*Emilie Sand Pedersen & Helle V. Dam**

Short-Term Memory in the Production Phase of Sight Translation[1]

Abstract

This article reports on an empirical study on short-term memory in sight translation. The aim of the study was to test the hypothesis that sight translation requires the use of short-term memory during target-text production, as suggested by previous research. The hypothesis was tested on the basis of an experiment involving sight translation from Spanish into Danish and subsequent interviews with the translators. The data – the Spanish source text, seven sight translations into Danish, and the post-interviews – were analysed using both quantitative and qualitative methods, and the results of the study confirmed the hypothesis. In fact, the (quantitative) analyses of the sight-translated texts indicated that the subjects needed their short-term memory extensively during target-text production. However, the (qualitative) analyses of the interviews showed that the subjects had little awareness of this need.

1. Introduction

Sight translation, also known as prima vista, is a hybrid form of transfer positioned between (written) translation and (oral) interpreting. It involves the immediate rendition of "a message written in one language into a message delivered orally in another language" and, hence, "both oral and visual forms of information processing" (Lambert 2004: 298). Sight translation can thus be considered translation as well as interpreting, even if most scholars choose to describe it as a specific variant or mode of interpreting (Cenkova 2010: 320; Gile 2009: 179; Hurtado/Jiménez 2003: 49; Pöchhacker 2004: 19). Perhaps due to its hybrid nature, sight translation has a somewhat orphan status in translation studies and has received very little scholarly attention so far. It is used in a wide range of contexts – courts, conferences, business meetings, etc. – and it is a component in many interpreter and translator training programmes, but in terms of research, it remains the translation family's "poor cousin" (Cenkova 2010: 322).

In an attempt to start filling this gap in research, the study reported on in this article focuses on sight translation and, more specifically, sets out to investigate the role of short-term memory during production of this particular form of translation. As we shall see in the literature review below, the theoretical status of short-term memory in sight translation remains uncertain, and the few empirical studies that have been conducted so far show no clear patterns and even conflicting evidence.

2. The literature on sight translation and short-term memory

2.1. Gile's Effort Model of sight translation

The main source of theory on the role of short-term memory in sight translation is Daniel Gile's Effort Model of sight translation (e.g. Gile 1995 and 2009): developed in the 90s, it remains the only model to address sight translation directly. This model, originally developed for interpreting,

1 This article is based on research conducted for the MA-thesis of the first author (Pedersen 2013) under the supervision of the second author.

* *Emilie Sand Pedersen & Helle V. Dam*
Department of Business Communication
Aarhus University
Jens Chr. Skous Vej 4
DK-8000 Aarhus C
emiliesand@gmail.com – hd@bcom.au.dk

describes the mental operations a sight translator needs to execute in order to perform the task. These operations, referred to as *Efforts*, are non-automatic and compete for the sight translator's limited processing capacity.

In a book published in 1995, Gile presented a basic version of the model, which included two Efforts only: a Reading Effort and a Production Effort (Gile 1995: 183). At the time, it was assumed that no Memory Effort was required in sight translation as – in contrast with simultaneous or consecutive interpreting – the information in the source text never disappears, but remains available to the sight translator at all times. Thus, if the sight translator forgets what he has read before completing the target-language version, Gile argues, he can always go back to the source-text passage in question and refresh his memory. The reflections on memory in this early version of the model were thus restricted to the potential relevance of short-term memory for the processing of source-text input; the relevance of short-term memory for the production of target-text output was not addressed.

In the revised version of his 1995-book (Gile 2009), Gile offered an expanded model of sight translation, adding two new Efforts: a Memory Effort and a Coordination Effort (Gile 2009: 179-181). The revised Effort Model of sight translation looks as follows:

> Sight translation = Reading Effort + Memory Effort + Speech Production Effort + Coordination Effort (Gile 2009: 179)

In this version of the model, the term *Memory Effort* is used to refer to non-automatic memory operations lasting up to a few seconds, i.e. short-term memory processes (Gile 2009: 165). Gile does not explain his motivation for adding the memory component in the revised model, but simply states that a sight translator does need his short-term memory to store source-text segments while these are identified and understood. It is maintained, however, that a sight translator does not need to draw on his short-term memory to the same extent as an interpreter because of the continued availability of the source text in sight translation. Gile's focus also in the 2009-version of the model is thus on short-term memory requirements for the processing of source-text input rather than for the production of target-text output.

It is, however, intuitively plausible that a sight translator needs to draw on short-term memory to execute and monitor his own speech production to much the same extent as an interpreter, especially when sentences are long and complex. With respect to production, short-term memory requirements in sight translation and interpreting seem comparable: in both conditions, the (spoken) target text disappears immediately after it is produced. The potential short-term memory efforts required for production in sight translation are not completely ignored by Gile, but they are only mentioned in passing in his discussion of the Memory Effort:

> When sentences are long and/or include embedded clauses, it may be necessary for the sight-translator to read much more than one Translation Unit before reformulating it, which involves much more time and much more effort, both in the reading component and in **short-term Memory during production**. This occurs inter alia when translating from languages such as German or Japanese into French or English. (Gile 2009: 180; our emphasis)

It should be noted that in the 2009-version of the model, the kind of short-term memory required for speech production can be seen to be included in the Production Effort, which comprises "the set of operations extending from the mental representation of the message to be delivered to speech-planning and the performance of the speech plan, including self-monitoring and self-correction when necessary" (Gile 2009: 163). If the point is, then, that the Memory Effort concerns source-text processing only, whereas the memory efforts involved in target-text production are represented in the model as part of another component, the Production Effort, it is not clear to us why there should be a separate memory component for the (written and permanently available) input side of sight translation but not for the (oral and ephemeral) output side. We shall revert to this discussion in the conclusion (section 5).

2.2. Empirical research

Empirical studies on sight translation are few and far between, and less than a handful studies have addressed the role of short-term memory in sight translation so far. The most comprehensive study of sight translation published to date is a doctoral dissertation by Ámparo Jiménez Ivars (Jiménez 1999). Among a series of experimental studies on different aspects of sight translation, Jiménez conducted a word-recall task in three different conditions, one involving articulatory suppression (reading words while saying 'bla'), designed to resemble sight translation, and two control conditions (reading only) (Jiménez 1999: 278-280). After the experimental condition, the subjects, 22 final-year students of interpreting and translation, recalled a significantly lower number of words than in the two control conditions, a finding which indicates that memory is hampered in sight translation due to concurrent reading and speaking. An additional regression analysis of the students' grades and their memory performances in the experiment showed no relation between these two variables. Based on the latter result, Jiménez (1999: 288) concludes that the importance of short-term memory in sight translation is limited, a finding she interprets as being in line with Gile's model of sight translation from 1995, which, as we recall, did not include a Memory Effort.

The input-processing perspective adopted by Jiménez is salient in other studies on sight translation too. For example, Viezzi (1989) conducted an experiment on information retention after simultaneous interpreting and sight translation, among other tasks. 18 professional and 24 student interpreters performed both a simultaneous interpreting task and a sight translation task, after which their recall of the information presented in the source text was measured by means of questionnaires. It turned out that the subjects' retention rate was higher after simultaneous interpreting than after sight translation, a finding Viezzi explains drawing on Craik and Lockhart's depth-of-processing hypothesis, according to which information retention indicates how deeply information is processed (Viezzi 1989: 65). On this basis, Viezzi suggests that the lower retention rate after sight translation is indicative of shallower processing, which again is due to the continued availability of the source text in this translation mode. For more studies on the issue of processing in sight translation (but not specifically on memory), see Lambert (2004).

As we have seen, the studies by both Jiménez and Viezzi focus on memory as used by sight translators to process source-text input, not to produce and monitor target-text output. In addition, both studies address the issue of memory beyond the scope of short-term memory as defined by Gile (operations lasting up to a few seconds, cf. section 2.1), which we have adopted for the purpose of the present study[2]. By contrast, a study conducted by Agrifoglio (2004) addresses short-term memory in the narrower sense of the term and looks at its role in both the reception and production phases of sight translation. The aim of Agrifoglio's study was to compare simultaneous interpreting, consecutive interpreting and sight translation in a broader perspective, not specifically to test short-term memory in sight translation, but the results of the study indicated that short-term memory does play a role. Among other tasks, six professional freelance interpreters performed a sight translation. The translations were analysed for errors by the author and possible explanations were suggested. According to Agrifoglio, one source of errors was the translators' failure to use their short-term memory when needed. She concluded that:

> Although it may seem that there is almost no Memory Effort in ST [sight translation] because source-text information is always accessible, our results indicate that **the sight translator has to rely on short-term memory to retrieve information from the beginning of sentences, or the formulation s/he has already embarked on**, especially where grammatical structures differ markedly between the two languages (Agrifoglio 2004: 61; our emphasis)

As the highlighted passage shows, Agrifoglio found evidence that the sight translators needed to make a Memory Effort in order to both process the source text and produce the target text. This

2 For a discussion of short-term memory vs. working memory, see Gile (2009: 166-167).

result seems to conflict with the evidence obtained by Jiménez, who, as we recall, concluded that short-term memory has limited importance for performance in sight translation.

3. Introduction to the study: aim, hypothesis, data and methods

As indicated in the introduction, the aim of the present research is to investigate the role of short-term memory in what, for convenience of expression, will be referred to here as the *production phase* of sight translation, even if source-text reception and target-text production in sight translation strictly speaking occur in overlapping rather than separate phases. In line with the results of the study by Agrifoglio and, partially, Gile's revised Effort Model of sight translation from 2009, the hypothesis that guides the research is that *sight translators need to draw on their short-term memory to perform and monitor their target-text production*.

The hypothesis was tested drawing on an embedded mixed-methods research design (e.g. Creswell 2014: 16 and 227-228): an experiment involving sight translation from Spanish into Danish and subsequent interviews with the translators. The subjects were seven students at Aarhus University enrolled in an MA programme in International Business Communication with a specialisation in translation and interpreting between Danish and Spanish. Danish was the subjects' native language and Spanish their first foreign language. Sight translation was new to five of them, whereas two subjects (1 and 2, cf. section 4) had some experience with the task. The subjects were selected based on availability of candidates with the desired study and language profile, with all the risks such a sampling method (convenience sampling) entails. However, even if the subjects' different levels of experience with sight translation seemed less than ideal at the outset, these differences turned out not to affect the results: the translation performances of the subjects with sight-translation experience were not different from those of the other subjects with respect to the investigated parameters (cf. tables 1-3 in section 4.1.2), nor were the interview responses of the former group qualitatively different from those of the latter group (cf. section 4.2). More generally, the nature of the hypothesis under scrutiny – that short-term memory is required for sight translation – allows testing on students and professionals alike, which justifies the use of students as subjects in the present context.

For the first task, the subjects performed a Spanish-into-Danish sight translation of a manipulated text. The text was based on an article on poverty in Mongolia published in the Spanish newspaper *El País* on August 1st, 2006 (Bonet 2006). In order to investigate if the subjects needed their short-term memory during the production phase of sight translation, a number of so-called *problem triggers* (Gile 2009: 171) – i.e. elements assumed to increase the mental load of the translator, *in casu* elements believed to trigger a particular need for short-term memory – were incorporated into the text. As we saw in section 2.1, Gile (2009: 180) points to syntactic differences between source and target languages (cf. Agrifoglio 2004: 61, section 2.2) as well as to long and/or embedded clauses as possible problem triggers with respect to short-term memory in sight translation; such elements were therefore incorporated into, or simply identified in, the source text. A total of 10 source-text sentences *with* such problem triggers (also referred to as STS 1-10, the problematic or experimental sentences), as well as 10 source-text sentences *without* problem triggers (also referred to as STS 11-20, the problem-free or control sentences) were selected for analysis. In contrast with the so-called problematic sentences, the so-called problem-free sentences were characterized by the fact that they could be translated almost directly from Spanish into Danish, with considerable ease and, hence, presumably without making (considerable) recourse to short-term memory.

The sight translation task was followed by semi-structured interviews with the subjects in order to shed light on their perception of the role of short-term memory during translation. The subjects were first interviewed about selected experimental (problematic) and control (problem-free) sentences. Through indirect, close-ended questions, they were asked if anything in a given sentence had caused problems during the translation. If the response was positive, they were asked to elaborate. To avoid disclosing the purpose of the study from the onset, only towards the end of the

interviews were the subjects asked directly if they thought their short-term memory had played a role during translation. The interview data thus served to inform the study further and give access to information which could not be elicited from the translation data alone. Still, the sight translations constitute the primary data of the study, whereas the interviews serve as secondary data only.

Prior to the actual data-collection sessions, two pilot tests were conducted with translators who do not form part of the final sample, based on which minor adjustments of the source text and interview questions were made. Data were then collected in individual sessions, with one subject at the time. The subjects were first asked some questions regarding their background and previous experience with sight translation, after which they were given instructions on the translation task. They were asked to imagine that they were in a real-life situation and were to translate a Spanish text for a Danish person without any knowledge of Spanish. They were instructed to translate the text concurrently with the first reading, i.e. without preparation. After the translation task, the subjects were interviewed as described above. Sight translations and interviews were audio-recorded during the data-collection sessions and later transcribed, essentially following orthographic conventions but with hesitations, repetitions, etc. represented. Self-interruptions (i.e. when a subject began uttering a word but interrupted himself) were marked by two dashes (--) and incomprehensible passages by a question mark (?).

In sum, both quantitative and qualitative data sources were used in the study. The quantitative (and primary) data consist of a total 140 target-text sentences, corresponding to the seven subjects' sight translations of the 10 sentences with problem triggers and the 10 sentences without problem triggers. The qualitative (and secondary) data comprise the seven post-translation interviews.

4. Analyses and results

In this section, the analyses of the sight translations (section 4.1) and the interviews (section 4.2) will be described.

4.1. Sight translations

The 140 selected target-text sentences were analysed for indications of short-term memory requirements in the production phase of sight translation. First, a series of categories were generated in order to describe whether and how a given target-text rendition indicated a need for short-term memory during production; these categories were formed inductively, on the basis of data, but with inspiration from previous research, especially Agrifoglio (2004). Each of the target-text sentences in the sample was then assigned to a category, based on which a quantitative synthesis was made. The categories are described in section 4.1.1, whereas the synthesis is presented in section 4.1.2.

4.1.1. Categories of renditions

Two main categories were generated to describe evidence, or lack of evidence, of short-term memory requirements in the target-text renditions: one (referred to as type A) which did indicate short-term memory requirements in the production phase and one (referred to as type B) which did not. Below, categories and subcategories are described and illustrated with examples from the sight-translation data. When relevant, the translations are complemented by extracts from the interview data.

4.1.1.1. A-type renditions: Indication of short-term memory requirements

As indicated, the A-category comprises target-text sentences *with* indicators suggesting that the subjects needed their short-term memory during the production phase of sight translation, i.e. ren-

ditions that supported the hypothesis of the study. The A-type indicators were further divided into a series of subcategories, as described below.

A.1: Short-term memory was required but *not* used

Subcategory A.1 comprises target-text sentences with indicators that suggest that the subjects did need their short-term memory during target-text production – *but did not use it.* Renditions with incoherent syntax, such as incorrect word order or lack of grammatical agreement between the elements in a sentence or phrase, were analysed as indicators of this type. In line with Agrifoglio (2004: 52-53), we thus assume that syntactic incoherence in sight translations is due to the subjects' failure to use their short-term memory during production.

In the analyses, it was taken into consideration that the syntactic rules are not as strict for spoken as for written language. In oral language production, a certain degree of disfluency is not uncommon, especially in syntactically complex utterances (Chafe/Danielewicz 1987: 95), but unless there is an unusual disfluency in the speech, listeners rarely notice it (Chafe 1985: 113). Therefore, only target-text sentences which could not be considered syntactically coherent even in spoken language were analysed as A.1. By contrast, self-corrections, repetitions, obvious mispronunciations and other features typical of spoken language were not interpreted as incoherent syntax and, hence, not analysed as A.1-type indicators. Though great care was exercised in delimiting 'true' instances of incoherent syntax from standard, spoken-language deviations from the syntactic rules, the threshold between the two is far from clear-cut and, ultimately and inevitably, the analyses of A.1-type occurrences were based on the discretion of the researchers.

The example below is one of the so-called problematic source-text sentences, which, in subject 2's rendition, is characterized by what is considered incoherent syntax in the present analyses:

STS 1: (6) En el remoto país situado entre Rusia y China, las palabras, procedentes en su mayoría del inglés, se empezaron a usar para nombrar cosas que (…)

[In the remote country situated between Russia and China, the words, the majority of them deriving from English, began to be used to name things which (…)]

Sub. 2: (6) I de i det fjerne land som ligger mellem Rusland og Kina er det ord er ord som kom s-- som hovedsagelig kom fra det engelske sprog begyndte man at bruge til at give navn til ting eller rettere sagt s-- til ting som (…)

[In the in the remote country which is situated between Russia and China is the word are words which came whi-- which primarily came from English they began to use to give names to things or should we say s-- to things which (…)]

Example 1[3]

The sentence from which the above extract derives is both long and complex. It contains embedded clauses, and the two languages involved, Spanish and Danish, differ in syntactic structure at sentence level: the Spanish ASV (Adverbial-Subject-Verb) word order must be transformed into, for example, AVS (Adverbial-Verb-Subject) when the sentence is translated into Danish. The target-text extract clearly shows how the translator struggled with this sentence. If we eliminate self-corrections and embedded clauses, the condensed version of the rendition by subject 2 is: 'I det fjerne land er ord begyndte man at bruge til at give navn til ting (…)' ('In the remote country are words they began to use to give names to things (…)') – i.e. a sentence that is evidently syntacti-

3 In the examples, the extracts of the source-text sentence are preceded by the abbreviation 'STS' (for *source-text sentence*) after which a number indicates the source-text sentence in question (1-20). The target-text extracts are preceded by the abbreviation 'Sub.' (for *subject*) followed by the number of the subject in question (1-7). In a subsequent parenthesis, the number of the exemplified source-text or target-text extract as it appears in the full data set (Pedersen 2013, appendices) is stated. Following each extract, a literal translation into English is provided in square brackets.

cally incoherent. Presumably, the translator needed to draw on his short-term memory to produce a syntactically correct rendition of this long and complex source-text passage - but failed to do so.

A.2: Short-term memory was required - and *was* used

The A.2-category comprises target-text sentences with indicators suggesting that the subjects needed their short term memory during production – *and used it*. Two types of indicators suggested this, namely self-corrections and restatements, as detailed below.

A.2.1: Self-corrections

Self-corrections, i.e. utterances whereby the translator corrects previous utterances, were considered to indicate use of short-term memory by logical implication: if a correction is made, it must be because the translator remembers that something needs to be corrected and what. It should be noted that instances in which subjects made a literal repetition of a previously uttered word or interrupted themselves while uttering a word and then stated it in full afterwards were not analysed as A.2.1-indicators and thus not interpreted as self-corrections, but rather as hesitations, i.e. features of oral language production not (necessarily) related to short-term memory.

The example below illustrates a self-correction, indicated in bold-face (the source-text sentence is only shown to provide a context):

STS 10: (34) Para construirle un monumento en el centro de Ulan Bator, el mausoleo que contenía los restos de Damdin Süjbaatar y Jorloogiin Choibalsan, dos de los líderes del Estado comunista fundado en los años veinte, ha sido demolido.

[In order to build him a monument in the centre of Ulan Bator, the mausoleum which contained the remains of Damdin Süjbaatar and Jorloogiin Choibalsan, two of the leaders of the Communist state founded in the twenties, has been demolished.]

Sub. 3: (33) For at konstruere et monument for ham i midt i Ulan Bator er mausoleet som indeholdt resterne af Damdin Süjbaatar og Jorloogiin Choibalsan to af de k-- to af den kommunistiske stats ledere ja og det her mausoleum blev blev lavet i trediverne eller i tyverne og er sidenhen blevet demoli-- **demoleret eller ødelagt nedrevet revet ned.**

[In order to construct a monument for him in in the middle of Ulan Bator the mausoleum which contained the remains of Damdin Süjbaatar and Jorloogiin Choibalsan two of the Co-- two of the leaders of the Communist state yes and this mausoleum was was made in the thirties or in the twenties and has later been demoli-- **demolied or destroyed down torn torn down**.]

Example 2

In this example, the subject corrects the strictly speaking incorrect word 'demoleret' ('demolied'), saying first 'ødelagt' ('destroyed'), then 'nedrevet' ('down torn') and finally, 'revet ned' ('torn down'). Every time he corrects himself, he presumably draws on his short-term memory to recall the expression that needs to be replaced. When asked during the post-interview if he had experienced problems with the translation of this sentence, subject 3 mentioned that the subordinate clauses and proper names had caused him problems. Moreover, he stated:

> (…) personally, when I spend two minutes pronouncing the name, then I need to get back to my train of thought. To me, clearly the most difficult task is to actually say these names and still try to keep track of where the hell I am when I am reading the sixth syllable in some name and – argh – who was he again, right? Then my short-term memory fails. (Subject 3; our translation from Danish)

This is one of the only examples in the interview data of translators explicitly mentioning short-term memory without being prompted to talk about it by the interviewer (cf. section 4.2). As the subject explains, he had difficulties recalling his own output and what he was planning to say as

most of his mental capacity was devoted to processing the difficult proper names. The extract thus shows that the subject has some awareness that he needed his short-term memory to produce this sentence.

A.2.2: Restatements

The A.2.2-category covers instances in which subjects restate, in a condensed version, a previously stated longer utterance. Restatements were taken to indicate the use of short-term memory since an utterance cannot, logically, be restated unless the translator has some recollection of having stated the original utterance.

A typical example of a restatement is shown in the following target-text extract, in which both the restated and the restating expression are indicated in bold-face (again, the source-text sentence is only shown to provide a context):

STS 4: (21) Pero en el Parlamento, una nueva ley de minería, que regulará las actividades de las empresas multinacionales y que creará un fondo estatal con parte de los ingresos del sector, todavía no ha sido aprobada.

[But in the Parliament, a new mining law, which is to regulate the activities of the multinational companies and which is to create a public fund with part of the revenues of the sector, has still not been approved.]

Sub. 2: (21) Men i parlamentet er der **en ny lov til en minelov som skal regulere a-- de aktiviteter som de multinationale virksomheder akti-- de int-- multinationale virksomheders aktiviteter og som vil skabe en en stats-- statslig grobund som skal skabe indtægter til sektoren** men **den lov** er endnu ikke blevet kommet blevet stemt igennem.

[But in the parliament there is **a new law for a mining law which is to regulate a-- those activities which the multinational companies acti-- the int-- multinational companies' activities and which will create a a pub-- public basis which is to create revenues to the sector** but **that law** has still not been come been passed**.**]

Example 3

As we can see, subject 2 first states a long noun phrase consisting of the noun plus a number of modifiers (an adjective and a series of relative clauses – from 'en ny lov' ('a new law') to 'sektoren' ('the sector')), after which he restates it as a short noun phrase that consists of a demonstrative pronoun and the noun ('den lov'/'that law'). We assume that the subject used his short-term memory to recall the previously stated noun phrase and, hence, to produce the condensed restatement.

During the interview, subject 2 also indicated that he had made recourse to his memory to translate this particular sentence. When the interviewer, inquiring into a previous comment by the translator, asked him to specify if it was the structure of the sentence that had caused him problems during translation, he answered:

> Yes, it was these embedded clauses and all those preceding elements "en el parlamento" and that. When there is too much information that you need to remember before getting to the verb (…). (Subject 2; our translation).

As we can see, subject 2 explicitly states that he needed to draw on his memory. However it is not clear whether he means during the reception phase, the production phase or both.

4.1.1.2. B-type renditions: No indication of short-term memory requirements

As opposed to the A-categories, the B-category comprises target-text sentences *without* indicators suggesting that the translators needed their short-term memory during the production phase, i.e. renditions that did not support the hypothesis of the study. Target-text sentences were categorized

as B-type renditions when none of the A-type indicators - syntactic incoherence, self-corrections and restatements - were present in the renditions.

An example of a B-type rendition is the following:

STS 9: (31) Vestido de una camisa naranja y sin quitarse las gruesas botas, Erdenebulgan, que procede del campo, ve un concierto de rock en la televisión mientras su esposa prepara el té en la estufa.

[Dressed in an orange shirt and without taking off his thick boots, Erdenebulgan, who comes from the country, watches a rock concert on TV while his wife makes tea on the stove.]

Sub. 6: (31) Klædt i en orange skjorte og uden at tage de store støvler af **sidder Erdenebulgan som kommer fra landet** og ser en en rockkoncert i fjernsynet mens hans kone laver te på kogepladen.

[Dressed in an orange shirt and without taking off his big boots **is Erdenebulgan who comes from the country**[4] watching a a rock concert on TV while his wife makes tea on the hotplate.]

Example 4

The source-text sentence in this example was one of the sentences with problem triggers. The word order of the Spanish sentence is: (1) free complement ('Vestido de (…) botas'/'Dressed in (…) boots') followed by (2) subject ('Erdenebulgan (…) campo'/'Erdenebulgan (…) country') and (3) verb ('ve'/'watches'). When a sentence in Danish is initiated by a free complement, the word order must be inverted so that the verb precedes the subject. This syntactic difference apparently poses no problem to subject 6, who renders a syntactically coherent target text in Danish, with the correct word order ('sidder' (verb) before 'Erdenebulgan (…)' (subject)). It could, of course, be argued that subject 6 correctly inverted subject and verb exactly because he *remembered* having started his sentence with a free complement. The correctly inverted word order could, in other words, be interpreted as indicating that the translator needed (and successfully used) his short-term memory. However, syntactically correct target-text renditions were not considered positive evidence of short-term memory use in the present study as other explanations could in principle be given for correct renditions, including the continued availability of the source text in sight translation.

When asked during the post-interview if he had experienced difficulties when translating this sentence, subject 6 replied that he did think its structure was difficult. However, he did not bring up the issue of memory.

4.1.2. Quantification

Table 1 below shows how the seven subjects' target-text renditions of the ten experimental source-text sentences (with problem triggers) are distributed over the categories described in section 4.1.1:

Category/Subject	Sub. 1	Sub. 2	Sub. 3	Sub. 4	Sub. 5	Sub. 6	Sub. 7	Total
A.1	1	3	3	4	2	3	3	19
A.2.1	23	30	33	11	12	13	8	130
A.2.2	4	3	3	3	1	4	1	19
B	2	--	--	1	3	2	2	10

Table 1. Representation of the categories in the translations of STS 1-10 (sentences with problem triggers)

4 The Danish word order (verb before subject) is maintained in the back-translation for illustration, though it is incorrect in English.

As we can see at the bottom of table 1, there are a total of 10 category-B renditions of the problematic source-text sentences. This means that only 14% (10 of 70) of the target-text sentences in the experimental sample showed no positive evidence of short-term memory requirements during production. The remaining 60 target-text sentences contained one or several A-type indicators (a total of 168), which indicates that the subjects needed to draw on their short-term memory at least once during the production of 86% of the sentences with problem triggers. It is also interesting to note that 149 of the 168 A-type indicators (89%) were registered in the two A.2-subcategories (self-corrections and restatements). This subsample is thus characterized by a predominance of indicators suggesting that not only did the sight translators need to draw on their short-term memory during the production phase, they also positively *used* it.

Table 2 below shows how the subjects' renditions of the ten control sentences (without problem triggers) are distributed over the categories:

Category/Subject	Sub. 1	Sub. 2	Sub. 3	Sub. 4	Sub. 5	Sub. 6	Sub. 7	Total
A.1	2	1	1	1	--	--	2	7
A.2.1	17	7	10	7	9	10	3	63
A.2.2	--	--	--	--	--	--	--	0
B	4	4	4	5	4	4	6	31

Table 2. Representation of the categories in the translations of STS 11-20 (sentences without problem triggers)

As we can see at the bottom of table 2, there are a total of 31 category-B renditions in the control sample, i.e. about three times as many as in the experimental sample. This means that 44% (31 of 70) of the target-text sentences in the control sample contained no evidence of short-term memory requirements during the production phase. The remaining 39 target-text sentences contained one or several A-type indicators (a total of 70), which indicates that the subjects needed their short-term memory at least once during the production of 56% of the sentences without problem triggers. 63 of the 70 (90 %) A-type indicators in the control sample consist of self-corrections (A.2.1), which again indicates that the subjects not only needed their short-term memory during production but also *used* it in most cases. In view of our original expectations - that sight translation of the problem-free source-text sentences would not require the use of short-term memory during target-text production – it is surprising to find evidence that the subjects needed their short-term memory for more than half (56%) of their target-text renditions of the control sentences. Still, the corresponding percentage found in the experimental sample – 86% – shows that the subjects did need and use their short-term memory considerably more when translating the source-text sentences with problem triggers.

Table 3 below merges the results of the experimental and control samples:

Category/Subject	Sub. 1	Sub. 2	Sub. 3	Sub. 4	Sub. 5	Sub. 6	Sub. 7	Total
A	47	44	50	26	24	30	17	238
B	6	4	4	6	7	6	8	41

Table 3. Distribution of categories A and B in the full sample (the translations of STS 1-10 and STS 11-20)

Table 3 shows that 41 of the 140 target-text sentences in the full sample were analysed as B-type renditions. A total of 29% were thus renditions with no indication of short-term memory requirements. The 238 A-type indicators were distributed over the remaining 99 target-text sentences, which means that the translators needed their short-term memory at least once to produce 71% of the target-text sentences selected for analysis.

4.2. Interviews

In the post-interviews, the issue of memory was probed into only indirectly to begin with, as explained in section 3: the subjects were simply asked if anything in a given sentence had caused problems during the translation task. If the response was positive, they were asked to elaborate. In this part of the interviews, the subjects showed no or little awareness of the short-term memory requirements of the task. Only subject 3 made an unsolicited comment on short-term memory as a factor in his production of a specific target-text sentence (cf. example 2, section 4.1.1.1). Subject 2 volunteered a comment on memory too (cf. example 3, section 4.1.1.1), but it was not clear if he referred to memory during the reception or the production phase.

At the end of the interviews, the subjects were asked directly if they thought their short-term memory had played a role when they sight-translated. In order to zoom in on the role of short-term memory in target-text production, they were asked more specifically if they had experienced difficulties in remembering how they had started their target-text sentences so as to be able to continue them in a way that ensured coherent sentences. When asked directly, five of the subjects (1, 3, 4, 6 and 7) replied that they did need to draw on their short-term memory during the sight-translation task and that they had experienced difficulties recalling the beginning of their own sentences. For instance, when asked if it was hard to remember how he had started his target-text sentences, subject 4 replied:

> Yes, I actually think that it was, throughout the whole process. I had a really hard time recalling what I had said first and then the next… but I also think that there is this pressure. I felt that I was under pressure. It had to be quick and then it doesn't end up sounding very well. (Subject 4; our translation)

The answers from 2 and 5, on the other hand, indicated that these subjects had no awareness of their need for short-term memory during the production phase, even when specifically asked about it.

5. Conclusion and discussion

The purpose of this study was to investigate the role of short-term memory in the production phase of sight translation. The hypothesis that guided the research was that sight translators need to draw on their short-term memory to produce and monitor their target text.

The quantitative analyses of the sight-translated texts showed that the subjects needed and/or used their short-term memory at least once while producing 71% of the target-text sentences. Substantial evidence thus supports the hypothesis of the study. Moreover, the subjects were found to need their short-term memory not only when translating the source texts with problem triggers (STS 1-10), but also when translating sentences without apparent problem triggers (STS 11-20). As expected, long and complex source-text sentences did seem to require more effort in terms of short-term memory for production – with A-type evidence (a total of 168 indicators) in 86% of the renditions of sentences with problem triggers – than simpler sentences, with A-type evidence (a total of 70 indicators) in 56% of the renditions of sentences without problem triggers. Overall, however, the results suggest that short-term memory is required extensively in the production phase of sight translation and that even relatively simple sentences with seemingly straight-forward translation options frequently present a challenge to sight translators' short-term memory.

The qualitative analyses of the post-translation interviews showed little or no awareness among the subjects of the short-term memory requirements associated with sight translation, let alone in the production phase. Only two translators volunteered unsolicited comments on memory requirements, and only one of these comments could be interpreted as related to short-term memory in the production phase. On the whole, it was not until they were asked directly that the translators recognized a need for short-term memory (and two of them never did). This result may not be replicable in studies using professional translators as subjects, but it is highly interesting from a pedagogical perspective, as discussed below.

All in all, the study revealed a discrepancy between the subjects' need for short-term memory during production, as indicated by the quantitative data, and their awareness of this need, as indicated by the qualitative data.

These findings, we suggest, feed directly into Gile's Effort Model of sight translation. As explained in section 2.1, the present version of the model is rather unclear with respect to the role of short-term memory. It is not entirely clear whether memory requirements for production are accounted for in the Memory Effort or the Production Effort – or even both or none of them. Considering the extensive need for and use of short-term memory during production found in the present study, we would suggest that this aspect of memory be included very explicitly in a future version of the Effort Model. One possibility would be to explicitly describe the existing Memory component as covering both the reception (reading) and production sides of sight translation. Another possibility would be to add a separate component to cater for all the self-monitoring processes that seem to be involved in sight translation. In view of the lack of awareness of these processes found among the subjects in this study, we would suggest the latter option. A separate self-monitoring component should prove eminently useful for pedagogical purposes; an expanded Effort Model could be used by teachers to explain to students that they not only read a source text (Reading Effort) and produce a target text (Speech Production Effort) when they sight-translate; they must also very actively listen to and monitor their own output (for example, Self-monitoring Effort). In fact, a self-monitoring component seems to be part and parcel of all types of translation into the oral medium - sight translation, sight interpreting, consecutive and simultaneous interpreting included. Such a component could therefore, we would tentatively suggest, usefully be added to the Effort Models of these variants of into-oral translation too.

6. References

Agrifoglio, Marjorie 2004: Sight translation and interpreting. A comparative analysis of constraints and failures. In *Interpreting: International Journal of Research & Practice in Interpreting* 6 (1), 43-67.

Bonet, Pilar 2006: Mongolia: un viaje al fondo de la desesperanza. In *El País*. http://elpais.com/diario/2006/01/08/domingo/1136695954_850215.html (last accessed 28 April 2014).

Cenkova, Ivana 2010: Sight translation. In Gambier, Yves/van Doorslaer, Luc (eds), *Handbook of Translation Studies*. Amsterdam/Philadelphia: John Benjamins, 320-323.

Chafe, Wallace 1985: Linguistic differences produced by differences between speaking and writing. In Olson, R. David/Torrance, Nancy/Hildyard, Angela (eds), *Literacy, Language, and Learning.* New York: Cambridge University Press, 105-123.

Chafe, Wallace/ Danielewicz, Jane 1987: Properties of spoken and written language. In Horowitz, Rosaling/Samuels, S. Jay (eds), *Comprehending Oral and Written Language*. San Diego: Academic Press Inc., 83-113.

Creswell, John W. 2014: *Research Design. Qualitative, quantitative, and mixed methods approaches*. Los Angeles/London/New Delhi/Singapore/Washington DC: Sage.

Gile, Daniel 1995: *Basic Concepts and Models for Interpreter and Translator Training*. Amsterdam/Philadelphia: John Benjamins.

Gile, Daniel. 2009: *Basic Concepts and Models for Interpreter and Translator Training*. Revised edition. Amsterdam/Philadelphia: John Benjamins.

Hurtado Albir, Ámparo/ Jiménez Ivars, Ámparo2003: Variedades de traducción a la vista: definición y clasificación. *Trans* 7, 47-57.

Jiménez Ivars, Ámparo 1999: La Traducción a la Vista. Un Análisis Descriptivo. Tesis doctoral. Universitat Jaume 1, Facultat de Ciences Humanes i Socials. http://www.tdx.cat/bitstream/handle/10803/10564/jimeneztdx.pdf;jsessionid=B3E502BC8374F1AC10E1990406BECD85.tdx2?sequence=1 (last accessed 28 April 2014).

Lambert, Sylvie 2004: Shared attention during sight translation, sight interpretation and simultaneous interpretation. In *META* 49 (2), 294-306.

Pedersen, Emilie Sand 2013: Korttidshukommelsen i prima-vista-oversættelse – en test af Giles Memory Effort i produktionsfasen [Short-term Memory in Sight Translation – a Test of Gile's Memory Effort in the Production Phase]. Master thesis. Aarhus University, School of Business and Social Sciences, Department of Business Communication. http://pure.au.dk/portal-asb-student/da/studentprojects/korttidshukommelsen-i-primavistaoversaettelse(922851c4-0937-4bdf-b73a-d8fae8538722).html (last accessed 28 April 2014).

Pöchhacker, Franz 2004: *Introducing Interpreting Studies*. London/New York: Routledge.

Viezzi, Maurizio 1989: Information retention as a parameter for the comparison of sight translation and simultaneous interpretation: an experimental study. In *The Interpreters' Newsletter* 2, 65-69.