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Pauses Reflecting the Processing of Syntactic Units in Monolingual Text Production and Translation

Abstract

This study explores how the process of translating relates to other types of writing processes by comparing pause lengths preceding syntactic units (words, phrases and clauses) in two types of writing task, a monolingual text production and a translation. It also discusses the grounds for interpreting pause length as a reflection of the cognitive demands of the writing process. The data was collected from 18 professional translators using the Translog keystroke logging software (Jakobsen/Schou 1999). Each subject wrote two texts: an expository text in Finnish and a translation from English into Finnish (Immonen 2006: 316-319). Firstly, phrase boundary pauses were categorised according to type, function and length of phrase. All three features correlate with pause length. On average, predicate phrases are preceded by short pauses, adpositional phrases by long pauses, and pauses preceding noun phrases grow with the length of the phrase. These findings suggest that the processing of the predicate begins before written production of the clause is started, whereas noun phrases and adpositional phrases are processed during writing. Secondly, pauses preceding clauses were categorised with respect to clause type. In monolingual text production, pauses preceding subordinate clauses are on average shorter than those leading to main clauses. In translation, pauses preceding subordinate and main clauses are almost the same length. It seems therefore that, in translation, the main clause and subordinate clause are processed separately despite the fact that the subordinate clause functions as a syntactic unit within the main clause.[1]

1. Introduction

During the typing of a text, keystrokes divide the total writing time into numerous intervals of different length. The keystrokes are points of keyboard activity, while the intervals between every two keystrokes can be considered pauses. Pauses during language production have been construed as indications of mental processing activity, the pause length reflecting the demands of the cognitive processing. This conviction has its roots in Hick's Law (Hick 1952) which ─ when condensed to a simple form ─ states that the larger the amount of information, the longer it takes to make a choice (Butterworth 1980: 155-156).

In this study, we investigate how research on the writing process of a translation relates to research on other types of writing. We explore and compare the duration of pauses detected prior to syntactic units during the production of two different writing tasks: monolingual text production, which refers to writing in a single language context, and translation, which means rewriting a text in another language. The focus is particularly on phrases in relation to other syntactic units. Our aim is to find out whether the processing of phrases differs in monolingual text production and translation, and whether the comparison of pause duration in the two writing tasks can shed light on the translation process.

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2. Background in writing research

Scientific interest in pauses found in written text production emerged in the later half of the 20th century in the wake of psycholinguistic studies on hesitation phenomena in speech production. Pause time distribution research is one part of investigations into the dynamics and temporal aspects of written language production.

> [T]he *lengths* of pauses, a measurable feature of writing behaviour, and their *location* in text, whether within a particular global discourse context […] or prior to a specific unit in language […], provides a temporal taxonomy or description of real-time aspects of written language production from which inferences about planning and decision-making can be made.

In this excerpt, Matsuhashi (1981: 114) explains how the combining of information drawn from the writing process (pause length) and the product (location in text) gives insight into the mental processes (planning and decision making) required during writing. She also mentions two factors which characterize pause location types: the "global discourse context", meaning the type of text, and the "unit of language". About two decades earlier, in the field of spoken language research, Goldman-Eisler (1958: 66-67) contemplated the grounds for the correlation between pauses and the structural arrangement of spontaneous speech. She came to the conclusion that because speech requires the organisation of symbolic processes into complex structures, pauses during speech could well be manifestations of the uncertainty of the next piece of text to be produced. Later on, Goldman-Eisler (1972: 103) was convinced that "if the transitions between these structures are of characteristic duration, then we can speak of their differential psychological reality and draw conclusions as to the degree of integration and independence of any of these units".

As the production of a written text is a highly complex activity and the outcome of numerous cognitive processes, it is difficult to determine any one cause to be responsible for a certain pause. Schilperoord (2002: 70-82) argues that even though it is not possible to determine precisely which cognitive processes result in which pauses, the study of pause time distribution can reveal features of the relationship between a pause and the ongoing cognitive processes as long as the environment of the pause is determined with a set of features which psychologically form a hierarchy (e.g.syntactic units). He also reminds us that pauses can have other than cognitive causes. For example, some pauses during writing may originate from physical or socio-psychological reasons. Schilperoord summarizes four fundamental assumptions which pause time distribution research involves: 1) the mental processing which takes place during the pause has something to do with the behaviour following the pause, 2) pausing is inadvertent, 3) pauses are the result of the need for cognitive processing, and it is not possible to delay them, and 4) the length of a pause is unintentional.

Let us now look at the mean pause length values of five writing process studies, all of which have measured pause duration prior to linguistic units. In the studies represented in Table 1, there is diversity in languages, mode of production, method of data elicitation and text type. Even so the mean pause lengths show a systematic correlation between the duration and the location of the pause in that the larger the unit, the longer the pause preceding it. When different text types are compared, texts with a linear organisation, such as reports and narratives, require less pausing time than texts with a global approach, like expository, persuading and generalising texts (compare results from Matsuhashi 1981 and van Hell et al. 2008). According to Immonen (2006: 327-328), pause length increases systematically with the size of the linguistic unit in translation and monolingual text production alike. When compared to monolingual text production, translation has longer mean pause lengths between the smaller units, but shorter pauses between the longer units.

Research	Language - mode - elicitation method	Text type	Pause location				
			word initial	phrase initial	clause initial	sentence initial	paragraph initial
Matsuhashi[2] (1981)	English - handwriting - video recording	generalizing			3.79	18.21	19.41
		persuading				13.80	14.56
		reporting				7.72	12.52
Schilperoord (1996)	Dutch - dictation - audio recording	lawyer's routine letter	0.245	0.312[3]	0.763	2.611	8.272
Chanquoy et al. (1996)	French - writing[4] - video recording	description	0.9	1.2	2.8	12.7	17.3
van Hell et al. (2008)[5]	Dutch - handwriting - digitizer tablet	expository		0.665	1.163	4.745	-
		narrative		0.519	1.119	3.593	-
Immonen (2006)[6]	Finnish - typing - keystroke logging	expository (monolingual text production)	1.924	-	3.880	19.261	40.474
		expository (translation)	2.887	-	5.533	12.696	26.023

Table 1. Pause location findings in five studies: the mean pause length (seconds) grows with the linguistic unit following the pause in all types of writing

The diversity of research methods and types of data often cause confusion when we try to compare studies in written text production, and even more so in a specific area like pause time distribution research, where the projects are dispersed in time and place. In the studies referred to in Table 1, four data elicitation methods are represented: handwriting recorded on video (Matsuhashi 1981, Chanquoy et al. 1996), dictation recorded on audio tape (Schilperoord 1996), handwriting recorded with an electronic ball-point pen and digitizer tablet (van Hell at al. 2008) and typing recorded with a keystroke logging programme (Immonen 2006). This gamut of methods reflects the technical development of data elicitation methods that has occurred during the past three decades of writing research.

3. Methodological considerations for measuring pauses

The method chosen for pause analysis can also have an influence on the results. To begin with, the decision must be taken as to which pauses are measured. The notion of setting a cut off point, where pauses shorter than the cut off value are discarded, was passed down from research in spoken language production. In spoken language research, the cut off point was used to eliminate pauses caused by the motor activity of speaking. This procedure was applied also in the pioneer-

2 Matsuhashi (1981) studied pause lengths prior to and within T-units in relation to various linguistic/textual aspects. The T-unit is defined as "a main clause with all its attached modifiers" (Hunt 1965 read in Matsuhashi 1981: 120). In this table, pauses which are originally categorized as prior to T-units with the abstraction level superordinate, are considered as sentence initial pauses.

3 Pauses which Schilperoord (1996) classified as constituent level pauses are in this table regarded as phrase initial pauses.

4 In Chanquoy et al. (1996) the mode of writing is not accounted for.

5 Van Hell et al. (2008) studied the writing of both children and adults. For the purpose of this paper, only the results of adults are included in this table.

6 In Immonen's study (2006: 323-324), phrase initial pauses were included in the word initial pauses.

ring studies of writing research. Matsuhashi (1981), for instance, analysed only pauses which were one second or longer, with the exception that every pause prior to a T-unit was accepted regardless of its length. Though motor activity obviously also plays an important role in written production, this has not been investigated separately in the present study. If the data for our study had been manipulated so that only pauses of one second or more would have been included in the analysis, it would have resulted in the recognition of only 5% of all the pauses in the fluent monolingual text production data and 6% of the pauses in the fluent translation production data. In monolingual text production, 7% of sentence initial pauses, 40% of clause initial pauses, 63% of phrase initial pauses and 76% of word initial pauses are shorter than 1 second. In translation, the figures are 4%, 44%, 54% and 72% respectively. Therefore, it seemed worthwhile to investigate all the pauses in order to get a reliable impression of the pause time distribution.

Similarly, some researchers eliminate pauses which exceed a certain length. As an example, van Hell et al. (2008) did not include pauses longer than 30 seconds in the data. Half a minute is indeed a long pause, and one may be tempted to think that what is going on in the mind of the writer during such a lengthy pause may not have anything to do with the writing task. But, our data indicates that professional translators, at least, may pause as long as 69 seconds between words, in the midst of fluent monolingual text production. And the maxima pause values tend to get even longer between the larger linguistic units. Therefore, we decided initially to include all pauses in our study.

Furthermore, the method of data elicitation will affect which pauses can be detected. For example, Schilperoord (1996: 24) collected dictated rather than written data. As speaking is faster than writing, the mean pause lengths in his research appear almost half the length of those measured by van Hell et al. which are the second shortest pause durations among the studies represented here. Additionally, dictated data includes pauses necessary for speaking but alien to writing, such as pauses for breathing. On the other hand, pauses typical of writing may not be detected. For example, in many writing systems words are separated from each other with a space. Depending on the definition of the pause, the making of this space often creates a pause. In handwritten data, a pause between two words is often considered to begin when the pen is lifted from the paper at the end of the first word, and to end when it is again put down onto the paper at the beginning of the second word (e.g. Matsuhashi 1981: 118, van Hell at al. 2008: 415).

When a keystroke logging computer program is used to study typed text, pauses must be determined in a different way. A pause between two words is usually comprised of two pauses: the first pause comes between the last letter of the first word and the space character, and the second one between the space character and the first letter of the second word. Likewise, a clause boundary is comprised of the pause between the last word of the first clause and the punctuation mark, the pause between the punctuation mark and the space character and the pause between the space character and the first letter of the second clause. In Immonen (2006: 324-325) as well as the present research, pauses between words and linguistic units larger than the word are calculated as the sum of the pause components. The reason for our choice to include all pause components is that in 20% of all sentence boundaries the pause prior to the punctuation mark is responsible for at least half of the total pause length, in 30% of sentence boundaries, the pause between the punctuation mark and the space character is the longest pause, and in 50% of sentence boundaries, the longest pause is between the space character and the first letter of the next sentence.

It is to be noted that punctuation is a specific characteristic of written text and it plays a significant role in the dynamics of writing. Therefore, pauses surrounding punctuation marks are not neutral or marginal. De Beaugrande (1984: 192) describes the status of punctuation as "a textual sub-system that meets various communicative needs of linearity: marking off units and sub-units, pausing indicating priorities, pointing backwards and forwards, excluding alternatives, and so on." Van Hell et al. (2008: 415) have followed different principles when measuring pause length. They do not take into account pauses between a word and a punctuation mark. Matsuhashi (1981: 122), by contrast, combines the pause time occurring before and after the punctuation mark as

we have done. Naturally, this will most likely result in longer pauses, especially pauses prior to large units.

Finally, we will mention the variety of languages represented in the studies of Table 1. English, Dutch and French are all Indo-European languages, but Finnish belongs to the Finno-Ugric language family. The elaborate use of the case system is perhaps the most conspicuous difference when the grammar of Finnish is compared to Indo-European languages. According to Dahl (2008: 549), only 24 out of the 261 languages mentioned in The World Atlas of Language Structures have more than ten case forms. Finnish has 15 cases. The case system in Finnish typically influences noun and adjectival phrases, but also verb-based infinitive forms. This highly versatile use of case affects the processing of words in that syntactic information must be chosen together with the word itself. It is, therefore, plausible that word initial pause lengths in Finnish tend to be longer than in languages such as English, Dutch and French which use prepositions rather than a case system. This tendency can be seen in the mean pause lengths measured by Immonen (2006) in both monolingual production and translation.

4. Pauses in monolingual text production and translation

Until now, pauses during translation have been studied almost solely in connection with segmentation research where pauses are considered as boundaries of translation units or cognitive units, depending on how the segment is determined. But a systematic pause analysis regarding translation is yet to be done.

The present study is a direct continuation of the pause time distribution research reported in Immonen (2006). Immonen conducted an exploratory study comparing the location and duration of pauses detected at the boundaries of linguistic units in translation and monolingual text production. Our aim now is to refine and augment this research by exploring in more detail the correlation between syntactic units and pause time distribution. Additionally, we attempt to gain more insight into the translation process by comparing pause time features of translation with those of monolingual text production. Therefore, we begin by investigating whether the type and function of a phrase is reflected in pause time (section 5.1). Do verb phrases, for example, require more pause time than noun phrases? Or does the function of the phrase influence the need for pausing time? Are pauses longer if they occur before long phrases (section 5.2)? Later (section 5.3), we continue with analysing pauses at sentence medial clause boundaries. The research questions which motivate our research are: does the processing of subordinate clauses result in longer pauses, and if so, is pause length the same in translation and monolingual text production?

The data used in this research was collected from 18 professional translators[7]. Each subject wrote two texts, an informative presentation in Finnish and a translation from English into Finnish, using the Translog keystroke logging software (Jakobsen/Schou 1999). Both assignments were written in Finnish which is the mother tongue of all subjects. To minimize the difference of the assignments, source material (a brochure in Finnish) was given also for the text production task, and the use of external information sources was not permitted during the writing of the texts[8].

In order to avoid the skewing effect that revision may have on pause length, the analysis was limited to pauses in fluent production passages, i.e. typing uninterrupted by corrections, deletions or cursor movements, of the 18 monolingual texts and 18 translations were categorised according to their location. The textual categories were paragraph and sentence boundaries, the syntactic categories were clause (sentence medial main clauses and subordinate clauses), phrase and word boundaries, and the word medial categories were compound word boundaries, syllable boundaries and pauses between other keystrokes. Each pause was defined only once, at the highest possible location in the hierarchy. Then mean pause lengths were calculated for each category.

7 We want to express our gratitude to each one of these translators for their invaluable contributions to this research.
8 For a more detailed description on data elicitation see Immonen (2006: 315-319, 323-325).

5. Characteristics of pauses and syntactic units

In this chapter, our focus is on pauses detected at the boundaries of syntactic units, i.e. words, phrases and sentence medial clauses. Word boundaries in written text are easy to recognise due to orthographic conventions, but phrase and clause boundaries can be identified only on the basis of a grammatical analysis of each sentence. The grammatical analyses for this study were done according to the principles described by Vilkuna (2003). The grammatical structure of every clause was studied to the level that enables the determination of phrase types and their function within the clause. Phrases were then categorised with regard to type and function. The categories and their abbreviations are compiled in Tables 2a and 2b.

Phrase type	Abbreviation
verb phrase	VP
noun phrase	NP
adjectival phrase	AdjP
adverbial phrase	AdvP
adpositional phrase	PP
infinitive phrase	InfP
quantifier phrase	QP

Table 2a. Phrase categories with regard to phrase type

Function of phrase	Abbreviation
predicate	Pred
subject	Subj
object	Obj
oblique	Obl
adverbial	Adv
(predicate) complement	Comp
infinitive verb form	V-inf
infinitive as a complement	Inf-comp
genitive subject	Gen-Subj

Table 2b. Phrase categories with regard to function of the phrase within the clause

The typical verb phrase in Finnish is a one-word phrase. In monolingual text production, 91% and in the translation 79% of all the verb phrases are one-word phrases. Examples 1 and 2 illustrate the decisions we had to make when deciding on verb phrase boundaries. To begin with, the Finnish verb phrase can be either a single finite verb carrying affixes that indicate subject and number (Example 1a) or a combined verb form with an auxiliary and a participle of the main verb (1b). Next, in Finnish, the negation word is also considered a verb and therefore part of a verb phrase because, when forming a negation, the expression of person and number shifts onto the negation word (1c). In the case of a combined verb form or a negated verb form, the pause preceding the first word in the phrase is regarded as the verb phrase initial pause. The pauses between the words of the phrase are phrase medial pauses.

(1a)

hyväksymme
accept-1PL
'we accept'

(1b)

olemme hyväksyneet
be-1PL accept-2ND PTC-PL
'we have accepted'

(1c)

emme ole hyväksyneet
neg-1PL be accept-2ND PTC-PL
'we have not accepted'

Key to abbreviations used in examples:

PAST	past	SG	singular
PTC	participle	PL	plural
COND	conditional	POSS	possessive
GEN	genitive	GEN	genitive
PASS	passive	PART	partitive
1	first person	INE	inessive
2	second person	ELA	elative
3	third person	ILL	illative

Moreover, verb phrases can have other phrases embedded in them. In Example 2, the verb phrase *emme voisi hyväksyä* 'we could not accept' (bold text) has the adverbial phrase *koskaan* 'never' embedded between the last two words of the phrase. In such cases where the words of the verb phrase are separated from each other, only the pause preceding the first word of the verb phrase, in this case *emme,* is considered a phrase initial pause. The pause preceding the second word *voisi* is a phrase medial pause, but the pause preceding the last word *hyväksyä* is not a phrase medial pause because the embedding has broken the word's connection with the beginning of the phrase. The pause preceding the embedded adverbial phrase *koskaan* is regarded as a phrase initial pause preceding the adverbial phrase.

(2)

Me britit	***emme voisi***	*koskaan*	***hyväksyä***
we Britt-PL	NEG-1PL can-COND	never	accept
NP/Subj	VP/Pred	AdvP/Adv	InfP/V-inf
'We British people could never accept …			

parlamenttimme	*alistamista*	*sellaiseen federalismiin*
Houses of Parliament-POSS	subjection-ELA	such-ILL federalism-ILL
NPObj	NP/Obj	NP/Obl
… the subjection of the Houses of Parliament to federalism of that kind.'		

Lastly, to complete the Finnish language examples regarding the categorisation of pause locations in the verb phrase environment, a verb phrase functioning as predicate can be followed by non-finite verb forms. In this study, these infinitive and participle verb forms are categorised as infinitive phrases. Their function within the clause can vary a lot. In Example 3, the finite verb *voidaan* 'can' is followed by two non-finite verb forms: *ymmärtää* which is the infinitive form of the verb 'to understand', and *viittaavan* which is a participle form of the verb 'to refer' (all three verb forms are in bold in Example 3). The latter can be analysed as replacing a subordinate clause. Only the first of the three verb forms is categorised as a verb phrase, the other two are infinitive phrases.

(3)

Ääripäässään	*sanoman*	***voidaan***	***ymmärtää***	***viittaavan***	*täyteen kukkaan puhjenneeseen eurooppalaiseen federaalivaltioon.*
extreme-INE-POSS	message-GEN	can-PASS	understand	refer-1 PTC	full-ILL flower-ILL burst-PTC-ILL European-ILL federal state-ILL
NP/Adv	Gen-Subj	VP/Pred	InfP/V-inf	InfP/Inf-comp	NP/Obl
'In its extreme meaning, the message can be understood to refer to (or 'that the message refers to') a European federal state in full bloom.'					

Phrases with a noun or pronoun functioning as the head were classified as noun phrases. Noun phrases in Finnish can be composed of simply one word, but only 53% of noun phrases in monolingual text production and 44% of those in translated texts are one-word phrases. Often noun

phrases are formed of two or more words which are bound grammatically with case agreement. Example 4 is an illustration of three noun phrases of different kinds. The first noun phrase at the beginning of the sentence *Euroopan yhteisöjen virallisten julkaisujen toimisto* is a proper noun, but demonstrates clearly the way in which Finnish words are tied together by case, in this example the genitive case, to form phrases. The second noun phrase *esitteen* at the end of the first clause is a noun phrase with just the noun with its genitive affix expressing, among other things, that the phrase functions as the object of the clause. The third noun phrase *tietoja uramahdollisuuksista Euroopan komissiossa* is at the end of the sentence[9].

(4)

Euroopan yhteisöjen virallisten julkaisujen toimisto	*on julkaissut*	***esitteen***
Europe-GEN Union-PL-GEN official-PL-GEN publication-PL-GEN office	be-3SG publish-2ND PTC-SG	brochure-GEN
NP/Subj	VP/Pred	NP/Obj
'The Publications Office of the European Union has published a brochure …'		

jossa	*annetaan*	***tietoja uramahdollisuuksista Euroopan komissiossa.***
which-INE	give-PASS	information-PL career possibility-PL-ELA Europe-GEN commission-INE
NP/Adv	VP/Pred	NP/Obj
'… in which information on the career possibilities in the European Commission is given.'		

5.1. Phrase type and function

In the monolingual text production data, there were 4442 word boundary pauses of which about 50% (2232) were phrase initial pauses. The number of word boundary pauses in the translated texts was 3433 of which 55% (1891) were phrase initial pauses[10].

Before categorising the pauses with regard to type and function of the phrase, the pauses prior to phrases and words were screened according to three requirements: Firstly, the pause must have both of the two pause components, which the keystroke logging programme registers between two words or phrases (for a detailed description, see section 3). Secondly, the type and function of the phrase following the pause has to be known. Occasionally, strings of words found in the log files were not consistent with the conventional patterns of the language. This ungrammaticality was mainly due to uncompleted structuring or restructuring of the sentence. In such cases, the type of phrase was sometimes recognisable, but the function was not, and therefore, when phrases were categorized according to type and function, these phrases were not included. Thirdly, it has to be known whether the phrase initial pause belongs to a main clause or a subordinate clause. Only pauses which met these requirements were included when analysing phrase initial and phrase medial pauses. The third requirement was not applied to word initial pauses located phrase medially.

Table 3 shows that phrase initial pauses are on average longer in translation than in monolingual text production. The mean pause length prior to phrases in monolingual text production is 2.54 seconds and in translation it is 3.81 seconds. Phrase medial pauses show a similar disposition: in translation the mean pause length at word boundary is 1.85 seconds, whereas in monolingual text production it is shorter, only 1.47 seconds. The standard deviations are higher in translation.

9 Determining if a word or string of words is part of a phrase or a phrase of its own is not always straightforward. If the constituent moves with the head of the phrase when placed in various positions within the sentence, it is considered part of the phrase. If, on the other hand, it can be substituted by some other expression or moved to a different position in the sentence without changing the meaning, it is classified as a phrase of its own. An alternative interpretation of the phrase under analysis would be to see it as two separate phrases: a noun phrase *tietoja uramahdollisuuksista* 'information on career possibilities' functioning as an object, and another noun phrase *Euroopan komissiossa* 'in the European Commission' functioning as an adverbial. In this case, the second noun phrase is semantically tightly connected to the preceding one, and for this reason it is considered a post-modifier and part of the preceding noun phrase

10 In Immonen (2006: 326) the number of word boundary pauses (including pauses at phrase boundary) was 4271 in monolingual production and 3434 in translation. The differences to the figures in this paper are due to errors in previous categorisation.

Location of pause		Number of pauses[11]	Standard deviation (sec.)	Mean length (sec.)
Phrase initial	Monolingual text production	2056	6.45	2.54
	Translation	1679	11.62	3.81
Phrase medial word initial	Monolingual text production	1892	3.62	1.47
	Translation	1339	5.58	1.85

Table 3. Comparison of mean lengths of phrase initial and phrase medial pauses in monolingual text production and translation

The figures in Table 4 allow us to compare the mean length of pauses located phrase initially and phrase medially with respect to phrase type. Again phrase initial pauses are longer in translation, with one exception: the mean pause length preceding adjectival phrases is longer in monolingual text production than in translation. Word initial pauses, however, do not follow a clear pattern. Sometimes they are longer in translation than in monolingual text production, sometimes shorter.

Location of pause			Phrase type						
			VP	NP	AdvP	AdjP	PP	InfP	QP
Phrase initial	Monolingual text production	Mean	1.87	3.33	1.77	2.08	4.24	1.25	1.50
		SD	5,50	7.91	3.34	4.85	7.85	2.33	1.36
	Translation	Mean	2.30	5.06	2.51	1.10	4.77	3.92	-
		SD	6.06	14.61	7.87	1.21	7.30	12.45	-
Phrase medial word initial	Monolingual text production	Mean	1.37	1.54	1.36	1.42	0.80	0.52	1.94
		SD	2.90	3.85	3.27	2.11	1.10	0.33	3.58
	Translation	Mean	1.20	1.99	0.86	0.60	1.91	0.32	-
		SD	2.75	6.06	0.66	0.75	4.80	0.20	-

Table 4. Comparison of mean lengths (seconds) of phrase initial pauses and phrase medial pauses with respect to different types of phrases in monolingual text production and translation

When phrase initial pauses are classified with respect to the function of the phrase in the clause (see Table 5), once more translation has longer pauses than monolingual text production. However, the comparison of the pause length values in Table 5 reveals that the phrase initial pause lengths appear to be shorter on average in phrases functioning as predicate or compliment than in phrases functioning as subject, object, oblique or adverbial. In both writing tasks, the mean length of pauses preceding predicate phrases and complement phrases is almost the same: in monolingual text production 1.89 seconds and 2.00 seconds, and in translation 2.31 seconds and 2.10 seconds. The phrase initial pauses for other phrases range from 2.75 to 3.27 seconds in monolingual text production and 4.00 to 6.11 seconds in translation.

11 Here, the number of pauses refers to those word and phrase initial pauses which fulfil the requirements set for them before carrying out further analysis on the effects of phrase type and function (see pages 7-8).

Location of pause			Function of phrase								
			Pred	Subj	Obj	Comp	Obl	Adv	V-inf	Gen-Subj	Inf-Comp
Phrase initial	Monolingual text production	Mean	1.89	3.21	2.75	2.00	3.27	3.05	1.25	2.65	1.64
		SD	5.56	6.99	6.28	4.27	8.05	7.53	2.26	2.72	3.59
	Translation	Mean	2.31	6.11	4.00	2.10	4.66	4.22	3.68	3.42	4.88
		SD	6.08	22.41	9.76	3.69	8.44	9.55	13.70	9.50	9.27
Phrase medial word initial	Monolingual text production	Mean	1.39	1.56	1.67	1.74	1.43	1.27	-	0.63	0.37
		SD	2.94	3.85	4.65	3.33	2.38	3.05	-	0.48	0.07
	Translation	Mean	1.19	1.54	2.35	1.11	2.67	1.90	-	-	0.35
		SD	2.74	3.64	7.46	2.29	9.30	5.26	-	-	-

Table 5. Mean lengths of phrase initial pauses (seconds) categorised according to the function of the phrase in monolingual text production and translation

According to valency grammar (Vilkuna 2003: 23-32), the predicate is considered to be the core of the clause, as it determines the other phrases of the cause. The central position of the verb phrase might be manifested in the shortness of the pause preceding it. In other words, of all the constituents needed to produce a clause, the verb seems to be decided first - maybe even before beginning to write the clause - and, therefore, the pause before the verb is shorter than the pauses preceding other syntactic units. In the case of a clause with a subject and complement, the verb is usually a copula (usually the verb *be*) with little independent meaning. The main function of the copula verb is to relate the subject to its complement. The processing of the verb phrase and the complement phrase might, therefore, be carried out before the processing of other constituents of the clause. For that reason, at least some of the processing time of the copular verb and complement would be included in the sentence initial pause, and less pausing time would be needed at the phrase boundary.

5.2. Phrase length

Two observations can be made regarding the potential influence of translation on pause length. If we examine phrases categorised according to the function of the phrase, the subject, object, oblique and adverbial phrases carry the greatest part of the cost of translating. But, when phrases are classified according to the phrase type, it seems that the noun phrases and adpositional phrases which are responsible for the initial pauses being longer in translation (see Table 4). In Finnish, prepositional and postpositional phrases are used less frequently than in Indo-European languages. In this analysis, these phrase types are grouped together into adpositional phrases. A closer study of Table 4 shows that, in the translated texts, it is the noun phrases and the adpositional phrases whose word initial pauses are longer, too. In comparison, the word initial pauses within other phrase types are shorter in translation than in monolingual text production.

Noun phrases and adpositional phrases are typically composed of more than one word. In monolingual text production, 76% of all phrases, which do not function as predicate or complement, and are not infinitive verb forms, are noun phrases or adpositional phrases. The mean pause length preceding noun phrases and adpositional phrases is 3.28 seconds. The Rank Sums test[12] shows a highly significant difference between the pauses of these two groups of measurements ($z = 9.009$, $p < 0.0006$). Further, 71% of all phrases in monolingual text production consisted of only one word, 15% of the phrases were made up of two words and 6% were composed of three words.

12 In the Rank Sums test (Hatch/Lazaraton 1991: 274-280) a z-value of 1.96 or more shows a significant difference and a z-value of 2.33 or more indicates a highly significant difference between the groups of measurements.

In translation, the proportion of noun phrases and adpositional phrases among phrases which do not function as predicate or complement and are not infinitive verb forms, is 78%, more or less the same as in monolingual text production. The mean pause length preceding noun phrases and adpositional phrases is 5.09 seconds and, again, the Rank Sums test shows a highly significant difference between the pauses of the two groups of measurements ($z = 8.922$, $p < 0.0006$). Of all the phrases in the translations, 65% were one-word phrases, 21% two-word phrases and 9% three word phrases. It seems, therefore, that translators working from English to Finnish use somewhat longer phrases when translating than in other types of writing in their mother tongue. The lengthening of phrases may be a specific feature of translated texts in general, or it may be the influence of English being the source language.

The mean length of pauses preceding noun phrases is 3.33 seconds in monolingual text production and 5.06 seconds in translation. In both types of writing, the noun phrase initial pause length grows with the length of the phrase (see Table 6). A noun phrase consisting of one word is preceded by a pause of about 2.7 seconds on average, but the pause prior to a noun phrase of four words has a mean length of 4.75 seconds in monolingual text production and as much as 10.72 seconds in translation. Regarding the phrase initial pauses in adpositional phrases, the same tendency can be seen in monolingual text production, but pauses in translation act quite differently. In translation, the mean pause length preceding adpositional phrases shortens as the phrases get longer. When phrase medial pauses are examined, in monolingual text production the mean pause length prior to noun phrases grows with the length of the phrase, while in adpositional phrases they remain much the same length in spite of phrase length. No consistency can be seen in the length of the phrase medial pauses in translation.

NOUN PHRASES						
	Number of phrases	**%**	**Mean pause length phrase initial**	**Standard deviation of phrase initial pauses**	**Mean word initial pause length phrase medially**	**Standard deviation of pauses phrase medially**
	Monolingual Text production					
1 word	421	47	2.66	5.99	-	-
2 words	221	25	3.62	9.09	0.87	1.39
3 words	120	13	4.22	10.21	1.47	4.60
4 words	64	7	4.75	9.71	1.41	4.22
> 4 words	73	8	3.63[13]	7.62	2.15	4.28
All	899	100	3.33	7.91	1.54	3.85
	Translation					
1 word	348	44	2.76	6.98	-	-
2 words	240	30	4.54	12.18	1.87	6.47
3 words	133	17	9.97	27.53	2.03	6.14
4 words	48	6	10.72	14.42	1.85	3.70
> 4 words	22	3	4.69[12]	4.99	2.41	7.80
All	795	100	5.06	14.61	1.99	6.06

Table 6a. Comparison of mean pause lengths prior to noun phrases and within noun phrases in monolingual text production and translation

13 The fact that the mean pause length decreases if noun phrases are longer than four words may suggest that very long phrases are not processed in one chunk.

ADPOSITIONAL PHRASES						
	Number of phrases	**%**	**Mean pause length phrase initial**	**Standard deviation of phrase initial pauses**	**Mean word initial pause length phrase medially**	**Standard deviation of pauses phrase medially**
	Monolingual Text production					
1 word	10	16	2.81	4.31	-	-
2 words	33	53	3.36	7.76	0.81	1.32
3 words	6	10	5.40	5.52	0.99	0.95
4 words	5	8	1.70	2.43	0.58	0.59
> 4 words	8	13	10.36	12.53	0.92	1.23
All	62	100	4.24	7.85	0.80	1.10
	Translation					
1 word	7	19	6.41	7.80	-	-
2 words	5	14	9.35	11.07	1.27	1.00
3 words	9	24	4.99	9.56	1.31	2.07
4 words	14	38	2.65	3.05	2.80	7.15
> 4 words	2	5	1.40	1.51	1.47	2.72
All	37	100	4.77	7.30	1.91	4.80

Table 6b. Comparison of mean pause lengths prior to adpositional phrases and within adpositional phrases in monolingual text production and translation

5.3. Clause type

Until now, we have investigated the phrase characteristics which affect pause length before and within the phrase. Now the focus turns to pauses at sentence medial clause boundaries. Clauses can be classified as main clauses which are autonomous and carry a full meaning on their own, and subordinate clauses which are grammatically dependent on and function as a unit in the main clause.

Clause boundary pauses in monolingual text production are, in general, shorter than clause boundary pauses in translation (see Table 7). The mean pause length is 4.54 seconds in monolingual text production and 5.72 seconds in translation. In monolingual text production, pauses preceding main clauses tend to be longer (5.78 sec.) than pauses preceding subordinate clauses (3.77 sec.). The mean lengths of phrase initial pauses within the clause also are shorter in the subordinate clause (2.05 sec.) compared to those in the main clause (2.69 sec.). If pause length signals the cost of the processing that is needed for the following unit, these figures can possibly be interpreted as evidence that, in monolingual text production, the subordinate clause is at least to some extent planned as part of the main clause.

In translation, the mean pause lengths prior to main clauses and subordinate clauses are almost the same (5.70 sec. and 5.72 sec.). The phrase initial pauses which appear clause medially, however, seem to reflect a difference in clause type. Phrase boundary pauses in main clauses are on average 7.72 seconds, whereas the mean length of phrase boundary pauses in subordinate clauses is 3.96 seconds. It seems, therefore, that in translation clause initial processing is very similar irrespective of the grammatical status of the clause in the sentence.

Location of pause	Monolingual text production		Translation	
	Mean	SD	Mean	SD
All clause boundaries	4.54	8.38	5.72	12.29
Prior to main clauses	5.78	7.03	5.70	7.70
Prior to subordinate clauses	3.77	9.01	5.72	12.99
Phrase initially within the main clause	2.69	7.17	7.72	24.21
Phrase initially within the subordinate clause	2.05	3.80	3.96	10.50

Table 7. Comparison of mean pause lengths (in seconds) prior to and within clauses in monolingual text production and translation

5.4. Pauses and the processing of syntactic units

Pause time is not scattered out arbitrarily, quite the contrary, it is distributed according to the current demands of production processes. Pause time distribution is surprisingly responsive to the size and nature of the linguistic unit which is being processed. Figure 1 illustrates the distribution of pause time prior to linguistic units of different types in monolingual text production and translation. The comparison of the mean pause lengths in monolingual text production and translation sheds light on features characterising the translation process. In translation, pause lengths between units smaller than the clause are longer, whereas between the larger units they are shorter.

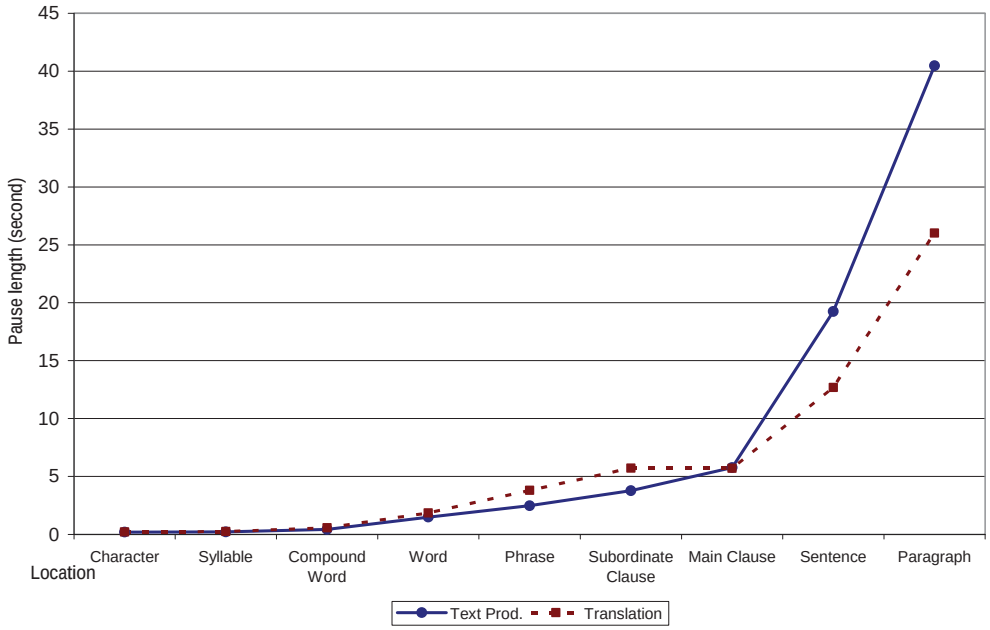

Figure 1. Comparison of mean pause lengths in monolingual text production and translation showing longer pauses between smaller units in translation, but shorter pauses between longer units, with the main clause as the pivotal unit

The Rank Sums test was carried out to ascertain the statistical significance of the difference between groups of pause length measurements in monolingual text production and translation. The differences in pause lengths between the two text types are highly significant between paragraphs ($z = 2.525$, $p = 0.0104$), sentences ($z = 2.709$, $p = 0.0068$), phrases ($z = 4.549$, $p < 0.0006$), syllables ($z = 6.189$, $p < 0.0006$) and characters ($z = 5.480$, $p < 0.0006$). The difference is not significant at word ($z = 1.869$, $p = 0.0614$) and compound word boundary ($z = 0.94$, $p = 0.3472$), nor between subordinate clauses ($z = 1.517$, $p = 0.1286$) and main clauses ($z = 0.218$, $p = 0.8258$).

However, within each text type the difference in pause lengths between adjacent levels (e.g. word vs. phrase) is always highly significant in both monolingual text production and translation. These figures suggest, firstly, that the nine categories chosen to describe pause location can be considered different, and secondly, that the difference in the production of translation is manifested in faster processing of paragraphs and sentences at the textual level, and in slower processing of phrases at the syntactic level, as well as slower processing of syllables and other keystrokes (which are not compound word boundaries) word medially[14].

Tables 8a and 8b indicate the number of pauses detected in each category, the standard deviation of pause length as well as the minima and maxima, the mode, and the mean pause length of each category.

Monolingual Text Production						
Location	**Number of pauses**	**Standard deviation (sec.)**	**Shortest pause (sec.)**	**Longest pause (sec.)**	**Mode (sec.)**	**Mean length (sec.)**
Paragraph	77	54.07	2.02	319.01	-	40.47
Sentence	188	22.26	0.58	167.71	3.37	19.26
Main Clause	83	7.03	0.24	43.22	1.55	5.78
Subordinate Clause	139	9.01	0.23	67.74	0.45	3.77
Phrase	2232	6.27	0.08	101.39	0.28	2.47
Word	2210	3.96	0.10	69.36	0.26	1.49
Compound Word	746	0.71	0.06	13.68	0.17	0.42
Syllable	10614	0.24	0.01	10.21	0.15	0.22
Character	26045	0.25	0.01	8.91	0.10	0.20

Table 8a. Basic information on pauses found in the fluent text production passages of the monolingual text production tasks

Translation						
Location	**Number of pauses**	**Standard deviation (sec.)**	**Shortest pause (sec.)**	**Longest pause (sec.)**	**Mode (sec.)**	**Mean length (sec.)**
Paragraph	85	32.73	1.09	175.26	8.11	26.02
Sentence	163	14.37	0.79	125.84	4.91	12.70
Main Clause	38	7.70	0.40	43.49	2.72	5.70
Subordinate Clause	200	12.99	0.33	89.34	0.44	5.72
Phrase	1891	11.64	0.08	274.75	0.31	3.80
Word	1542	5.57	0.06	86.59	0.29	1.86
Compound Word	297	1.34	0.07	16.45	0.18	0.58
Syllable	8722	0.49	0.11	22.48	0.14	0.25
Character	21155	0.29	0.01	8.95	0.10	0.21

Table 8b. Basic information on pauses found in the fluent text production passages of the translation tasks

The following is an example of pause time distribution in one sentence from the monolingual text production data. The numbers above the text indicate the lengths of the pauses detected between the words of the sentence. This sentence comprises two clauses: a main clause *Tyyli oli aivan toisenlainen* and a subordinate clause *kun EU:n komissioon ja muihin elimiin alettiin valita kääntäjiä ja tulkkeja yhdeksänkymmentäluvun puolivälissä*. The pause preceding the main clause

14 A preliminary analysis of pauses at the boundaries of three specific morphemes was also carried out. These morpheme boundaries included the word final genitive morpheme *-n* (e.g. *suome**n** kieli* – 'Finnish language'), the word medial genitive morpheme *-n-* (e.g. *työ**n**tekijä* – 'employee') and the inessive morpheme *-ssA-* or *-ssA*. (The capital A stands for /a/ or /ä/. The vowel is chosen according to the rules of vowel harmony.) The mean length of these morpheme boundary pauses was 0.22 seconds in monolingual text production and 0.26 seconds in translation. However, the difference of pause lengths at morpheme boundaries irrespective of whether the three morphemes were studied as one group or three different groups of measurements, was statistically not significant when the populations of the two text types where compared.

is long (22.65 seconds), whereas the pause prior to the subordinate clause (0.56 seconds) is short, which suggests that the subordinate clause might have been planned as part of the main clause. In both clauses, the verb phrases functioning as predicate are preceded with a relatively short pause, 0.38 seconds in the main clause and 0.24 seconds in the subordinate clause. Because of the importance of the predicate in structuring the clause, it may be processed before all the other constituents of the clause and perhaps even before the writer begins to write the clause. It may be possible that complement phrases and infinitive verb forms are processed together with the verb. Therefore, the complement phrase in the main clause and the infinitive verb in the subordinate clause are both preceded by a short pause.

(5) The figures in this example are pause lengths (seconds) between words.

22.65	0.38	0.33	0.29
Tyyli	*oli*	*aivan*	*toisenlainen*
style	be-PAST-3SG	entirely different	
NP/Subj	VP/Pred	AdjP/Comp	
'The style was entirely different …'			

0.56	0.82	0.35	0.97	0.27	0,57	0.24	0.30
kun	*EU:n komissioon*		*ja*	*muihin*	*elimiin*	*alettiin*	*valita*
when	EU-GEN Commission-ILL and other-PL- ILL institution-PL-ILL					begin- PAST-PASS	choose
conjunction	NP/Adv					VP/Pred	VP/V-inf
'… when (they) began to choose for the EU Commission and other institutions …'							

2.51	0.41	0.28	3.43	0.41
kääntäjiä	*ja*	*tulkkeja*	*yhdeksänkymmentäluvun puolivälissä.*	
translator-PL-PART and interpreter-PL-PART			ninety decade-GEN middle-INE	
NP/Obj			NP/Adv	
'… translators and interpreters in the mid 90's.'				

Unlike the phrases functioning as predicate or complement, noun phrases and adpositional phrases -especially when they occur later in the clause - appear to be processed just before they are written, or even during the writing of the phrase, if the phrase is long. In our example, the pause preceding the first noun phrase in the beginning of the subordinate clause is 0.82 seconds, and therefore not very long, but certainly longer than the pauses preceding phrases functioning as predicates, complements or consisting of infinitive verbs. This phrase seems to be processed in two parts: the first half being *EU:n komissioon* and the second part being *ja muihin elimiin*. Both parts are preceded by a pause of similar length 0.82 seconds and 0.97 seconds, whereas the other word initial pauses are shorter 0.35, 0.27 and 0.57 seconds. At the end of the subordinate clause there are two more noun phrases. They are preceded by very long pauses of 2.51 seconds and 3.43 seconds. The word initial pauses located phrase medially are short (0.41, 0.28 and 0.41 seconds). These noun phrases are most likely processed prior to the phrase initial word. The difference in processing time comes out very clearly if we compare the adjectival phrase in the main clause and the last two noun phrases in the subordinate clause. Despite the fact that the phrases are roughly of the same length, the distribution of pause time is very dissimilar.

6. Discussion

In this study, translation has been considered a specific type of writing process. The aim of this research was to explore the correlation between pause duration and the processing of syntactic units in monolingual text production and translation and to reflect on how our research relates to previous research both in translation and writing research. Our results are in line with the ideas voiced in writing research literature, as can be seen, for example, in the following quotation from Foulin (1998: 614-615).

> Because of the multi-level ways in which pause duration is determined […], the pause pattern does not reveal which type of processing is performed during pausing. Nevertheless, variations in pause duration can be understood as variations in the cognitive cost of the processes underlying written production and some explanation of writing management can be cautiously proposed.

Foulin expresses a word of warning and explains the dilemma of pause time distribution studies. Pauses are a fascinating behavioural feature of all language production. The prospect that these, often unnoticed "moments of physical inactivity" (Matsuhashi 1981: 114), could in fact be indications of the abundant cognitive activity in the mind of the writer is intriguing. But, at the same time, it must be accepted that there is still too little knowledge about the processing of language production to enable us to see clearly the connections between visible behaviour during language production and the hidden cognitive processes. Foulin (1998: 602) states that there is "a great need to establish some bases for the relationships between pause duration and writing components". We set out to continue the survey begun by Immonen (2006) and elucidate, for our part, some features of the syntactic processing of written text production which may have an influence on pausing.

Our results also agree with those of other writing research studies regarding the parallel between pause length and the size of the linguistic unit (e.g. Matsuhashi, 1981 Chanquoy et al. 1996). Pauses prior to large linguistic units are on average longer than pauses before the shorter units in both monolingual text production and translation. We can therefore make the generalisation that large textual units require more processing than the smaller syntactic and word medial units in writing generally. In translation, however, the processing of smaller units is intensified, whereas larger units require less processing. This divergent behaviour may reflect the translator's attempt to achieve the best possible translation, especially at the level of lexical meaning. The textual level, paragraph and sentence structure, on the other hand, is often copied from the source text. The translator is in a different situation compared to other writers: instead of being able to create the content of the text, the translator is usually asked to keep the idea unchanged but express it in another language.

We explored phrases of different types, function and length in relation to pause duration. Pauses preceding noun phrases tended to be longer than the ones preceding verb phrases. The difference in the processing of these two phrase types is that verb phrases are most likely processed during the sentence initial pause, before writing begins, while noun phrases seem to be processed locally. Evidence for this assumption is found in the length of the pauses preceding verb and noun phrases of the same length. The mean length of pauses prior to phrases comprising only one word shows that noun phrases require more processing time than verb phrases. And the picture becomes even clearer when examining phrases composed of two or more words. Word initial pauses within noun phrases grow with the length of the phrase, whereas word initial pauses within verb phrases do not reflect the length of the phrase. Even though adpositional phrases often consist of several words, an adposition and a noun phrase, the mean pause length values indicate that adpositional phrases are processed differently from noun phrases. Phrase initial pauses tend to be long, but phrase medial pauses short irrespective of phrase length indicating that, unlike noun phrases, adpositional phrases are processed mainly during the initial pause.

It seems that processing time during written text production takes two forms. The first strategy is to pause long enough to process the intended portion of text before starting to write. Adpositional phrases are an example of the use of this strategy. The second strategy is to begin writing even though the processing may not be finished. In this case, the slowing down of the production results in longer phrase medial pauses. The production of noun phrases seems to be characterised by this strategy.

In translation, the second strategy seems to be used more often than in other types of writing. The longer the stretches of text, the more processing time is needed, and it may not be possible to finish processing before beginning to write, since translation requires additional cognitive proc-

esses. Therefore, processing is done to the extent which is required to allow writing to begin, and more processing time is taken by pausing longer during the writing of the text. A possible hypothesis could be that translation is textually a more fragmented process than monolingual text production.

Finally, we investigated pauses preceding sentence medial clauses. The clause had attracted our attention as a unit where the effect of translation on pause length changed. In comparison with monolingual text production, translation has longer mean pauses between clauses and units smaller than the clause, but shorter mean pause length between units larger than the clause. We divided the clause level pauses into two categories: pauses prior to main clauses and pauses prior to subordinate clauses. In monolingual text production, pauses preceding subordinate clauses are on average much shorter than pauses preceding main clauses. Van Hell et al. (2008: 423) report of a similar finding and suggest that "the time both beginning and adult writers take to decide on how to express their ideas in syntactically linked clause structures varies with the grammatical and functional (in)dependency of the clause". In translation, the mean pause lengths preceding main clauses and subordinate clauses are almost the same. Thus, in translation the subordinate clause is most likely processed as a separate clause, even though it functions as a syntactic unit in the main clause. The long pre-phrasal pauses in subordinate clauses support this conclusion.

REFERENCES

de Beaugrande, Robert 1984: *Text Production: Towards a Science of Composition*. Norwood, New Jersey: Ablex Publishing Corporation.

Butterworth, Brian 1980: Evidence from Pauses in Speech. In Butterworth, Brian (ed.), *Language Production: Vol. 1 Speech and Talk*. London: Academic Press, 155-176.

Chanquoy, Lucile/Foulin, Jean-Noël/Fayol, Michel 1996: Writing in Adults: A Real-time Approach. In Rijlaarsdam, Gert/van den Bergh, Huub/Couzijn, Michel (eds.), *Theories, Models and Methodology in Writing Research*. Amsterdam: Amsterdam University Press, 36-43.

Dahl, Östen 2008: Kuinka eksoottinen kieli suomi on? (How exotic a language is Finnish?) Original title: Hur exotiskt är finska? Translation by Jarno Raukko. In *Virittäjä* 4, 545-559.

Foulin, Jean-Noël 1998: To What Extent Does Pause Location Predict Pause Duration in Adults' and Childrens' Writing? In *Current Psychology of Cognition* 17 (3), 601-620.

Goldman-Eisler, Frieda 1958: Speech Analysis and Mental Processes. In *Language and Speech* 1, 59-75.

Goldman-Eisler, Frieda 1972: Pauses, Clauses, Sentences. In *Language and Speech* 15, 103-113.

Hatch, Evelyn/Lazaraton, Anne 1991: *The Research Manual. Design and Statistics for Applied Linguistics.* Boston MA: Heinle & Heinle Publishers.

van Hell, Janet G./Verhoeven, Ludo/van Beijsterveldt, Liesbeth M. 2008: Pause Time Patterns in Writing Narrative and Expository Texts by Children and Adults. In *Discourse Processes* 45, 406-427.

Hick, William E. 1952: On the Rate of Gain of Information. *Quarterly Journal of Experimental Psychology* 4, 11-26.

Hunt, Kellogg W. 1965: *Grammatical Structures Written at Three Grade Levels*. Urbana: National Council of Teachers in English.

Immonen, Sini 2006: Translation as a Writing Process: Pauses in Translation versus Monolingual Text Production. In *Target* 18 (2), 313-335.

Jakobsen, Arnt Lykke/Schou, Lasse 1999: Translog Documentation, version 1.0. In Hansen, Gyde (ed.), *Probing the Process in Translation: Methods and Results*. Copenhagen: Samfundslitteratur, 1-36 [Appendix 1].

Matsuhashi, Ann 1981: Pausing and Planning: The Tempo of Written Discourse Production. In *Research in the Teaching of English* 15 (2), 113-134.

Schilperoord, Joost 1996: The Distribution of Pause Time in Written Text Production. In Rijlaarsdam, Gert/van den Bergh, Huub/Couzijn, Michel (eds.), *Theories, Models and Methodology in Writing Research.* Amsterdam: Amsterdam University Press, 21-35.

Schilperoord, Joost 2002: On the Cognitive Status of Pauses in Discourse Production. In Rijlaarsdam, Gert (series ed.)/ Olive, Thierry/Levy, C. Michael (volume eds.), *Studies in Writing: Vol. 10: Contemporary Tools and Techniques for Studying Writing.* Dordrecht: Kluwer Academic Publishers, 61-87.

Vilkuna, Maria 2003: *Suomen lauseopin perusteet.* (The basics of syntax in Finnish.) Helsinki: Edita Prima Oy.