Visual input in simultaneous interpreting: the role of lexical density

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Abstract : Visual supports in the form of PowerPoint presentations have been used in the last decades in contexts where conference interpreting is present. The presence of an additional source of information could facilitate or hinder the work of the interpreter by adding an additional layer of cognitive efforts. A group of interpreters were requested to interpret two similar speeches supported by more or less dense presentations with the objective of determining the influence of the textual density of the visual input. The results suggest that a presentation containing complete clauses could have a positive impact in the performance of the interpreter measured by the fluency of their utterance.

Keywords : visual input, simultaneous interpreting, fluency, text density, PowerPoint

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1. Introduction

Simultaneous interpreting involves many processes taking place at the same time, therefore it has been suggested that the cognitive demand in this mode of interpreting is high (Christoffels, 2004, pp. 454, 455; Moser-Mercer, 2005, p. 736). Nowadays, this challenge seems to have increased: with the introduction of new ICTs (Information and Communication Technologies), visual aids are now more and more present (Berber-Irabien, 2010; Causo & European Commision, 2011), and especially in the form of slide presentations, a staple of the interpreter's workday. Many speakers use slide presentations to support their speech, and this particular situation confronts the interpreter with an additional challenge: they have to decide whether the written information will be useful or not and, if they choose to follow both the speaker and the presentation, the interpreters have to double check that the written presentation follows the uttered speech. This additional input might represent an added load for the interpreter's cognitive system and raises a question: is this input as useful for the interpreter as the speaker intends it to be for the audience?

The authors hypothesize that a presentation with a high lexical density, composed of keywords instead of full sentences, will result in a more fluent interpretation in the target language. It could be considered that a higher lexical density requires a lower cognitive effort compared to a lexically less dense presentation, possibly due to the simple fact that a presentation consisting of keywords only is visually simpler than a presentation with full sentences. If the hypothesis is confirmed, we would advise speakers who are concerned about the quality of interpretation to use lexically dense visual aids. There are numerous sources that analyze the perception of presentations by the public and that define a set of characteristics for the ideal presentation (Bucher & Niemann, 2012; Kosslyn, 2007; Mackiewicz, 2008), but is this applicable to how presentations are processed by conference interpreters?

In order to support the hypothesis, the authors examined the current research related to this matter: information load in simultaneous interpreting, simultaneous interpreting effort models, perception of visual information, readability and influence of visual input in simultaneous interpreting. Although research in these individual fields is extensive, the number of studies on the role of presentations in simultaneous interpreting is limited. An experiment was carried out with the aim of determining whether a presentation with a higher lexical density has a positive influence on the fluency of the interpretation or not.

2. Overview

In the first part of this paper (3. State of the art), relevant literature on the subject matter, theories on simultaneous interpreting, visual input and reception and cognitive load that are felt to be pertinent for this study are presented. This is followed by the expected outcome of the experiment (4. Aims of the experiment and expected results). The second part is dedicated to the description of the experimental setting (5. Methodology), which covers a general description of the experiment, the definition of the independent variable (IV) and the dependent variables (DV), a description of the participants, the experimental material used and the procedure for the experiment. The presentation of the experimental data, its statistical analysis and discussion follow in the third part (6. Results and 7. Discussion). Conclusions and possibilities for further research are presented in 8. Conclusions

3. State of the art

Since the introduction of simultaneous interpretation in the 1920s, ICTs have gradually entered the conference room (Baigorri-Jalón, 2004; Bertone, 1989), improving, for some, the working conditions of interpreters (AIIC, 2012; Causo & European Commision, 2011). Research on the use of ITCs in interpreting has developed during the last decade; the AIIC, has also established guidelines for their use, considering that some technical developments may have an impact on the work of the interpreters (AIIC, 2012; Berber-Irabien, 2010). An example of these developments is the growing presence of presentations in the form of digital slides, also known as PowerPoint presentations.

Simultaneous Interpreting involves "objective stress factors: the constant information load, the time factor, the tremendous amount of concentration required, fatigue, the confined environment of the booth, etc." (Kurz, 2003, p. 51). It is commonly recognized that interpretation requires mental resources that are limited in quantity (Gile, 2009; Seeber & Kerzel, 2011). Gile (ibid.) states that an overload of processing capacity might translate to a deterioration of the performance. In the past century, a number of models and theories on cognitive effort have been elaborated. Seeber (2011; 2013) provides an extensive overview over the existing cognitive load models and their evolution, a large part of which are models based on cognitive psychology. The study of SI (simultaneous interpreting) has always been at the intersection of diverse fields of research: linguistics, psycholinguistics, cognitive psychology, amongst others (Kurz, 1996). In this chapter the relevant studies on the effort of the interpreter to deal with different sources with a special focus on visual perception will be presented.

Visual input and reception and processing of visual information have been in the focus of different fields of research. A lot of research has been carried out in the field of educational psychology, where the *Cognitive Load Theory* (Brünken, Plass, & Leutner, 2003; Chandler & Sweller, 1991; De Jong, 2010; Sweller, 1994, 2010) was developed. The theory considers, in the same fashion as Gile's effort model, that working memory is limited and thus can only deal with a limited amount of information (Pollock, Chandler, & Sweller, 2002). In contrast to the SI models presented above, this approach takes into consideration different elements that generate cognitive load. They distinguish between *intrinsic*, *extraneous* and *germane cognitive load.* Whereas intrinsic cognitive load is generated by the intellectual complexity of information and germane cognitive load stands for the effort of schema construction and automation

(Chang, Chen, & Yu, 2012; De Jong, 2010), extraneous cognitive load designates the cognitive load induced by the material and its design. It is linked to the way information is presented, thus amongst others to visual input:

> "Cognitive load theory makes a distinction between the two sources of cognitive load. Extraneous cognitive load is generated by the manner in which information is presented to learners and is under the control of instructional designers." (Pollock et al., 2002)

Nevertheless, these studies remain rather general and are focused on instructional contexts, giving little attention to visual input or audio-visual stimuli.

Gile's effort model takes into consideration the basic elements of interpreting that consist of listening and analysis, memory, production and coordination efforts, a sum of which result in the total requirements, that should be lower than the available capacity to ensure an adequate interpretation (Gile, 1998). On the basis of these elements, he elaborates his *effort model* for SI in form of a mathematical equation:

$$SI = L + P + M + C$$

Gile states that the effort of SI (SI) equals the sum of the efforts for listening (L), production (P), memory (M) plus for the coordination (C) of these tasks, as they have to be carried out simultaneously.

Seeber (2011) establishes a new model to explain the same process, the so called *Cognitive Load Model*. According to Seeber, Gile's effort model cannot take into consideration interferences between the different tasks; he therefore develops a model that accounts potential issues related to task overlap:

> "The theoretical foundation of the Cognitive Load Model, however, is in stark contrast to that of the Effort Model. The latter is based on Kahneman's (1973) single re-source theory and thus assumes that all tasks involved in the SI process draw on one and the same pool of undifferentiated resources." (2011, p. 189)

Whereas both models describe the effort of the inherent tasks of SI, none of them takes into account an eventual increase in the workload as a consequence of the introduction of new technologies in the conference room.

Research by Brünken, Plass & Leutner (2003; 2004) has concluded that a multimodal input is cognitively more efficient than a single input in the context of multimedia learning, and therefore there might be reasons to believe that a combination of audio and visual information can be beneficial for understanding and thus, in the interpreting process.

Due to the lack of evidence on the usefulness of these technologies from an interpreter's point of view, it might be interesting to have at a look at the different scenarios that, in the authors' view, could occur when interpreting with a visual input in the form of a text presentation. One scenario is that the interpreter looks at the visual input and, assessing different variables, considers it to be helpful. With the help of the presentation, he might be able to anticipate the information uttered orally or to control whether he has understood the spoken information correctly. Opposed to that, a case in which the interpreter considers it to be too much of an effort to double-check that the information visually presented reflects the information contained in the speech and decides to ignore the presentation. In between these two extremes, one could imagine a third scenario, where the interpreter keeps looking at the presentation, even though their performance is impaired by the ongoing task of coordinating the audio and visual input. In this last scenario, a presentation may seem helpful, but the increased effort required "deciphering" or understanding it may increase the total requirements to a point where they exceed the available capacity.

Lu and Wickens (2013), for instance, carry out an extensive meta-analysis of existing studies on task interruption in multimodal settings and look, amongst other settings, at audio-visual redundancy. They state that previous surveys did not allow consistent conclusions on the performance costs or gains of redundant versus single-modality presentations:

> "Redundancy may result in increased accuracy; however, the dual information-processing load of reading and listening imposed by redundancy can delay the time to process information and therefore reduce efficiency. Furthermore, the added processing requirements of redundant information could result in a performance cost on the ongoing task." (Lu & Wickens, 2013, p. 699)

But once more, the focus does not lie within the field of interpreting and the visual input is considered as the pre-eminent information channel over the auditory channel. Most of the research in the field of audio-visual stimuli is focused on other tasks such as vehicle driving or data control (Lu & Wickens, 2013), where the presence of verbal content in both channels is rare.

In the field of interpreting studies, authors such as Jesse, Vrignaud, Cohen & Massaro (2000) provide some evidence that in some cases, the presence of an additional visual stimulus may actually reduce the load in the listening and analysis efforts in cases where, for example, the sound quality is not good or the speaker does not express themself clearly. They examine the comprehension of spoken sentences when they are presented with "visible speech" in comparison to the understanding of auditory information alone. They define "visible speech" as the lip movements corresponding to the auditory information. The results of the study show, to the authors own surprise and contrary to findings from other authors such as Massaro (1998), that there is no significant difference between the two settings. Rennert (2008) carries out a similar experiment comparing the interpretation of two different conditions: one group was interpreting without seeing the speaker, the other group had free sight on the speaker. As in the research of Jesse et al.(2000), the researchers found "no significant positive or negative influence of visual input" (Rennert, 2008, p. 213). Moser-Mercer (2005) on the other hand refutes these findings in her study on Multi-Sensory Integration in a Multilingual Task, stating that in a remote interpreting setting, where the interpreter is not in the same locality as the speaker and the audience, even if he or she can see the speaker by means of a virtual environment, the fulfilment of the SI tasks in remote interpreting poses additional challenges from "the deficiencies created by the new environment" (Moser-Mercer, 2005, p. 736), therefore affirming the importance of visual input.

Finally, Lambert (2004) finally touches upon the subject of the influence of text on the interpretation process by comparing the performance of *sight translation* (ST), *sight interpretation* (SIT) and SI. She reaches the conclusion that the presence of the text helps the interpreter, which is clearly shown by the performance quality for ST and SIT that were substantially higher than for SI.

Unfortunately, there seems to be virtually no literature on the influence of visual input in form of slide presentations on SI. There are, however, studies on the reception of PowerPoint presentations. Bucher and Niemann (2012) follow an experimental approach to their research question about the influence of slide presentations on knowledge transfer, and how recipients deal with the multimodality of this communication situation. They examine the different forms of slides and their impact on the reception. Text slides, for instance, can be split in two groups according to their presentation mode: *static* or *dynamic*. According to one of their definition of their conditions, dynamic text slides cause the audience to switch attention between slide and speaker with every blended information element and can be a way to optimize the interaction between the speaker and his presentation. Furthermore, they are supposed to help to maintain the coherence between the two information modalities. Static text slides on the other hand, as used in our experiment, are considered to be visually complex and turn the audience's concentration on reading first. As a consequence, the speaker's words might be ignored.

3.1. Summary

Looking at the reviewed literature, there is one clear conclusion to be drawn: There are many theories on the different elements of our experimental setting, but none of them treats the combination of perception and comprehension of PowerPoint presentations linked to SI performance. This might be due to the fact that there is still a lot of work going on in the field of cognitive effort models. According to Brünken et al. (2002) there are many well developed theoretical that still fail to measure the cognitive effort:

> "In fact, recent research on multimedia learning routinely uses cognitive load as a theoretical rationale to explain differences in learning outcomes but does not actually assess the amount of cognitive load imposed on the learners."

A similar observation applies to research in the field of conference interpreting: Although there are new models that provide propositions for measuring the cognitive load (Seeber & Kerzel, 2011; Seeber, 2013), they are applied for the SI process as a whole and do not lend special focus to visual input.

Nevertheless, there seems to be common agreement on the hypothesis that visual input in form of text can be beneficial for the interpreter's performance:

> "A somewhat less obvious implication of our theoretical framework is that having both the written message and the spoken message would facilitate simultaneous interpretation." (Jesse et al., 2000)

As mentioned above, Brünken et al. (2004) state that from the perspective of working memory models it might be helpful for comprehension when there is a multimodal setting consisting of auditory and visual information, as these can be treated in the respective parts of the working memory and thus the capacity of both subsystems can be used. In what manner this visual information should be presented to support interpreting performance remains however unclear.

4. Aims of the experiment and expected result

In this experiment, the authors tried to determine whether a presentation with a higher lexical density and visual clarity, consisting mainly of keywords, had an influence on the measured parameters of fluency compared to a lexically less dense and visually less clear presentation consisting of simple clauses. A series of objective markers like pauses, filled pauses, false starts and repetitions (Riggenbach, 1991) were established as the dependent variables. We tested the effect of the independent variables to determine if the subject performance was influenced by the independent variables lexical density and visual clarity of the presentation.

Taking into account recommendations on presentations and their reception by the public (Bucher & Niemann, 2012; Mackiewicz, 2008) as well as the effort models (Gile, 2009), it was hypothesized that the best quality and fluency would be obtained with the visually clearest presentation. The hypothesis assumes that a slide with a high lexical density (that means a slide consisting almost only of content words and little to no function words) would provide all the supposed benefits of redundant audio-visual stimuli without imposing a cognitive load on the interpreter that may have a detrimental effect. A lower lexical density and therefore a higher presence of function words, on the other hand, was thought to be a hindrance for the recognition of the content words which carry, as their name says, information the interpreter might be looking for. According to Ure (1971, p. 445), content words can be defined as "words with lexical properties", whereas function words can be considered as "[…] items, which, if we take them one by one, can be described purely in terms of grammar, without any reference to lexis items […]".

Hence, it seems to be promising to carry this experiment in order to find out if there might be relations between the visual clarity of a presentation and interpreting performance. It remains clear that this experiment only covers two restricted settings of one out of many possible examples of visual input in the interpreters' working context and is carried out with a small sample of participants. The aim of this study is therefore to lay the groundwork for further experiments and the application of existing theories to this situation.

5. Methodology

The method to test the proposed hypothesis consists of a simple experimental design. There are two different levels of the IV in the form of two slide presentations with higher and lower visual clarity and lexical density. These serve as a support for two video speeches which have to be simultaneously interpreted. The DV –or measure of performance– is based on fluency[1] of the interpreting performance, which is defined on the basis of prosodic elements.

5.1. Independent Variables

As explained in the introduction, slide presentations have been chosen as the object of this study because they typify the growing presence of visual information in interpreters' work. Slide presentations can be diverse in form. To restrict the set of variables to our experiment, it has been necessary to establish one single IV and two clear conditions which would make it possible to ascertain the effects on the DV. For this purpose it was decided to use slide presentations with text only, which differ from each other in their visual clarity or readability. Amiran and Jones (1982, pp. 13–14) define readability as a function of three concurrent variables: *structure, texture* and *content density*. The three variables are intrinsically linked to the comprehension of the text and not only to the visual reception, the former two being described as follows:

> "Texts that are very hard to comprehend may be composed of short and familiar words and short sentences, as readers of Beckett or the Bible will readily agree. What makes texts difficult to understand, beyond complex text structures, is the amount of inference they demand, a quality we shall call texture. Thus a Sartre story which a traditional readability scale assigns to sixth grade could not be understood by sixth grade readers, since they would be unable to infer the existentialist principles that motivate its main character and define 'what happens.' In short, a text may be difficult to read because of a complicated

[1] The term *fluency* and not *fluidity* of the delivery has been chosen based on the existing literature on the subject matter (Pradas Macías, 2006; cf. Zwischenberger & Poechhacker, 2010).

structure, or because of its inexplicit texture, the number of 'holes' between its propositions." (1982, p. 14)[2]

The two speeches contain a similar type of information relevant to the interpreting task, the only difference being the linguistic packaging of the visual support: simple sentences on one presentation, keywords on the other one. Regarding the three variables described by Amiran and Jones (ibid.), there is clearly a difference in the complexity of the structure of the two presentations, but talking about *structural complexity* as an independent variable could be misleading due to the fact that none of the slideshows actually presents complex structures.

The independent variable needs another term to define the present setting. One possible approach is based on the cognitive load theory as described in chapter 3, which establishes the concept of intrinsic, germane and extraneous load. Chang et al. (2012) introduce the variable of *visual clarity of information* for extraneous load in opposition to *informational density* for intrinsic load. On the basis of these two concepts the two levels of IV in this study shall be described as visual clarity of information in relation to the design of the two presentations. The presentation with the higher amount of verbal context around the actual information that is supposed to help the interpreter translate the speech shows lower visual clarity of information. The presentation mainly consisting of keywords (considered the "clear presentation") shows higher visual clarity. The informational density has to be considered as a variable measuring the proportion of essential information compared to the total information on each slide. This idea is reflected as well in the concept of *lexical density* presented by Ure (1971, p. 445), which establishes the proportion of lexical items (content) to the total amount of (orthographical) words. In our case, we could therefore state that one presentation is of higher lexical density and visual clarity (only keywords), the second one is of lower lexical density and visual clarity (complete sentences). As lexical density and visual clarity are obviously interconnected, they shall be treated as one IV.

[2] Underlined for emphasis by the authors.

5.2. Dependent Variables

5.2.1. Prosody as a sign of quality in SI

Compared to the research on visual input on SI, research on prosody seems to be more developed, either from the purely linguistic point of view or in relation to the interpreting process. The role of pauses and hesitation phenomena in simultaneous interpreting has been in the focus of research during the last years, and based on the available data, these phenomena can be used as markers to determine performance and cognitive load if their relation to the source text and their mutual interaction is taken into consideration (Ahrens & Germersheim, 2005; Pradas Macías, 2007; Tissi, 2000). In the following sections, the different DV will be defined and the extent to which they can be considered a sign of quality for SI will be explained.

5.2.2. The concept of fluency and its relevance for SI quality

The DV is the fluency of the interpreting performance, which can be determined on the basis of different concurrent prosodic elements. Fluency has been chosen as a measure of performance as an indicator of the difficulties encountered during the interpreting process. As explained with regard to the source texts (speeches and presentations), the focus will not be placed on the content, but rather on the non-verbal features of the spoken output. There is sufficient evidence in literature for prosodic features as signs of quality. The results of Pradas Macías' study (2006, p. 34) about quality in SI show that 44% of the subjects of her study rate fluency of the delivery as having a strong influence on quality evaluation, and 19% consider it fundamental. In a recent survey amongst AIIC members (Zwischenberger & Poechhacker, 2010), 70.7% of the subjects stated that the *fluency of delivery* was a *very important* criterion for output-related quality in interpreting, 28.6% rated it to be *important.* Fluency of delivery was therefore judged by the interpreters to be one of the top three criteria for quality after *sense consistency with original* and *logical cohesion.*

When it comes to defining fluency, several authors have established classifications of fluency-related features. Pöchhacker (1994, pp. 130–137) identifies vocal quality and prosodic-articulatory phenomena that characterize the vocal product in SI. He establishes five scales: *speed of speech* (syllables per time), *pauses*, *filled* *pauses/hesitations*, *slips of the tongue* and *corrections*[3]. Riggenbach (1991) tries to determine what fluency is on the basis of the analysis of nonnative speaker conversations. She examines two categories of fluency-related phenomena: *hesitation phenomena* and *repair phenomena* (1991, pp. 426–427). The former comprises the features of *micropauses*, *hesitations*, *unfilled pauses* and *filled pauses.* The latter includes two forms of reformulation: the *retraced start* and the *unretraced start.* Details of these will be treated on the following pages. Pradas Macías (2007) gives an extensive overview over the existing studies in the field of quality and especially fluency in SI.

5.2.3. Silent pauses

Pradas Macías (2006, p. 28) affirms that "silent pauses were consistently related to fluency, but it was difficult to establish a priori if they played a positive or negative role"; it is therefore a matter of quantity, and they can only be perceived as negative when the interpretation contains "abundant or frequent" pauses (ibid.). Pradas Macías further states that salient pauses have an important role in studying simultaneous interpreting quality and that they may be considered markers of reduced performance. Tissi (2000, p. 103) recognizes the "communicative value and/or tactical use" of pauses, and therefore it is reasonable to consider them in relation to the source text and not as an isolated phenomena. Ahrens et al. (2005, p. 53) consider pauses to be "indicators of the cognitive processes involved in the planning of what the speaker is going to say", anticipation that can be eased or hindered depending on the textual density of the support materials.

For the purpose of our research, we have used the term *silent pauses* to define any period of time over 500ms where the speaker or the interpreter is not uttering any sound. This is opposed to *filled pauses*, where a sound without any verbal content is produced. The pauses are identified by automatic means only due to the mere amount of natural pauses during a speech and the subjectivity of listener perception of pauses (cf. 6.1. Data processing).

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[3] Literal translation by the authors of this study. The original categories are: *Redetempo, Pausen, Gefüllte Pausen/Zögern, Versprecher, Planänderungen* (cf. Pöchhacker 1994: 133-135).

There seems to be a lack of consensus on the minimum length of a pause (Barik, 1969; Pöchhacker, 1994; Riggenbach, 1991). Pradas Macías (2006, p. 31) considers any silence over 250ms as a silent pause, while Barik uses 600ms as the minimum duration. For our study and after an analysis of different values ranging from 250ms to 1s, we decided to set the threshold at 500ms. Based on the subjective perception of the interpretations from our subjects, we consider that silences under 500ms are too short to be perceived as an unnatural break in the speech flow. Riggenbach (1991, p. 426) tries to deal with this problem by introducing various nuances of pauses:

> "Short pauses of .4 seconds or less occur frequently in NS speech (Deese, 1980; Fillmore, 1979) and are often considered 'micropauses' in the literature on fluency (e.g., Grosjean, 1980). Thus, it is possible that such short pauses are not indicative of a lack of fluency or of breakdowns in speech but rather are within the range of normal or fluent speech. [...] Given the possibility that short pauses may not be abnormal or indicative of lack of fluency, distinctions were made between fluent-sounding, nativelike micropauses and hesitations or disfluent-sounding micropauses and hesitations."

In this research, the identification of such "micropauses" shall be carried out on the basis of instrumental analysis only, with the threshold set at 500ms. The problem of disfluent-sounding pauses shall be treated under the following point, *salient pauses.* In contrast to the beginnings of this field of research, where authors such as Lederer (1978) or Déjean Le Féal (1978) who, partly due to the technical restrictions, had to rely mainly on the subjective perception of pauses (Pöchhacker, 1994), it is nowadays easy to carry out an automatic analysis with software. Still, it might always remain difficult to establish exact values for when variables such as pauses start to be considered by the audience as a sign of poor quality. Pöchhacker (ibid.) states that the audience's *tolerance level* for such variables may vary according to the situation, the language or the listener's knowledge of the language.

5.2.4. Salient pauses

The second DV is another category of pauses, defined as *salient pauses* by Pradas Macías (2006). This category comprises, according to Pradas Macías (ibid.), pauses with a duration over two seconds. Pauses of such duration may be considered as complete interruptions of the interpretation and indication of a decrease in performance that could be linked to the levels of the IV in the source text. Salient pauses are identified both instrumentally and on the basis of listener perception by independent judges. As the instrumental identification of short pauses and salient pauses does not take into consideration how these may be perceived, it is important to assess their occurrence as well on the basis of subjective listener perception. There may be long pauses which are natural (for instance, when there is a change of subject) or pauses shorter than 2 seconds that regardless of their length are perceived as unnaturally long. Pöchhacker (1994, p. 133), amongst others, considers such longer pauses to have an important influence in the perception of quality in interpretation.

5.2.5. Filled pauses

In contrast to *silent* or *empty pauses*, authors such as Duez (2001), Pöchhacker (1994) and Riggenbach (1991) identify what are defined as *filled pauses.* Duez defines filled pause in French as every occurrence of "euh" by itself, preceding or following another word. Pöchhacker (ibid., p. 133) defines them as hesitation sounds that can be described, depending on the language, as "äh", "uhm" or "heu". According to Pöchhacker, these phenomena are audible evidence of tension related to a lack of control of the glottis. Riggenbach classifies them with other hesitation phenomena and defines them as *nonlexical fillers* with little or no semantic information ("uh", "uhm"), *sound stretches* of 0.3 seconds or longer and *lexical fillers* such as "you know" and "I mean" that are lexical items but do not actually provide semantic information. We consider that a higher occurrence of filled pauses may be a sign of reduced performance in the SI process caused by the independent variables (Pöchhacker 1994, p. 132-133). Filled pauses are identified only on the basis of listener perception, as it is almost impossible to have such hesitation sounds detected by software in a reliable way.

5.2.6. False starts and repetitions

Concerning *false starts*, *repetitions*, *corrections* etc., once more it can be observed that there is no common terminology in literature, but the established concepts are all very similar (Pradas Macías, 2006, p. 40, 2007). Riggenbach (1991) introduces the category of *repair phenomena* that consists on the *retraced restart* and the *unretraced restart*, also known as *false start.* The latter is defined as a "reformulation in which the original utterance is rejected" (ibid.). Pöchhacker (1994) establishes an analogous category called *plan modification*[4], which is defined as corrections that are not seeking to improve faulty utterances, but denote changes of strategy.

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[4] Translation by the authors of this research. The original term is: *Planänderungen.*

Repetitions distinguish themselves from *false starts* insofar as there is a reformulation with a corrective scope. Riggenbach (1991) places these phenomena under the category of *retraced restarts* and differentiates between *repetitions* and *insertions,* the latter being a reformulation including new elements. Pöchhacker (1994) talks about *slips of the tongue*[5] and corrections. His division between the so called plan modifications and slips of the tongue remains somewhat unclear as he does not explicitly define whether these phenomena remain uncorrected or are corrected following his classification. For the purpose of this study, the category of false starts and repetitions including both cases of repetitions and insertions is defined as one single DV. It is identified on the basis of listener perception.

5.3. Participants

The sample for this experiment consists of four interpreters (3 female, 1 male), three interpreting students and one recent graduate, all of whom were trained at the Master's in Conference Interpreting of the Faculté de Traduction et d'Interprétation (FTI) at the University of Geneva between 2011 and 2014. All the interpreters have French as their A language and English as a C language, with a mean age of 26 years at the time of the experiment (Standard Deviation of 1.87) and little or no professional experience as conference interpreters. Their participation at the experiment was voluntary. Since they were trained at FTI, the room and the installations of the experiment were well known to all of the participants. The interpreting task they had to perform was very similar to the tasks carried out during interpreting classes or training sessions.

5.4. Materials

5.4.1. Speeches

The starting point for the design of this experimental setting was the drafting of two speeches. As they had to be of comparable difficulty and feasible in SI without preparation, it was decided to draft two speech scripts about two countries. The countries selected were Estonia and Bulgaria. This choice would to a certain extent guarantee that the participants would not be familiar with the subject of the speeches (as Bulgaria and Estonia were deemed to be among the less well-known countries),

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[5] Original term: *Versprecher.*

without the speeches being too difficult. The advantage of countries as a speech topic is that one can easily follow the same structure in both speeches and choose similar information. Accordingly, both speeches talked about the history, the geography, the government system and the culture of the countries. On the basis of the two scripts, a native English speaking student of simultaneous interpreting elaborated a final version of the speeches that was to be spoken. The speech-rate of the speeches was of an average of 130 words per minute for the presentation on Bulgaria and 126 for the presentation on Estonia.

5.4.2. PowerPoint presentations

For the purpose of this study, two slide presentations were created based on and designed to accompany the uttered speeches. The fact that the two speeches follow the same structure and contain similar information is reflected in the two slide presentations. Each presentation is displayed as a static presentation (the complete slide appears on the screen already containing all information) and consists of six slides, according to the information presented in the speech: a title slide, a slide on history, one on geography, one on the government system and two slides dedicated to the culture of the respective country. The slides contain text only. The number of lines and the font sizes are the same for every corresponding slide for the two presentations (cf. Appendix: PowerPoint Presentations). The only difference is the way the information is presented: in the slideshow about Estonia, information is mainly presented in simple clauses whereas the presentation of Bulgaria contains only keywords, the former presenting lower lexical density and more visual clarity, the latter higher lexical density and less visual clarity.

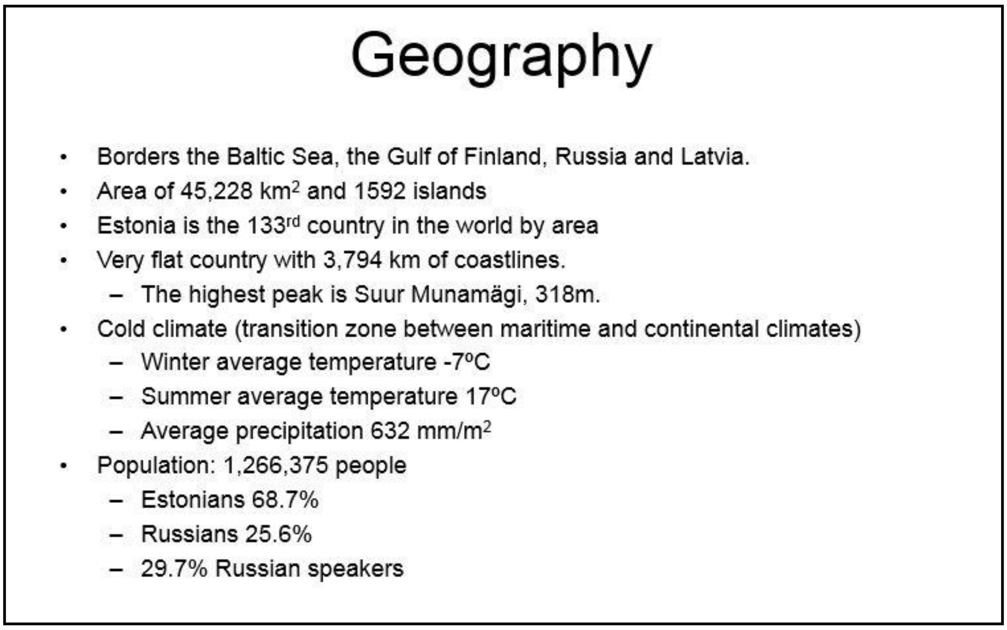

Figure 1: Slide with lower lexical density and visual clarity

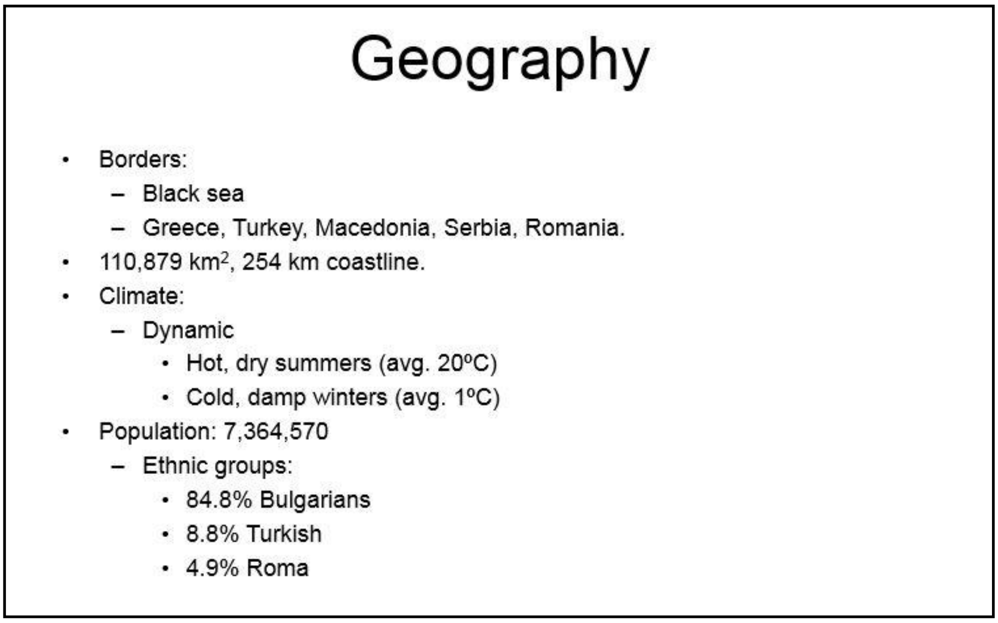

Figure 2: Slide with higher lexical density and visual clarity

5.4.3. Video recordings

With the help of a native English speaker, also an interpreting student, the two speeches were recorded in high-definition video with a Sony PMW-EX1R camera on the school premises by the university audiovisual technicians. At a later stage, the video footage was edited using Adobe Premiere yielding a picture showing both the speaker and the slides over a black background, with the images larger in size than the speaker (cf. Figure 3). The slides were aligned to the top left of the screen and the speaker, to the bottom right. The edited video was encoded with a H264 codec and a resolution of 1920x1080 pixels at 25 frames per second. The audio had a sampling rate of 48000 Hz and was codified in stereo with the MPEG AAC Audio codec.

The duration of the video related to Bulgaria is 05’40’’ and for Estonia, 05’42’’.

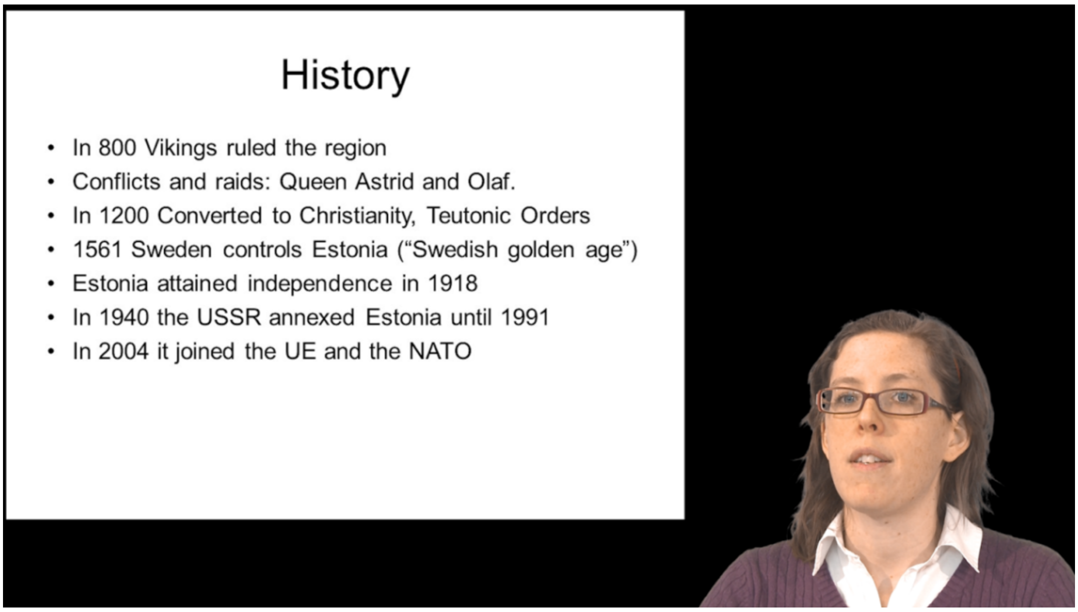

Figure 3: Video screenshot

5.4.4 Other equipment

For the experiment, the videos were played in one of the simultaneous interpreting labs at the Faculté de Traduction et d’Interprétation. Audio and video were transmitted from the Teacher’s computer to the booths using the Televic interpreting training software. Booth equipment comprises a Televic interpreter console, a Televic TEL10 set of professional dynamic headphones developed for interpreting and a Dell 19-inch TFT computer screen where the video was displayed for the subjects.

5.5. Procedure

The experiment was carried out in individual sessions. Due to the limits imposed by the characteristics of this experiment, there was no pilot project. As the participants already knew the installations, there was no need for an extensive briefing. They were informed of the experimental procedure, but not about the purpose of it. The instructions were given orally and consisted mainly of the information that there were video recordings of two roughly six minutes speeches in English that had to be interpreted into French, that their interpretation would be recorded and that there was no preparation required. Before starting the experiment, the participants went into the booths, got comfortably settled and a short test was carried out to ensure that the transmission of sound and image as well as the recording worked as desired.

The experiment was started as soon as the participant said that they were ready. In order to avoid the order of the speeches influencing the quality of the resulting interpretation, two of the participants started with the presentation about Estonia, the other two started with the Bulgaria presentation. After the first speech, the participants took a break of five minutes or longer, until they indicated that they were ready for the second speech. The intention of the break was to avoid an effect of fatigue during the second speech in comparison to the first speech.

As is usual in SI, the participants had no opportunity to clarify doubts or correct themselves afterwards. They were not given any feedback about their performance.

6. Results

6.1. Data processing

A combination of human and computer-based counting methods was used for this experiment. Calculation of silent pauses and salient pauses was obtained by using the free phonetics software “Praat”. Filled pauses, false starts and repetitions were manually assessed by three independent judges, all of whom were interpreting students with French as a passive language. They received the definitions of the respective DV and the audio material of the interpretations and they were asked to note down the number of occurrences of each of the DV. The values discussed below represent the average value of the listener’s assessment. The category of salient pauses has been assessed either instrumentally and of the basis of listener perception as explained above.

The analysis was carried out on both the source and the interpretations.

The function “Annotate to TextGrid (Silences)” present in Praat was used for determining the silent pauses with the following settings: Minimum pitch of 100 Hz, time steps of 0.32ms (Praat’s default setting), a variable silent threshold adjusted according to the voice volume of the interpreted version, a minimum silent duration of 0.500 s and a minimum sounding interval duration of 0.05 s. For each recording, the settings used were thoroughly tested to ensure that the resulting calculations were as accurate as possible. Finally, they were exported to a plain text format and imported into an Excel spreadsheet where the sum of the silences (total silent pauses and salient pauses) was obtained.

In addition to the use of Praat for silent pauses, salient pauses were also counted by the subjects evaluating the interpretation, using a Praat grid (configured with the same settings but with a minimum pause duration of 2 seconds) as guidance. They were instructed to annotate any pause that struck them as unnatural, allowing us not to count pauses that, from their point of view, appeared to fit in the discourse or that were a direct consequence of a salient pause in the source. As it has been said, pauses play a dual role in prosody, and when used accordingly by the speaker, they may have a prosodic value and they should not be considered as a sign of lower interpreting quality.

Filled pauses, false starts and repetitions were assessed by the authors taking into consideration the criteria established as DV using a pair of Sennheiser HD 201 headphones and the sound editing software Audacity. Each recording was subject to, at least, two passes in order to ensure accurate readings.

All data was input intro an Excel spreadsheet and compared against the original values.

The authors hypothesized that a visually clear, hence highly readable presentation would be more helpful for the interpreters and that therefore, the number of occurrences of the set of dependent variables would be lower if that were the case.

However, these phenomena (pauses, filled pauses, false starts, repetitions and, to a lesser extent, salient pauses) are present in any oral utterance, and do not determine a worse performance or a higher cognitive load *per se*.

Taking this into consideration, it was decided that, regarding silent pauses, the original would be considered the benchmark against which the interpretation was compared. If the source speech has a given number of silent pauses, it can be expected that the interpretation will present at least the same amount. However, a higher presence of silent pauses may be detrimental to the quality of the interpretation.

Finally, results from the DV were compared in respect to the IV.

6.2. Results

If the average results are considered, all the dependent variables except for salient pauses show similar results. When compared against the original, the number of silent and salient pauses (10 pauses on average versus 5.75 pauses) was higher in the clearer presentation. The number of filled pauses (7.125 versus 6.25) and false starts (6.75 versus 5.75) were slightly higher for the clearer presentation. No repetitions were identified.

Table 1. Average results for the clear and less clear presentation (Bulgaria, Estonia)

Bulgaria	Pauses	Salient pauses	Filled pauses	False starts
Average	81,5	10	7,125	6,75
Source	66	0	n/a	n/a

Estonia	Pauses	Salient pauses	Filled pauses	False starts
Average	75,25	5,75	6,25	5,75
Source	72	3	n/a	n/a

6.2.1. Silent and Salient Pauses

Table 2. Silent pauses and Salient pauses identified in the clear presentation (Bulgaria)

	Silent Pauses	Salient pauses
Source	66	0
Subject 1	95	11
Subject 2	84	5,5
Subject 3	73	14
Subject 4	74	9,5
Average	81,5	10
Total	326	40

Table 3. Silent pauses and Salient pauses identified in the less clear presentation (Estonia)

	Silent Pauses	Salient pauses
Source	72	3
Subject 1	84	4
Subject 2	68	3
Subject 3	94	10
Subject 4	55	6
Average	75,25	5,75
Total	301	23

Regarding the clearer presentation, the average amount of silent pauses (an average of 81,5 pauses), when compared against the figures from the original, was a 23% higher in the interpreted version, of which 10 were considered as salient pauses. No salient pauses were present in the original.

The less clear presentation shows a closer relation between the original and the interpreted version, at an average 75,25 silent pauses in the interpreted version (compared to 72 in the source speech, only a 4,51% higher). The number of salient pauses is also closer to the source, at a 5,75 to 3 ratio, which is much closer to the source than the clear presentation.

6.2.2. Filled pauses

Table 4: Filled pauses identified in the clear presentation (Bulgaria)

	Filled pauses
Subject 1	1,5
Subject 2	7
Subject 3	5
Subject 4	15
Average	7,125
Total	28,5

Table 5: Filled pauses identified in the less clear presentation (Estonia)

	Filled pauses
Subject 1	0,5
Subject 2	6
Subject 3	3
Subject 4	15,5
Average	6,25
Total	25

The amount of filled pauses was roughly equivalent between subjects and original speech. The difference between presentations is only 0,875 on average. Each subject maintained his or her tendency across the two speeches.

6.2.3. False starts

Table 6: False starts identified in the clear presentation (Bulgaria)

	False starts
Subject 1	7,5
Subject 2	3,5
Subject 3	7
Subject 4	9
Average	6,75
Total	27

Table 7: False starts identified in the less clear presentation (Estonia)

	False starts
Subject 1	8
Subject 2	3,5
Subject 3	4
Subject 4	7,5
Average	5,75
Total	23

The same can be said of false starts, where the average difference between the two speeches is only of one false start; each subject has maintained the same profile across the two speeches.

6.3. Analysis of the results

A series of patterns and salient characters can be observed from the results of this study. The most prominent is the higher prevalence of salient pauses in the speech with the clearer PowerPoint, both in relation to the source speech (an average of 10 versus 0) and with the less clear PowerPoint, where the interpreters only introduced an average of 5,75 salient pauses. It can also be observed that, even if there are salient pauses in the less clear presentation, the deviation from salient pauses in the original is lower than in the first case. It is also to be noted that when it comes to the total average of pauses in the interpreted version of both presentations, the clear one presents a slightly higher number (81,5 versus 75,25).

Filled pauses and false starts are present in similar numbers across the board and do not suggest any specific pattern that could be taken into consideration for the scope of this experiment.

The dependent variables were selected by the authors as possible markers of increased cognitive load and reduced fluidity. In consequence, considering the results, the hypothesis is not supported by the outcome of the experiment.

7. Discussion

Due to the sample size and the fact that only descriptive statistics have been used, the results may not be significant enough to extract a firm conclusion. However, they seem to indicate that the cognitive load of the interpreter is higher if the presentation is composed of keywords rather than complete phrases. This contradicts our hypothesis that, the clearer the presentation, the more fluent the output will be. One explanation for this may be that there is an additional effort related to the analysis the interpreter has to perform to link the keywords with the oral speech, adding a layer of complexity that may then impact the performance and results of the interpretation. Lu and Wickens (2013) consider that audio-visual redundancy results in an interpretation that is at least as good as what it would be without the visual support, especially when it comes to accuracy. While a keyword-only presentation may have information that duplicates some constituents of the speech, it is true that a presentation with phrases that will be delivered by the speaker is more redundant. In such a case, the interpreter may not need to analyze the keywords and infer their relation to the oral speech, resulting in a genuine case of redundancy as the same message is being transmitted through two channels. It can be considered that in the case of keywords, there is only a partial redundancy.

Filled pauses and false starts remained within the same range, which leads the authors to consider that these dependent variables are not relevant as cognitive load markers. It is also thought that trained interpreters may have better self-monitoring skills that help them avoid filled pauses or false starts, thus producing a more fluid delivery (Liu, 2008, p. 166). With respect to these two points, further research could study in greater detail the role of pauses as cognitive load markers.

8. Conclusions

The pattern of results tends not to confirm the hypothesis, which leads us to the following considerations:

It would be interesting to carry out empirical research on the visual clarity and/or lexical density of presentations that are used in real interpreting contexts. Furthermore, it seems a promising field of research to engage in a deeper analysis of such material by applying existing cognitive theories on visual input.

Secondly, one could replicate the experiment with an added control group, that is a group interpreting the same speech, but using only the audio recording of the speech without the visual input of the speaker or the presentation, as Lambert (2004) did by comparing the performance of ST, SIT and SI or as Jesse et al. (2000) did comparing SI performances with and without the speaker being visible. This would make it possible to draw a comparison between the interpreting performance on the basis of the speech only and the performance with visual input.

A third approach would consist in the application and/or extension of cognitive load theories such as Seeber's model (2011) to such communication situations. The scope would be to measure the – additional – workload imposed by slide shows. Eye tracking technology could also be used in a similar experimental setting, with a focus on the way interpreters' eyes follow material with different lexical density.

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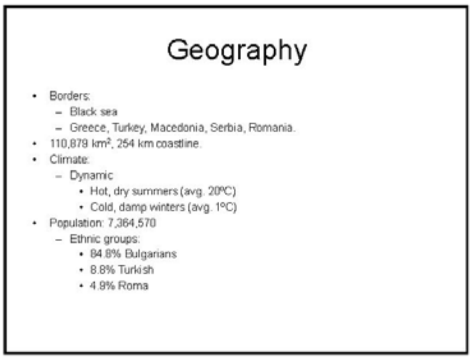
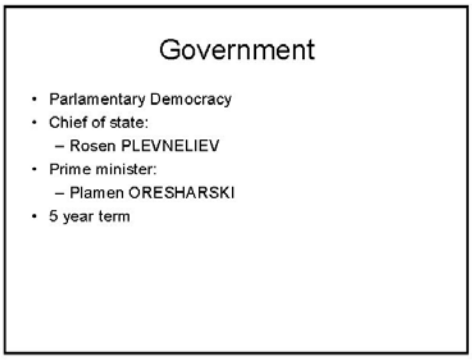
Appendix: PowerPoint Presentations

Bulgaria: clearer presentation (keywords only)





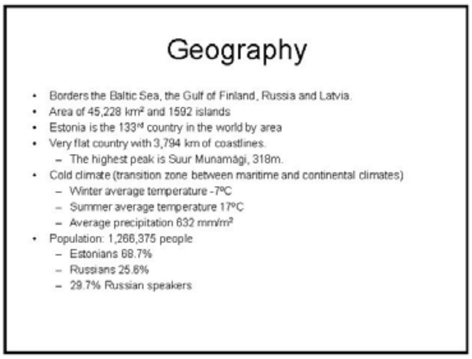
Culture I

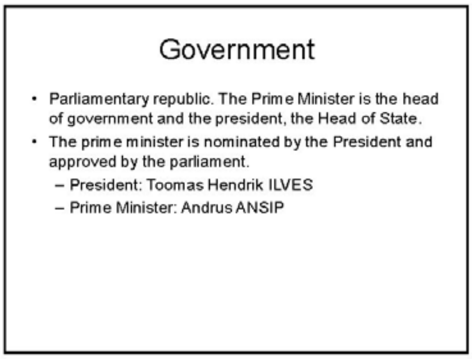
- Influences:
  - Greeks, Romans, Ottomans, Persians, Celts
  - Thracian, Slavic, Bulgar heritage
- Tzvetan Todorov
- Christo
- Voice ensemble

Culture II

- Thracian fire dance (***Nestinarstvo***)
  - Mountain villages close to Black Sea
- *Nestinari* (barefoot dancers)
- Circle dances
- Tourist attraction
- Still alive in some small villages

Estonia: less clear presentation (full sentences)






Culture
• Estonian culture is heavily influenced by Finnish and German culture.
• Today Estonia shares many traits with Nordic Countries
– Work ethic
– High-quality, free education system.


Culture II
• Music plays an important role in Estonian culture.
• Estonian Song Festival (every 5 years)
– The main choir, 30,000 singers. Audience, 80,000.
• This festival dates back to the 19th century
– Estonians sang traditional songs to forge identity
– The songs were limited during the soviet era