

The concept of ‘translation unit’ revisited

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Abstract. In translation studies, the theoretical concept of ‘translation unit’ has traditionally been a subject of debate. This paper will discuss different views of the concept, relating it to the dichotomy between product and process-oriented translation studies. It will be argued that ‘translation unit’ has two readings: ‘unit of analysis’ in product-based studies, and ‘unit of processing’ in cognitive translation studies. With the exception of literary translation, translation services may now be said to fall within the domain of the language industry, which calls for considering the relevance of ‘translation unit’ to machine translation (MT). From a historical perspective, the concept will be related to the main issues of system design and translation quality.

1 Introduction

In theoretical studies of translation, the concept of ‘translation unit’ has been widely debated. While translation theory covers written as well as oral translation, or interpreting, the discussion here is limited to written translation. Some previous explications of ‘translation unit’ will be reviewed before various approaches to translation research are presented. In Section 2, different types of textual translation correspondences will be illustrated by samples of parallel texts. Section 3 presents the dual nature of the concept of ‘translation unit’, discusses the different approaches to it within product and process-oriented studies respectively, and comments on the relevance of the concept to the language industry. Finally, in Section 4 ‘translation unit’ will be related to the field of machine translation before conclusions are drawn in section 5.

1.1 The concept

Explications of ‘translation unit’ provided by selected reference works may provide a point of departure for the discussion. In their *Dictionary of Translation Studies*, Shuttleworth and Cowie (1997, p. 192) define *translation unit* as “[a] term used to refer to the linguistic level at which ST [source text] is recodified in TL [target language]”. Further, this is discussed in relation to Barkhudarov’s definition of ‘translation unit’ as “the smallest unit of SL which has an equivalent in TL” (Barkhudarov 1969, cited by Shuttleworth and Cowie 1997, p. 192). In Barkhudarov’s understanding, any kind

of linguistic unit, ranging from the smallest building blocks of the language system to the level of entire texts, may occur as units of translation. This calls for a clarification: translation units are *tokens* of linguistic types, not units of the language systems.

Shuttleworth and Cowie (1997, p. 192) comment on Barkhudarov's definition by observing that "[t]he wording at a given point in ST would determine the most appropriate unit of translation, which could be expected to vary in the course of a text or even a single sentence". Thus, it is the specific translation task that determines the size and linguistic type of a translation unit. Moreover, with regard to the size of translation units, Shuttleworth and Cowie (1997, p. 192) cite Koller (1992, p. 100) who argues that the degree of structural relatedness between source and target language may influence the size of translation units. It is likely that translation between unrelated languages will involve larger units than translation between closely related languages.

In an article in *Translation. An International Encyclopedia of Translation Studies* (Kittel et al. 2004), the translation theorist Irma Sorvali states that *translation unit* "... is usually taken to denote a unit or part of the text on which the translator concentrates at one time before going on to translate the next, similar unit" (Sorvali 2004, p. 355). In this way she assumes that units of translation are processed in sequence, and one at a time. Sorvali's definition is not very specific, which is in line with her observation that it is difficult to find a definition of this concept which is "generally applicable" (Sorvali 2004, p. 355).

These introductory references are examples of various understandings of 'translation unit' offered by translation theorists. In Section 3, the concept will be explored further while relating it to different approaches to the study of translation.

1.2 Approaches to translation studies

The field of translation theory is wide and heterogeneous, and there are several possible ways of describing and classifying the various approaches to the study of translation. A standard reference in this respect is the so-called map of translation studies provided by Holmes (1988), and further articulated by Toury (1995, p. 19). According to the 'Holmes-Toury map', the discipline branches into two main subfields: pure and applied translation studies. The latter field is directed towards translation practice, whereas pure translation studies investigate the phenomenon of translation itself. This subdiscipline branches further into theoretical and descriptive translation research. Descriptive studies deal with existing translations, seeking to detect generalisations explaining the phenomenon of translation. Finally, the map presents three subfields of descriptive translation studies, oriented towards the product, process and function of translation, respectively. Over the years, the dichotomy between product-oriented and process-oriented studies has received much attention within translation research.

In short, product-oriented studies of translation are focused on topics such as characteristics of translated texts, and relations between source and target texts, whereas process-oriented studies deal with the translation activity, including the cognitive pro-

cesses behind the production of a translation. A basic difference between these two approaches follows from the fact that the product of translation is a more easily accessible object of study than the activity that takes place in the mind of the translator at work. Hence, the two approaches rely on very different research methods. In terms of methodology, a good deal of product-oriented research resembles contrastive language studies, a frequent common denominator being the use of language corpora and associated search tools. There are also product-oriented case studies which do not involve corpora. The methods of process-oriented translation research, on the other hand, are related to those of cognitive science, psycholinguistics in particular. The two approaches will be further discussed in Sections 3.2 and 3.3, respectively.

It should be noted that the division between product and process orientations could be seen as a continuum rather than as a binary distinction. Thunes (2011, pp. 18–26) presents an overview of this continuum, which shows that some theorists have described the product of translation partly by paying attention to the steps leading from source to target text, and others have described the process, but to some extent in terms of the relation between original and translation. This is in line with Chesterman (2005, p. 19) who makes the point that many translation researchers are not entirely “clear about whether the focus is on processes themselves or the results of processes”.

2 Two samples of parallel texts

Before the discussion of translation studies continues, two short samples of translationally parallel texts will be presented in order to illustrate various types of textual translation correspondences. The examples are taken from two quite different domains, legislation and fiction, and demonstrate substantial text-typological differences. They are chosen as representatives of restricted and unrestricted text types, respectively.

2.1 Law text

The first example is a short piece of translationally parallel law texts: Article 91 of the *Agreement on the European Economic Area (EEA)*, and its Norwegian translation.¹

1 Texts obtained from The Norwegian Royal Ministry of Foreign Affairs, 1992.

Article 91.

1. The office of President of the EEA Council shall be held alternately, for a period of six months, by a member of the Council of the European Communities and a member of the Government of an EFTA State.

2. The EEA Council shall be convened twice a year by its President. The EEA Council shall also meet whenever circumstances so require, in accordance with its rules of procedure.

Artikkel 91.

1. Et medlem av Rådet for Det europeiske fellesskap og et regjeringsmedlem fra en EFTA-stat skal etter tur være formann i EØS-rådet i seks måneder.

2. EØS-rådet skal innkalles av formannen to ganger i året. EØS-rådet skal også møte når omstendighetene krever det, i samsvar med forretningsordenen.

In this example there are one-to-one correspondences between translationally parallel sentences and headings. The correspondences exist at the level of main sentences, delimited by capital letters and full stops. Below the level of main sentences, the texts are no longer fully matched in terms of linguistic structure. A syntactic example may illustrate this: in paragraph 1, a passive construction in the English sentence (*The office of President ... shall be held ... by a member ...*) corresponds to an active sentence in the Norwegian version (*Et medlem ... skal ... være formann ...* 'a member shall be president'). However, in this sentence pair, as well as in the succeeding pairs, there is no translational mismatch between the sentences at the semantic level, and pairwise they have the same legal interpretations.

The given text sample illustrates the way in which parallel law texts are perfectly matched with respect to how the texts are divided into articles, numbers and sentences. This follows from the strict, institutionalised norms of law text writing, in particular the fact that the sequential order of the elements in a law text is of legal importance (cf. Bhatia 2010, pp. 38–39; Cao 2007, pp. 13–14; Šarčević 2007, p. 46). Hence, it is obligatory that the order of articles, paragraphs and sentences is the same in different language versions. In the case of the *EEA Agreement*, this requirement is indispensable, since the two texts have equal legal status. The Norwegian version is not, in the legal sense, a translation, but an authentic, independent law text, even if the Norwegian version has, in practice, been translated, primarily from the English text.

In parallel law texts, it appears trivial to identify translation correspondences between headings, paragraphs, and sentences. They are aligned units at the surface level of the texts, and as such they illustrate how legal translation is constrained by domain-specific text norms. Whether they qualify as units of translation cannot be decided by looking at the parallel texts alone. Correspondences between paragraphs and sentences appear as inadequate units of analysis if one aims at a deep exploration of law text translation.

From a cognitive point of view, law text translators clearly do not always work with only one sentence at a time, from top to bottom. It is necessary to consider a sequence of sentences simultaneously, and also to move back and forth in the text in order to secure consistency in the translation of recurring text elements. How this happens is not possible to detect merely by inspecting the translation result.

2.2 Fiction text

The second example is the opening of Doris Lessing's (1985a) novel *The Good Terrorist* and Kia Halling's translation (Lessing 1985b) into Norwegian:

THE house was set back from the noisy main road in what seemed to be a rubbish tip. A large house. Solid. Black tiles stood at angles along the gutter, and into a gap near the base of a fat chimney a bird flew, trailing a piece of grass several times its length.

Huset lå litt tilbaketrukket fra hovedveien, midt i noe som minnet om en søpelfylling. Et stort hus. Massivt. Svarte takstein hadde kilt seg fast i uryddige vinkler langsmed takrennene, og oppe ved skorsteinen gapte et mørkt hull; en fugl smatt inn i hullet med et strå i nebbet, strået var flere ganger lengre enn den vesle fuglekroppen.

Some comments are in order about the correspondences between sentence-level units in this piece of fiction text. Firstly, the opening sentence of the English text, *THE house was set back from the noisy main road in what seemed to be a rubbish tip*, corresponds with the opening sentence in the Norwegian translation. Then, the noun phrase *A large house* corresponds with the Norwegian noun phrase *Et stort hus*. Next, there is a correspondence between two single-word expressions, the English adjective phrase *Solid* and the Norwegian adjective phrase *Massivt*. But after this, there is a break in the pattern of one-to-one correspondences between units delimited by capital letters and full stops. The last sentence in the English text is a sequence of two conjoined independent sentences, including a non-finite adverbial subclause embedded in the second main clause: *Black tiles stood at angles along the gutter, and into a gap near the base of a fat chimney a bird flew, trailing a piece of grass several times its length*. This has been translated into a sequence of no less than four sentences in the Norwegian text, running from *Svarte takstein* onwards, and throughout the given text sample.

As in the case of the law text example, it is clearly limited to what degree the orthographic units of source and target text may serve to identify the units of processing during translation. Within these pairs of textual units, there are several instances of source–target matches as well as mismatches at various linguistic levels, especially on the level of semantics.

An example of a semantic mismatch is the correspondence between the two noun phrases *the noisy main road* and *hovedveien* 'the main road', where the information ex-

pressed by *noisy* is lost in the target text expression. Further, concerning the description of the chimney mentioned in the text, the translator has added the information that the gap close to the chimney is dark, while, on the other hand, the width of the chimney, indicated by the adjective *fat*, is not expressed in the translation. Moreover, the Norwegian verb phrase *hadde kilt seg fast* ('had got stuck') adds information not contained in the source text.

Concerning the level of syntax, several mismatches have already been mentioned in the previous discussion of sentence-level units. A further example could be the translational correspondence between the noun phrase *a gap near the base of a fat chimney* and the independent sentence *oppe ved skorsteinen gapte et mørkt hull* ('up by the chimney a dark hole was gaping'). Semantic differences involved in this example have already been commented on.

Again, the comparison of source and target text in this example can hardly shed light on what the translation units were during the translation process. For example, did the translator focus on only one of the two conjoined sentences at the end of the English text sample, or did she treat them as one unit? It is likely that she did not treat them as one unit, since they ended up as a longer sequence of four independent sentences in the translation. And when she translated the very short units *A large house* and *Solid*, did she pay attention to any neighbouring units or not?

The discussion of the two examples given of parallel texts ties in with Shuttleworth and Cowie's comments on Barkhudarov's understanding of 'translation unit', presented in Section 1.1 (Shuttleworth and Cowie 1997, p. 192). In general, a large variety of linguistic types may occur as translation units in Barkhudarov's sense: single lexical units, phrases, clausal constructions, independent sentences, paragraphs, or other types of units, large or small, depending on the particular translation task. It appears likely that this holds for the cognitive units as well as for the textual ones, and some light may be shed on this by the discussion of cognitive research on the translation process in Section 3.3.

3 'Translation unit': approaches and applications

In relation to the concept of 'translation unit', it will be shown that whether the object of study is the product or the process of translation in fact changes the content of this concept. It will be argued that within product-oriented approaches 'unit of translation' can be understood as 'unit of analysis', whereas in process-oriented studies, it primarily means 'unit of processing'.

3.1 A dual concept

The presentations of product-oriented and process-oriented studies will reveal that the concept of 'unit of translation' has a dual nature, and this view is compatible with a definition given by two researchers who work within the avenue of process-oriented translation studies, Amparo Hurtado Albir and Fabio Alves. In *The Routledge*

Companion to Translation Studies (edited by Jeremy Munday 2009), Hurtado Albir and Alves describe 'unit of translation' both as a "(bi)textual unit", and as a cognitive unit. From the perspective of the translation process, they understand the concept as a "[c]ommunicative and cognitive unity [sic] employed by a translator/interpreter in the performance of a translation task" (Munday 2009, p. 238). In other words, this is a 'unit of processing'. From a textual perspective, they claim that the concept "is embedded in a complex relationship with all the other units in a given text" (ibid.). The phrase "other units" refers to micro-textual units, as well as units of a macro-textual character, and units with special text-structuring functions. This calls for the 'unit of analysis' reading, as the identification of such textual units presumes some kind of linguistic analysis.

3.2 Product-oriented approaches to 'translation unit'

One definition of 'unit of translation' in the context of product-oriented studies is provided by Malmkjær 1998 (p. 286): "Considered from a product-oriented point of view, the unit of translation is the target-text unit that can be mapped onto a source-text unit". Prominent topics within the product-oriented approaches have been, e.g., characteristic features of translated texts, the relationship between source and target texts, and comparisons of different translations of the same originals, whether into one or more languages. Such studies have in common that the researcher's observation applies to intersubjectively available objects, i.e. the translated text in comparison to the source text. These are entities that have been produced before the observation takes place.

An example of a strictly product-oriented approach is found in Thunes (2011), which is a study of linguistic correspondences in English-Norwegian parallel texts of two types, law and fiction. The empirical analysis is based on the assumption that it is possible to compute, or construct without human intervention, a target language expression by using information about source and target language systems, and about how the two language systems are interrelated. This is an assumption that lies at the bottom of linguistic approaches to machine translation.²

The main research questions in Thunes (2011) are, first, to what extent it is possible to compute the translations found in the selected parallel texts, and, second, whether the chosen text types differ with respect to the first question. In the empirical investigation, the notion of 'translation unit' is used purely in the sense of 'unit of analysis'. The discussion of empirical data accentuates the product-oriented approach of Thunes (2011), as the analysed units are generally referred to as *string pairs*, or *translational correspondences*, and not as *translation units*.

In the study, the finite clause is chosen as the primary unit of analysis, and the motivation for this is twofold. Firstly, finite clauses can be identified by fairly simple linguistic criteria, which makes it easy to detect relevant patterns in the analysed

² Cf. Section 4.2.

parallel texts. Secondly, the finite clause is chosen because it reflects the approach of rule-based machine translation, which normally works at sentence level. For methodological purposes, phrases with embedded clauses are also applied as units of analysis.

Elgemark (2017) is another example of the product-oriented approach to translation. Her investigation is a corpus-based, contrastive study of English–Swedish, aimed at exploring a phenomenon related to the information structure of sentences, i.e. *N-Rhemes*, defined by Elgemark (2017, p. 1) as “the last constituent that has a function in the clause”. Normally, N-Rhemes contain information that is of relatively high importance in utterances. Elgemark’s study aims at describing properties of N-Rhemes individually in the two languages, as well as examining correspondences and non-correspondences between English and Swedish N-Rhemes.

As a unit of analysis, she applies *T-units*, which are, basically, main clauses including any embedded dependent clauses, and in the empirical investigation, the N-Rheme is identified in each T-unit. Elgemark’s analysis of corpus data has detected word order and information structure differences between English and Swedish N-Rhemes, mirroring differences between the two language systems.

The translation theorist Gideon Toury applies an understanding of translation unit as a unit of comparative analysis, or in Toury’s own terminology, “the coupled pair”. Toury’s contribution to descriptive translation studies can be placed among the approaches that are not purely product-oriented, but show elements of process orientation. He describes his study as “an attempt to gradually reconstruct both translation decisions and the constraints under which they were made” (Toury 1995, p. 88), and this is his motivation for identifying units of comparative analysis.

He defines ‘coupled pairs’ as correspondences between specific translation problems in the source text (i.e. tasks to be solved), and their solutions in the target text (1995, p. 77). Also, he emphasises that in coupled pairs, source problems and target solutions “should be conceived of as determining each other in a mutual way” (1995, p. 77).

The perhaps most noticeable aspects of Toury’s understanding of ‘translation unit’ are, firstly, that it involves a *pair* of linguistic segments, and, secondly, that the two units of analysis mutually determine each other. It is a challenging question to what extent such pairings can reveal the decisions made by translators, because the actual correspondences that we find in translationally parallel texts are created by an interplay between the translational relationship between source and target language systems, on the one hand, and, on the other hand, a range of factors which are specific to individual translation tasks.

3.3 Process-oriented approaches to ‘translation unit’

In process-oriented studies of translation, the object of study is the translator’s activity. From the cognitive perspective, Hurtado Albir and Alves state that “... the translation unit is considered as a comprehension unit and as a processing unit, i.e. as a dynamic segment of the ST [source text], independent of specific size or form, to which, at a

given moment, the translator's focus of attention is directed ..." (cf. Munday 2009, p. 238). This description implies that the processing of a translation unit relies on its comprehension. Thus, if the translator's understanding of the source text can be regarded as a kind of analysis, it follows that the analysis aspect is present also in this view of 'translation unit'. However, the dynamic character of the processing unit is a more prominent aspect, and the unit is dynamic in the sense that its length and linguistic type may vary as the translator is working.

Concerning the translation process, research has shown that it cannot be assumed that there is a fixed set of steps that are carried out in any act of translation. This was reported already by Krings' (1986) dissertation *Was in den Köpfen von Übersetzern vorgeht*, which was the first extensive, published study of translation activity using the method known as Think-Aloud-Protocols (TAP). In TAP studies the translator is typically asked to report, unselectively, everything that goes through her/his mind when performing the translation task, i.e., literally, to think aloud, while the reporting is audio or video recorded. Other actions, such as note-making and consulting reference works, are also documented.

TAP studies have shown that the ways in which translation processes may run are influenced by numerous factors determined by the skills of the translator, by the translation situation, and by the type of translation task, to mention some. In the light of this, it is to be expected that the unit of translation, or unit of processing, also varies greatly during translation activity. This was documented fairly early by TAP studies. Malmkjær (1998, p. 286) observes that "... Lörscher (1991, 1993) shows that the unit of translation used by language learners tends to be the single word, while experienced translators tend to isolate and translate units of meaning, normally realized in phrases, clauses or sentences".

In this context, it is a relevant question whether translators are aware of the actual units of processing. Sorvali (1994) tried to investigate, among other things, how translators perceive the unit of translation, whether the unit really exists during translation, and whether translators make use of it. She concluded that "... translators regard the unit of translation as a self-evident fact to which they rarely give any thought during the actual translation process but which nevertheless exists as a functional unit" (Sorvali 2004, p. 358).

This raises another question: what is the significance and status of the concept of 'translation unit'? Sorvali (2004) notes that there may be different answers to this among translators and translation researchers. Among translators, 'translation unit' is associated with practical work, but it may not be of great significance: according to Sorvali (2004, p. 355), "[t]he unit of translation may ... be no more than an insignificant intermediate stage in the process as far as the translator is concerned". She further argues that although the unit of translation is a more abstract concept among translation theorists than among translators, it is still more significant to the former than to the

latter, because “[r]esearchers may use such a unit as a tool for providing a theoretical description of the translation process”. Also, she explains that the types of linguistic units used for such descriptive purposes may be of different kinds than the units that are actually processed by the translator at work (2004, p. 355).

Sorvali (2004, p. 358) presents some conclusions regarding the translation unit in the context of the translation process. Firstly, because the unit of processing is so variable, or instable, and because it is so highly dependent on the translation task and situation, it is difficult to give the concept a general definition. Secondly, it cannot necessarily be deduced from the product of an act of translation what kinds of units that have been used during the process. Thirdly, the quality of the product indicates whether the translator has selected units of a size that is sufficient in order to create a successful target text. The argument is that if the units of processing are insufficient, the translator may not be able to choose optimal target expressions.

The latter point is compatible with an observation made by Malmkjær (1998, p. 286), regarding translation quality: “The typical finding is that target texts in which the units are larger appear more acceptable than those in which the units are smaller.” Further, Malmkjær (1998, p. 286) concludes that the clause is the primary unit of translation: “In general, the clause seems a sensible structure to aim for as translation unit, because it tends to be at clause level that language represents events [...] In addition, the clause is a manageable unit of attentional focus [...]”.

This reference to attentional focus leads over to the strictly process-oriented study of Carl and Kay (2011), which is worth looking into in some detail as it has provided ground-breaking insight into translation. Their contribution is an exploration of the cognitive notion of ‘translation unit’, based on the observation that “... there is a confusion in the usage of the term *translation unit* ...” because some researchers apply it to “... basic segments of activities in the *translation process*, whereas others think of the segments more statically as properties observable in the *translation product* ...” (Carl and Kay 2011, p. 953). Their solution to this terminological problem is to reserve *translation unit* for “units of cognitive activity”, defined as “the translator’s focus of attention”. These units can be explored in data on the translation process. Further, they use the term *alignment unit* to refer to translational correspondences observable in the product of translation (ibid.).

Carl and Kay (2011, p. 960) assume three phases in the translation process: skimming the source text (ST), drafting the target text (TT), and revising the translation. In their study, the reading and writing activities of translators at work are documented by tracking their eyeball movements during skimming, and by tracking their typing of the draft translation. The Translog software (Jakobsen 1999) is used for acquiring such *user activity data*. To achieve a controlled experiment, the subjects used no dictionaries or other common translation tools.

In order to analyse these data as empirical facts about the cognitive process of translation, Carl and Kay (2011, p. 954) "... rely on the "eye-mind assumption" (Just and Carpenter 1980), which hypothesizes that "there is no appreciable lag between what is being fixated and what is being processed" (Just and Carpenter 1980, p. 331). On the basis of this assumption, Carl and Kay (2011, pp. 955–956) identify *fixation units* during skimming by tracking and analysing the translator's eyeball movements when reading the source text.

With respect to the translator's typing during drafting, Carl and Kay (2011, p. 954) assume "... it is likely that the translator's focus of attention is close to what s/he writes, and that units of text production coincide to some extent with the entities of the translator's cognitive processes". This assumption allows for identifying *production units* by logging the translator's typing during drafting (2011, p. 955). Notably, their term *production unit* signifies the dynamic, cognitive concept; *product unit*, which would be synonymous with the static concept 'alignment unit' does not occur in their work.

Thus, Carl and Kay (2011) decompose the translation unit into two different kinds of processing units, the fixation unit involved in ST understanding, and the production unit of TT writing. They describe the physical realisations of translation units as three-component structures (2011, p. 954): a translation unit consists of (i) an act of writing which creates a production unit within a certain time span, (ii) an act of reading which tells the translator how to translate the fixation unit which is read, and (iii) "the ST segment(s) of which the produced TT is a translation". Surprisingly, the third component refers to alignment units, which, we have seen, are excluded from Carl and Kay's concept of 'translation unit' (2011, p. 953).

The method applied in order to identify translation units in the recorded user activity data relies on mappings between different types of information (Carl and Kay 2011, p. 957): eyeball movements are mapped onto ST fixation units; typing actions onto TT production units. Then, by relating these mappings to source–target alignment information, it is possible to identify correspondences between individual keystrokes and specific ST units. Thus, Carl and Kay (2011) have provided an exact, empirical method for describing how processing units are realised during the act of translation.

An important aspect of this method is the tuning of the production unit segmentation threshold (Carl and Kay 2011, pp. 966–969). This amounts to setting the minimum length of a typing pause that may identify a boundary between two production units. Selecting a too low threshold value will yield segments of an arbitrary character, i.e. segments which are neither cognitively nor linguistically plausible as they do not form complete units of meaning. Carl and Kay (2011, p. 969) conclude that "[t]he likelihood of [production units] to be consistent with linguistic entities ... is maximal for typing pauses of one second or more". In relation to Malmkjær's (1998, p. 286) assumption that the clause is the primary unit of translation, it is interesting that Carl and Kay's (2011) findings show that production units will not necessarily represent complete

units of meaning, and need not conform with alignment units (2011, p. 956). On the other hand, this supports the view of Sorvali (2004, p. 355), commented on above, that units of analysis may be of different kinds than units of processing.

A great asset of Carl and Kay's (2011) method of analysing fixation and production units is that it provides intersubjectively available data on the processes that take place in the minds of individual translators. However, fixation as well as production units are not unique to the translation process; they occur generally in reading and writing activities, such as text copying.³ The Translog system used by Carl and Kay (2011) to acquire translation process data is designed for tracking any kind of computer-based reading and writing activity. In their study, it is by linking the recorded fixation and production units with alignment units that it becomes possible to identify the units of the translation process. This illustrates the point made by Thunes (2011, p. 66) that "... in the case of translation it is the product and its relation to the original text which gives the process its identity". Still, this observation does not reduce the importance of Carl and Kay's (2011) contribution to knowledge about the translation process, and their study is a very good answer to a call for conceptual clarity made by Chesterman (2005, pp. 17–22), where he argues that many concepts applied in translation research need to be sharpened in order to achieve terminological stringency across the field.

3.4 Relevance to the language industry

Moving out of the domain of translation research, it may be noted that translation has become an everyday tool, an application taken for granted by everyone with Internet access. In a historical perspective, translation started as something that was carried out by relatively few people of high learning, and applied only to texts of special importance. Towards the modern age, translation gradually emerged as a profession to meet a growing market, and during the 20th century, globalisation created an enormous demand for non-literary translation in multinational domains of industry, trade, legislation, politics, and science.

Thus, translation has become part of the language industry. Machine translation in the shape of Google Translate has become as widespread as the Internet, and has achieved a position where it can even form the layperson's idea of what translation is. In spite of its usefulness, this application cannot, however, remove the need for translation work carried out by professional, human translators. On the other hand, translators have become dependent on language technology in order to meet demands of efficiency. Bilingual dictionaries, terminology bases, and translation memories are among the required parts of a translator's work station. Moreover, given the availability of useful MT systems, there has been an important change in the way professional translation is carried out. With the exception of literary translation, it has become a normal approach to post-edit machine-translated text rather than to work from scratch.

3 Cf. the study by Carl and Dragsted (2012) where translation is compared with text copying.

As discussed in Section 3.3, the concept of 'translation unit' is hardly of any relevance to the translator at work. For the translator, as well as for the client, what matters is the quality of the output, not the size or linguistic type of individual processing, or production units. The product-oriented notion of 'translation unit' is, however, applicable when distinguishing between different types of translation tools. In bilingual dictionaries and terminology bases, the lexical unit is the primary unit of translation, whereas in translation memories, which are databases of previously translated texts aligned with their source texts, units of translation are headings, paragraphs, sentences, clauses, phrases, list items, and others.

4 'Translation unit' in machine translation

The product-based concept of 'translation unit' may shed some light on certain issues of the domain of automatic translation. Jurafsky and Martin (2009, p. 898) divide the field into classic and modern machine translation, and this opposition reflects the important distinction between *rule-based MT* (RBMT) and *statistical MT* (SMT). In recent years, a newer approach has evolved, too, *neural machine translation* (NMT). SMT and NMT may be described as non-linguistic methods, in contrast to the linguistic approach of RBMT. In Sections 4.1 and 4.2, the concept of 'translation unit' will be related to different paradigms within MT research and development.

4.1 Relevance to non-linguistic approaches to MT

In RBMT, the translation procedure relies on information about source and target language and their interrelations, whereas in SMT, translations are computed on the basis of statistical, or probabilistic, information about recurrent translational patterns in large bodies of parallel texts, or parallel corpora. Thus, the corpus provides what is regarded as the training data for the system; these data provide the probabilistic information which is the basis for generating the translations output to the end user. SMT techniques work without using any information about source and target languages, and this is why they are normally described as a non-linguistic approach to MT. An important reason for the success of modern, statistical MT is that it does not suffer from the problem of lexical coverage, which has been among the heaviest obstacles to the development of linguistic MT systems. While RBMT systems cannot translate words which are not included in their lexical databases, SMT systems do not need lexicon components. However, lexical coverage in a different sense is a challenge also for SMT: if a word does not occur among the training data, then an SMT system cannot compute a target language match for it.

As the concept of 'translation unit' is primarily a linguistic notion in translation theory, it appears to be of limited relevance to the field of statistical MT. One aspect could be commented on: SMT works by using probabilistic information about translational correspondences between word sequences, or N -grams, in the training corpus. An N -gram is a sequence of N words where N is a low number. The value of N may

vary between translation systems, and will have a maximum value in each system. If N is 1, 2 or 3, the word sequences are uni-grams, bi-grams or tri-grams, i.e. strings of respectively 1, 2 or 3 word forms in running text. Possibly, this notion of N -gram could be given the status of ‘translation unit’ in SMT, but as no linguistic analysis is involved, it is not a unit of analysis in the translation-theoretic sense. N -grams could, however, be regarded as units of processing, i.e., units of processing defined by the algorithms implemented in statistical translation systems.

Neural machine translation (NMT) draws on neural network technology, in which computational systems are modelled on biological neural networks. Like SMT, NMT relies on probabilistic techniques. NMT models are trained on representations of the entire source and target sentences, rather than on N -grams. Words are still important as units in the source and target texts, but “[c]onnections between source and target words, phrases and sentences are learnt only implicitly as mappings between their continuous representations” (Kalchbrenner and Blunsom 2013, p. 1701). Hence, in NMT, it is hard to see any applicability of the translation-theoretic notion of ‘translation unit’.

4.2 Relevance to linguistic MT

It is more relevant to apply the notion of ‘translation unit’ to the linguistic approach of rule-based machine translation. In RBMT systems, some notion of a translational unit is applied as an analytical concept in the construction of the system. During the procedure of computing the target text, this unit becomes a unit of processing from the point of view of the algorithm used by the system. Thus, within linguistic MT, units of translation are units of analysis as well as units of processing. This is a parallel to the dual nature of the translation-theoretic concept.

From a historical perspective, there has been some variation concerning the linguistic types of translation units applied in rule-based machine translation. First-generation systems operated on word-level translation units. These systems were designed using the so-called *direct translation strategy*, which can be described as mapping the words in the input text directly onto words in the target language. Direct MT systems are commonly characterised as implementations of bilingual dictionaries with certain syntactic reordering rules for accommodating structural differences between source and target language.

Early work on machine translation grew out of information theory in the 1950s and 1960s, in a period when information scientists often held the view that translation was in essence a task of decoding the source text and recoding it in the symbols of the target language. During the same period, many translation theorists held quite similar views of what translation was about. This point is e.g. made by Koller (1992, pp. 89–92) in a discussion of early models in translation theory, and Sorvali (2004, p. 355) claims that in early translation research, the word was often regarded as the unit of translation, which she ascribes to the influence of the structuralist tradition in language studies. Clearly,

in that era there were strong parallels between machine translation and translation theory with respect to the conception of translation.

Direct MT systems failed to deliver high-quality output, and researchers concluded that it was necessary to develop systems that were able to do a more thorough linguistic analysis of the source text. The field then saw the emergence of various types of second-generation systems, which came to be described as *indirect MT systems* to separate them from the direct systems of the first generation. The development of indirect translation systems involved highly sophisticated computational linguistic engineering. Although there were substantial differences in system architecture among second-generation systems, a common denominator between them is that the sentence is normally the primary unit of translation.

The main characteristic of the indirect approach is that the first step in the translation procedure is an analysis stage which produces a formal, system-specific representation of the input sentence. In such representations, the meaning and structure of the source language expression are made more explicit than in the source expression itself. Thus, in some second-generation systems, the representation of the input sentence contains sufficient information for generating a target sentence. In other systems, the target sentence will be generated after the source text representation has been modified in accord with information about the target language system and how it is related to the source language.

There are some quite understandable reasons why the sentence is the basic unit in second-generation systems. Firstly, if a translation system is to be useful, it must at least be able to handle linguistic units at sentence level. Direct MT systems did not do this, and the quality of the output that they produced was in general too poor. Secondly, a translation system must be able to deal with sentences because the sentence can be seen as the maximal domain of grammatical analysis. That is, the sentence is the largest type of linguistic unit whose construction is governed by syntactic rules. The latter point echoes the translation-theoretic view of the clause as the typical unit of translation, which was presented in Section 3.3 with reference to Malmkjær's (1998, p. 286) comments: firstly, if translators work on units of an insufficient size, translation quality tends to suffer, and, secondly, the clause is a sensible unit because it is manageable, and functional since in natural languages events are normally represented at clause level.

On the other hand, automatic translation becomes non-robust if a system operating at sentence level does not return a translation whenever the input cannot be recognised as a syntactically complete source language sentence. Failed analyses may occur either because the ST sentence contains a grammatical structure that is not covered by the SL rule component of the system, or because the input is not a complete sentence, which frequently occurs in running text. Within rule-based MT, there are systems that process phrase-level units in cases where the input is not a sentence, but a smaller unit,

or in cases where the system is unable to analyse the input sentence completely, but is able to recognise subparts of the input as independent syntactic units. An example is LOGON (Oepen et al. 2004, 2007), a Norwegian-to-English translation system which was developed by a Norwegian research group in cooperation with international partners. Primarily, LOGON processes sentences, but the system is also designed to handle noun phrases and preposition phrases. In relation to the issue of robustness, this is a clear advantage and illustrates the fruitfulness in MT of using not only sentences as processing units, but also linguistic structures at phrase level.

5 Summary and conclusions

There are two distinct readings of the translation-theoretic concept of ‘translation unit’, and these are correlated with the fundamental differences between product-oriented and process-oriented approaches to translation research. Within product-oriented studies of source texts paired with their translations, the concept can be understood as ‘unit of analysis’. It is a bi-textual linguistic unit, an alignment unit, and plays an important role in the methods of corpus-based contrastive language studies. Within process-oriented studies of translation activity, ‘translation unit’ can be read as ‘unit of processing’, which can further be explicated as a cognitive unit of attentional focus.

The concept of ‘translation unit’ is mainly of importance to translation researchers, less so for translators. In relation to the language industry, the product-oriented reading is of some relevance in relation to tools like bilingual term bases and translation memories. When it comes to machine translation, the concept is of minor relevance in SMT, and even less in NMT. However, the rule-based approach of linguistic MT can be related to both readings of ‘translation unit’. In the design of an RBMT system, the ‘unit of analysis’ reading applies to the types of source text units that can be identified by the system, and the ‘unit of processing’ reading applies when the translation algorithm operates on the analysed input in order to generate a target text.

Over the years, translation theorists have argued that translation units are highly variable with respect to size and linguistic type. This observation holds for both readings of ‘translation unit’ across the different fields that have been discussed.

Recent research on the cognitive activities of translators has contributed to a sharpening of the distinction between the two understandings of ‘translation unit’. However, it has been shown in this article that it is difficult to identify units in the translation process without relating them to textual alignment units, or product data. The reason is that the units of cognitive activity that can be observed while translators are working can be associated with reading and writing activities in general. In order to identify the actual units of the translation process, it is necessary to link process data with data collected from the translation product.

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References

- Baker, Mona, ed. (1998). *Routledge Encyclopedia of Translation Studies*. London and New York: Routledge.
- Barkhudarov, Leonid (1969). "Urovni yazykovoy iyerarkhii i perevod [Levels of language hierarchy and translation]". In: *Tetradi perevodchika [The Translator's Notebooks]* 6, pp. 3–12.
- Bhatia, Vijay K. (2010). "Specification in legislative writing: accessibility, transparency, power and control". In: *The Routledge Handbook of Forensic Linguistics*. Ed. by Malcolm Coulthard and Alison Johnson. London and New York: Routledge, pp. 37–50.
- Cao, Deborah (2007). *Translating Law*. Topics in Translation 33. Clevedon, Buffalo, and Toronto: Multilingual Matters Ltd.
- Carl, Michael and Barbara Dragsted (2012). "Inside the monitor model: Processes of default and challenged translation production". In: *Translation: Computation, Corpora, Cognition (Special Issue on the Crossroads between Contrastive Linguistics, Translation Studies and Machine Translation)* 2.1, pp. 127–145.
- Carl, Michael and Martin Kay (2011). "Gazing and typing activities during translation: A comparative study of translation units of professional and student translators". In: *Meta: Journal des traducteurs / Meta: Translators' Journal* 56.4, pp. 952–975.

- Chesterman, Andrew (2005). "Problems with strategies". In: *New trends in Translation Studies: In honour of Kinga Klaudy*. Ed. by Kristina Károly and Ágosta Fóris. Budapest: Kiadó, pp. 17–28.
- Elgemark, Anna (2017). *To the Very End. A contrastive study of N-Rhemes in English and Swedish translations*. PhD thesis. University of Gothenburg.
- Gambier, Yves and Jorma Tommola, eds. (1993). *Translation and Knowledge: Proceedings of the Fourth Scandinavian Symposium on Translation Theory, June 4–6, 1992*. Turku: Centre for Translation and Interpreting.
- Hansen, Gyde, ed. (1999). *Probing the process in translation: Methods and results*. Vol. 24. Copenhagen Studies in Language. Fredriksberg: Samfundslitteratur.
- Holmes, James S. (1972/1988). "The Name and Nature of Translation Studies". In: *Translated! Papers on Literary Translation and Translation Studies*. Ed. by James S. Holmes. Amsterdam: Rodopi, pp. 67–80.
- Jakobsen, Arnt Lykke (1999). "Logging target text production with Translog". In: *Probing the process in translation: Methods and Results*. Ed. by Gyde Hansen. Vol. 24. Copenhagen Studies in Language. Fredriksberg: Samfundslitteratur, pp. 9–20.
- Jurafsky, Daniel and James H. Martin (2009). *Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition*. 2nd ed. Upper Saddle River, New Jersey: Pearson Education / Prentice Hall.
- Just, Marcel Adam and Patricia A. Carpenter (1980). "A theory of reading: from eye fixations to comprehension". In: *Psychological Review* 87.4, pp. 329–354.
- Kalchbrenner, Nal and Phil Blunsom (2013). "Recurrent continuous translation models". In: *Proceedings of the ACL Conference on Empirical Methods in Natural Language Processing (EMNLP)*. Association for Computational Linguistics, pp. 1700–1709.
- Kittel, Harald, Armin Paul Frank, Norbert Greiner, Theo Hermans, Werner Koller, José Lambert, and Fritz Paul, eds. (2004). *Übersetzung — Translation — Traduction. Ein internationales Handbuch zur Übersetzungsforschung / An International Encyclopedia of Translation Studies / Encyclopédie internationale de la recherche sur la traduction*. Vol. 1. Berlin / New York: Walter de Gruyter.
- Koller, Werner (1992). *Einführung in die Übersetzungswissenschaft*. Heidelberg: Quelle & Meyer.
- Krings, Hans P. (1986). *Was in den Köpfen von Übersetzern vorgeht*. Tübingen: Günter Narr.
- Lessing, Doris (1985a). *Den gode terroristen (The Good Terrorist)*. Trans. by Kia Halling. Oslo: Gyldendal.
- (1985b). *The Good Terrorist*. London: Jonathan Cape.
- Lörscher, Wolfgang (1991). *Translation Performance, Translation Process and Translation Strategies: A Psycholinguistic Investigation*. Tübingen: Günter Narr.
- (1993). "Translation Process Analysis". In: *Translation and Knowledge: Proceedings of the Fourth Scandinavian Symposium on Translation Theory, June 4–6, 1992*. Ed. by

- Yves Gambier and Jorma Tommola. Turku: Centre for Translation and Interpreting, pp. 195–211.
- Malmkjær, Kirsten (1998). "Unit of translation". In: *Routledge Encyclopedia of Translation Studies*. Ed. by Mona Baker. London and New York: Routledge, pp. 286–287.
- Munday, Jeremy, ed. (2009). *The Routledge Companion to Translation Studies*. London and New York: Routledge.
- Open, Stephan, Helge Dyvik, Jan Tore Lønning, Erik Velldal, Dorothee Beermann, John Carroll, Dan Flickinger, Lars Hellan, Janne Bondi Johannessen, Paul Meurer, Torbjørn Nordgård, and Victoria Rosén (2004). "Som å kapp-ete med trollet? Towards MRS-Based Norwegian–English Machine Translation". In: *Proceedings of the 10th International Conference on Theoretical and Methodological Issues in Machine Translation*. Baltimore, MD.
- Šarčević, Susan (2007). "Making multilingualism work in the enlarged European Union". In: *Language and the Law: International Outlooks*. Ed. by Krzysztof Kredens and Stanisław Goźdz-Roszkowski. Łódź Studies in Language 16. Frankfurt am Main: Peter Lang, pp. 34–56.
- Shuttleworth, Mark and Moira Cowie (2007). *Dictionary of Translation Studies*. Manchester, UK and Kinderhook (NY), USA: St. Jerome Publishing.
- Sorvali, Irma (1994). *Översättare och översättningsprocess*. Institutionen för nordiska språk vid Uleåborgs universitet.
- (2004). "The problem of the unit of translation". In: *Übersetzung – Translation – Traduction. Ein internationales Handbuch zur Übersetzungsforschung / An International Encyclopedia of Translation Studies / Encyclopédie internationale de la recherche sur la traduction*. Ed. by Harald Kittel, Armin Paul Frank, Norbert Greiner, Theo Hermans, Werner Koller, José Lambert, and Fritz Paul. Vol. 1. Berlin / New York: Walter de Gruyter, pp. 354–362.
- Thunes, Martha (2011). *Complexity in Translation. An English-Norwegian Study of Two Text Types*. PhD thesis. University of Bergen.
- Toury, Gideon (1995). *Descriptive Translation Studies and Beyond*. Benjamins Translation Library 4. Amsterdam and Philadelphia: John Benjamins.