver	7	7	4	7	6.25
28	Spattered	6	1	1	1	2.25
29	Red ink	6	7	4	1	4.5

30	Pain	5	1	2	7	3.75
31	Choke	4	2	2	3	2.75
32	Shell-shocked	7	7	2	7	5.75
33	Clamber	2	1	2	1	1.5
35	Turned upside down	7	7	5	7	6.5
36	Fallen off a cliff	5	6	2	7	5
37	Chernobyl	7	7	1	7	5.5
38	Radioactive	6	2	1	1	2.5
39	Gorge	5	1	1	1	2
40	Detonate	6	6	4	7	5.75

Appendix 7: Total Fixation Time - absolute values (ms)

Total Fixation Time								
	Reading				Translation			
	Text1		Text2		Text3		Text4	
Participant	Meta phor	Compa rison	Meta phor	Compa rison	Meta phor	Compa rison	Meta phor	Compa rison
1	12079	12201	10186	12223	23855	23696	22725	26246
2	6596	9568	8633	3090	13213	19772	12551	7632
3	4365	4205	5243	2412	27054	18414	24797	9450
4	9149	7416	14494	11842	22903	10922	16863	5862
5	16027	11557	6638	7716	71824	14554	27242	9628
6	4546	13573	11778	9389	27169	24593	28859	13956
7	3566	2134	4465	4522	11415	15364	8193	11621
8	6996	3168	3231	4245	25796	20799	16593	8191
9	16865	18954	14629	14587	43888	32823	49102	33996
10	1298	4224	7557	6280	27253	22426	29043	14110
	Reading				Translation			
	Text3		Text4		Text1		Text2	
Participant	Meta phor	Compa rison	Meta phor	Compa rison	Meta phor	Compa rison	Meta phor	Compa rison
11	10684	15491	13238	9650	4682	4287	1835	2649
12	24382	24301	31675	18477	8812	11463	7534	8470
13	16047	13775	12620	10045	11148	5580	6994	5360
14	12437	6480	4086	6697	7374	15367	12284	10744
15	7395	10683	17006	8853	26968	17019	17518	14090
16	7430	6698	11396	7810	28940	27184	23234	22517
17	7594	12778	9432	10027	5800	14491	7933	4804

Appendix 8: Total Fixation Number - absolute values

Count								
	Reading				Translation			
	Text1		Text2		Text3		Text4	
Participant	Meta phor	Compa rison	Meta phor	Compa rison	Meta phor	Compa rison	Meta phor	Compa rison
<i>1</i>	116	96	68	48	1018	823	913	658
<i>2</i>	67	84	56	20	483	708	184	110
<i>3</i>	43	33	46	34	1784	742	1065	126
<i>4</i>	63	8	31	41	432	186	180	68
<i>5</i>	178	84	61	69	2511	166	702	117
<i>6</i>	16	56	55	34	367	461	856	159
<i>7</i>	27	18	54	78	295	769	136	181
<i>8</i>	80	24	33	54	878	800	346	114
<i>9</i>	121	323	395	417	1476	1342	1958	1206
<i>10</i>	11	31	59	45	1251	1000	986	254
	Reading				Translation			
	Text3		Text4		Text1		Text2	
Participant	Meta phor	Compa rison	Meta phor	Compa rison	Meta phor	Compa rison	Meta phor	Compa rison
<i>11</i>	125	117	55	49	94	29	18	20
<i>12</i>	119	148	172	104	134	244	137	175
<i>13</i>	302	158	58	76	114	75	92	58
<i>14</i>	211	66	18	68	128	539	281	327
<i>15</i>	101	174	171	86	1025	487	430	457
<i>16</i>	146	90	196	90	667	872	822	823
<i>17</i>	88	341	145	110	112	145	143	75

Appendix 9: First Pass Fixation Time - absolute values (ms)

First Pass Fixation Time								
	Reading				Translation			
	Text1		Text2		Text3		Text4	
Participant	Meta phor	Compa rison	Meta phor	Compa rison	Meta phor	Compa rison	Meta phor	Compa rison
1	4566	3528	2830	4267	3210	2868	1993	2648
2	2312	3071	2871	1754	2053	2871	2409	1953
3	2174	2769	1317	738	2294	2570	2972	2293
4	4205	7416	9032	10746	2211	2034	3069	3310
5	3190	2372	2073	1756	4366	2333	4584	2451
6	1995	6318	5979	6439	3728	3327	2708	4206
7	1633	977	977	1712	2609	2711	2154	3388
8	3011	2013	2014	1256	6978	2689	4265	3806
9	10286	5640	2452	2630	4724	3367	6618	3690
10	579	3865	1815	4047	2512	2331	3072	2213
	Reading				Translation			
	Text3		Text4		Text1		Text2	
Participant	Meta phor	Compa rison	Meta phor	Compa rison	Meta phor	Compa rison	Meta phor	Compa rison
11	6340	7278	7556	4725	1494	1754	759	1135
12	4625	4705	5581	3286	2153	2074	1655	2272
13	4265	4846	7078	3946	2772	1355	2751	1514
14	3209	2832	3567	3109	1415	1235	1795	1276
15	2889	2829	4389	3989	2413	1594	2849	1815
16	1952	2393	3908	2869	2372	2013	1434	2433
17	2351	2990	2534	1893	917	1574	2054	1734

Appendix 10: Production Time - absolute values (ms)

Production Time				
	Text3		Text4	
Participant	Metaphor	Comparison	Metaphor	Comparison
<i>1</i>	49252	47630	39315	47133
<i>2</i>	75731	65956	29386	52154
<i>3</i>	69507	38483	82667	35733
<i>4</i>	92007	33397	32124	31717
<i>5</i>	69145	38733	44792	35713
<i>6</i>	67543	63255	38160	34596
<i>7</i>	64929	58816	43902	48431
<i>8</i>	68487	48829	32782	36123
<i>9</i>	47155	41078	49100	31339
<i>10</i>	55671	42414	57997	60838
	Text1		Text2	
Participant	Metaphor	Comparison	Metaphor	Comparison
<i>11</i>	19317	13945	13970	14052
<i>12</i>	30137	16807	29150	15132
<i>13</i>	16884	12115	12291	13718
<i>14</i>	41809	37498	34661	25415
<i>15</i>	55269	31973	23227	21326
<i>16</i>	89519	42169	29678	22539
<i>17</i>	57990	20144	22733	29911

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