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Cognitive load in processing ELF: Translators, interpreters, and other multilinguals

Kognitive Belastung bei der Verarbeitung von ELF-Input: Übersetzende, Dolmetschende und andere Mehrsprachige

Abstract: Many factors can affect the translation and interpreting process, but the quality of source texts has been explicitly identified as an issue in surveys of professional translators and interpreters as well as in recent workplace studies. If translators and interpreters encounter resistance in carrying out their tasks, for example by difficulties in extracting meaning from non-native English input, then flow can be interrupted and performance affected. In this paper, we explore how English as a lingua franca (ELF) input could potentially increase the cognitive load not only for translators and interpreters but also for other multilinguals. We describe the range of methods that can be used to measure the cognitive effort and stress associated with processing ELF input and explain the challenges that can be encountered when researchers are committed to using authentic ELF material to make comparisons under relatively controlled but ecologically valid conditions. One of the driving motivators for this type of research is to understand how interpreters and translators deploy their expertise to deal with ELF input in work settings in order to draw inferences about strategies for other segments of the population.

Keywords: cognitive load, cognitive effort, authentic ELF material, translation, interpreting

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Zusammenfassung: Dolmetsch- und Übersetzungsprozesse werden von einer ganzen Reihe von Faktoren beeinflusst. Der Ausgangstextqualität kommt dabei ein besonderer Stellenwert zu, wie sich in Umfragen unter professionellen Dolmetschenden und Übersetzenden sowie in jüngsten Arbeitsplatzstudien erwiesen hat. Wenn Dolmetschende und Übersetzende auf Widerstände bei der Ausübung ihrer Tätigkeit stossen, beispielsweise durch Schwierigkeiten bei der Bedeutungserschliessung im Fall von nichtmuttersprachlichem englischen Input, kann es zu Störungen im Verarbeitungsfluss und einer erschwerten Translationsleistung kommen. Im vorliegenden Artikel wird der Frage nachgegangen, inwieweit ELF zu erhöhter kognitiver Belastung für Dolmetschende und Übersetzende, aber auch für andere Mehrsprachige führen kann. Es werden darin die verschiedenen Methoden zur Messung von kognitivem Aufwand und Stress, die mit der Verarbeitung von ELF-Input einhergehen, beschrieben. Weiterhin wird aufgezeigt, auf welche Herausforderungen Forschende beim Einsatz authentischen ELF-Materials stossen, wenn sie Vergleiche unter relativ kontrollierten und zugleich ökologisch validen Bedingungen anstellen wollen.

Schlagworte: kognitive Belastung, kognitiver Aufwand, authentisches ELF-material, Übersetzen, Dolmetschen

1 Introduction

The academic study of the use of English as a lingua franca (ELF) between non-native speakers or between non-native and native speakers of English has tended to focus on the communicative success as well as the linguistic and sociolinguistic aspects of the phenomenon (Jenkins et al. 2011). Far less attention has been paid to the potential cognitive load and stress associated with non-native speakers having to use English to conduct business, academic, and other types of professional communication. In particular, the potentially negative effects on listeners or readers having to process non-native English input when they do not have the possibility to check whether they have understood correctly remain to be addressed (cf. Albl-Mikasa and Ehrensberger-Dow 2019). Research into the implications of ELF for the traditional management of multilingualism, namely translation and interpreting, has also been rare (cf. Albl-Mikasa 2017; House 2013).

These important gaps motivated our interdisciplinary team of researchers to join forces to explore how to assess the cognitive demands of ELF in language professionals and non-professionals. Interpreters and translators are particularly interesting in discussions of ELF processing because they are assumed to have the expertise to deal with non-native English input and to optimize communication

(Reithofer 2010) using strategies that non-professionals might not have at their disposal. Increasingly often in their training and professional lives, interpreters are expected to be able to cope with challenges such as incomplete utterances and a wide variety of dialects and/or accents, and translators with poorly written texts that can lack cohesion and coherence.

Non-native English may be ambiguous, incoherent, and imprecise on the textual level, which likely results in the need for additional plausibility checks and compensation loops while processing the input and producing the output. This additional effort may have an adverse effect on knowledge access, on general processing, and, ultimately, on interpreting or translation performance. More generally speaking, impaired bottom-up processing is likely to impede fundamental processes such as inferencing and anticipation as well as the production of translation equivalents and transfer routines (Albl-Mikasa 2013a), while at the same time forcing a greater reliance on top-down processing and higher-order inferences. Thus, ELF input is probably resource-intensive, weighing most heavily on the comprehension phase, with consequences for other cognitive processing, namely transfer and target text production. On the basis of anecdotal evidence and introspective accounts by conference interpreters, it has been suggested that ELF increases cognitive load (Albl-Mikasa 2010). Just as ELF in non-interactive settings is very much under-researched, so has written ELF been put on the research agenda only recently (Mauranen 2017). Translators are increasingly often asked to translate texts produced by non-native speakers of English in a wide range of domains. And, as with conference interpreters, translators usually have little or no recourse to the text producers to clarify intended meaning.

The approach taken in our interdisciplinary research[1] addresses these gaps by examining how translators and interpreters with different levels of expertise cope with ELF input compared with multilinguals with no training in translation or interpreting. In the next section, we consider the conceptual and methodological issues associated with determining the cognitive load of processing ELF input and justify the deployment of methods which are commonly used in translation and interpreting (T&I) process research to measure cognitive effort. An over-riding concern in both strands is ecological validity, but working with authentic ELF texts and speeches presents many additional challenges, as explained in Section 3. Finally, we outline the implications of this type of research for methodology development in ELF and T&I studies.

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1 For more information about the *CLINT project* (*Cognitive Load in Interpreting and Translation*), see www.zhaw.ch/linguistik/iued/clint (last accessed 21 September 2020).

2 Cognitive load in interpreting and translation

Interpreting studies is a relatively young discipline and only over the past few decades have attempts been made to describe the cognitive task in which an interpreter listens to a source text and in real time delivers the same message aloud in a different language. As the process of simultaneous interpreting is characterized by an almost permanent temporal overlap of language comprehension and language production processes, the distribution of cognitive resources and the notion of cognitive load attracted the interest of interpreting scholars early on (e.g., Gerver 1976; see also Setton 2015 or Chen 2017). In their influential models of simultaneous interpreting, Moser (1978) and Gile (2009 [1995]) also addressed the issue of the interpreter's limited processing capacity.

Both models assume that simultaneous interpreting is made up of overlapping component tasks, such as comprehension, production, or storage of information in working memory, which tax processing capacity and generate cognitive load. In particular, Gile argues that the total amount of required "mental energy" (Gile 2009 [1995]: 159) must not exceed the interpreter's available cognitive resources in order for simultaneous interpreting to be successful. Building on this, scholars set out to learn more about the notions of cognitive load and cognitive effort in simultaneous interpreting on the basis of empirical data. Using pupillometry to assess cognitive effort, Hyönä et al. (1995) provide experimental evidence that cognitive effort significantly increases during simultaneous interpreting compared to other language processing tasks, such as listening comprehension or shadowing. Seeber and Kerzel (2012) addressed the importance of language-specific factors for cognitive load in simultaneous interpreting and conclude from their experiment that syntactically asymmetrical structures (e.g., VSO vs. VOS) may add to the load involved in the interpreting task. Further, their results indicate that the availability of discourse context, compared to processing sentences in isolation, can reduce the amount of cognitive effort needed to perform simultaneous interpreting.

In translation research, there has been an increase in interest in how translators develop the competence to cope with the complex cognitive activity of understanding texts of various levels of quality in one language and producing high-quality texts in another. Beginners often cannot recognize problems beyond the lexical level and tend to search for word-by-word equivalents. As translators gain competence and experience, they seem to have the capacity to consider and handle more and more global aspects of the task (i.e., Ehrensberger-Dow 2014; Ehrensberger-Dow and Massey 2013; Hunziker Heeb 2016). Keeping an overall view and applying an overarching strategy to every single aspect of the task would

suggest that the task may be cognitively more demanding for professionals, yet they are still able to perform well.

2.1 Differentiating cognitive load and cognitive effort

While the concepts of cognitive load and cognitive effort have often been used interchangeably and without being defined in T&I studies (Hunziker Heeb et al. submitted), we suggest differentiating between the two. We associate cognitive load with the complexity of the stimuli and task (i.e., source text, commission, situation, and so on), and cognitive effort with the actual response by the task performer. This is in accordance with the constructs of cognitive load and cognitive effort in cognitive load theory, which was developed in educational psychology (Sweller et al. 1998). While cognitive load can theoretically be identical for different translators, cognitive effort cannot. This definition makes it clear that the amount of cognitive effort expended during a task is individual and may be managed to a greater or lesser degree. This means that the translator or interpreter does not simply have to cope with cognitive load but may have a certain freedom with regard to how much effort to expend and how to expend it. For example, out of interest, a translator may decide to do more information searching than would be needed to get the job done. Similarly, the interpreter can take targeted preparation measures in order to reduce cognitive effort in the booth.

Based on Piolat et al. (2004), Kruger (2016) defines cognitive effort as "simply the amount of cognitive resources required to complete a processing task" (Kruger 2016: 27). While we can only assume or model theoretically what could cause or add to cognitive load for an individual or a group of subjects, we can measure how much effort a performer expends during a task. By measuring and analyzing indicators of cognitive effort, which are mostly indirect, we can infer whether a predicted high load actually requires more effort than normal to process (e.g., whether ELF input presents higher cognitive load than native English).

Among other aspects of the translation process, cognitive load and cognitive effort have been empirically investigated in cognitive translation and interpreting studies in relation to the following:[2]

- translator's processing of different types of input from various sources (e.g., O'Brien 2007);
- source text difficulty (e.g., Andres 2014; Dragsted 2012);
- types of segmentations (e.g., Alves and Gonçalves 2013; Seeber 2011);

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2 As it is beyond the scope of this paper to present and review an exhaustive list, we provide representative references for each research aspect.

- levels of metaphoricity (e.g., Alexieva 1999; Sjørup 2013);
- impact on task performance (e.g., Korpal 2017);
- directionality (e.g., Gile 2005; Hunziker Heeb 2019);
- reading, listening versus shadowing, revising, or pausing (e.g., Hvelplund 2017; Lambert 1988);
- structural/typological differences between language pairs (Gile 2009 [1995]; Seeber and Kerzel 2012).

In the case under discussion here, the object of study is whether and how processing ELF can have an impact on the cognitive effort expended by interpreters, translators, and non-T&I multilinguals. The fact that cognitive load can only be measured indirectly via cognitive effort has led to implicitly adopting triangulation as good practice, which we strongly support. Similarities and differences in behavior compared across tasks and/or individuals can inform us on whether there are also similarities and differences in the underlying processes and their effects and causes (i.e., cognitive effort and cognitive load). Various techniques can be used to measure cognitive effort in language processing tasks, as explained below.

2.2 Measuring cognitive effort

For research focused on understanding the cognitive effort involved in processing ELF, the question of measurement provides special challenges due to the inherent complexity of both constructs. Cognitive effort can only be measured via indirect indicators that can be related to this concept in different ways. A comprehensive approach to the measurement of cognitive effort includes individual indicators that manifest themselves in different response systems. These features are not equivalent to the whole construct of cognitive effort but allow us to select and focus on individual indicators or to combine them in a complementary fashion to elucidate the phenomenon of cognitive effort from different angles.

Our approach to measuring cognitive effort is situated within the mixed-methods research paradigm (see Phakiti and Paltridge 2015: 16–17). We simultaneously collect quantitative and qualitative data and triangulate analyses and results. This approach is particularly relevant as research into cognitive effort in translators, interpreters, and multilinguals draws on both the cognitive sciences and applied linguistics. Traditionally, cognitive science has been guided by the methods used in the natural sciences, dominated by quantitative methods with an emphasis on experimental designs and statistical analysis. In contrast, disciplines such as translation and interpreting studies as well as the study of English as a lingua franca are rooted in the study of language and have had

a strong reliance on qualitative data. The mixed-methods paradigm makes it possible to bridge these differences and allows for a better understanding through multiple perspectives.

Categorizing different measures, Chen et al. (2012) suggest that cognitive effort can be assessed through (i) subjective measures, (ii) physiological measures, (iii) behavioral measures, and (iv) performance measures. Each of these categories is sensitive to different aspects of cognitive effort, while presenting particular challenges with respect to measurement and validity. For assessing the cognitive effort of processing ELF, we consider some measures particularly suitable for translation, interpreting, and other types of language processing tasks (see overview in Table 1).

2.2.1 Subjective measures

Subjective measures provide insight into an individual's perception and experience of cognitive effort during a language processing task. This experience can only be accessed through verbal reporting, so subjective measures of cognitive effort are obtained through different types of self-report, such as responses to questionnaires, commentaries, and interviews. In addition, self-report instruments can shed light on how cognitive effort shapes the conscious experience of the language processing task, for example with respect to perceived stress. Questionnaires can be based on forced-choice measurement for a circumscribed number of response options. For example, study participants can be asked to rank their subjective level of stress on the *State-Trait Anxiety Questionnaire* (Spielberger et al. 1983) after a language task. When making use of such standardized tests, one

Table 1: Measures of cognitive effort suitable for ELF processing tasks.

Subjective measures	Physiological measures	Behavioral measures	Performance measures
– questionnaires – retrospective commentaries – retrospective interviews	– pupil dilation – heart rate and heart rate variability	– screen recording – keystroke logging – gaze patterns – video recordings of gesturing and facial expression	– target language accuracy – pausing patterns – target language complexity – target language fluency – level of comprehension

has to consider the reliability and validity of the instruments. Another aspect to consider is that, while forced-choice measurement has the disadvantage that participants can be "primed" by response alternatives and choose responses that they might not have chosen otherwise, this method lends itself to advanced statistical processing due to the use of scales with nominal, ordinal, or interval characteristics. In contrast, interviews and retrospective commentaries, where individuals are asked to comment freely on a recording of their translation or interpreting performance, allow for exploration, induction, and discovery (cf. a cautionary note in House 2015: 51–52). Retrospective methods rely on post-hoc construction and involve a re-coding of information as well as selection and interpretation mechanisms. For methods that are employed retrospectively, data collection should therefore take place as soon as possible after the language processing task and possibly be supplemented with cues (e.g., processed texts or recordings of the process) to facilitate recall.

While self-report techniques are relatively easy to apply compared to other methods, they are limited to providing access only to conscious, verbalizable aspects that the individual considers worth telling and therefore remain indirect measures. Moreover, individual differences exist with respect to awareness of and willingness to report experiences. The latter may be a particularly important limitation when people are asked to do a task that is related to their profession, as is the case with translators or interpreters processing ELF input. As people learn a task, they tend to think of it in increasingly higher levels in their hierarchy of goals, because it becomes more related to their sense of self (Vallacher and Wegner 1987). This may lead to a decreased willingness for professionals to report negative experiences of cognitive effort when taking part in a research study. In addition, individuals with a general tendency to respond in a socially desirable way may be less willing to report negative experiences.

2.2.2 Physiological measures

Physiological measures are complementary to subjective measures of cognitive effort in that they can provide a more objective indication of the amount of cognitive capacity devoted to a particular task. These measures are based on activation of the autonomic nervous system, which is responsible for modulating peripheral functions in the human body. Activation of the autonomic nervous system affects, among other things, heart rate and pupil dilation. The latter has been shown to be sensitive to cognitive processing demands during a task (Just and Carpenter 1993), with numerous studies suggesting that pupil dilation increases with cognitive effort (e.g., Hyönä et al. 1995; but see O'Brien 2010 for a word of caution). In interpreting studies, in particular, pupil dilation has to

date served as the main physiological indicator of cognitive effort. Overall pupil dilation has been compared between different language processing tasks (Tommola and Hyönä 1990), and pupil dilation has been assessed during periods of interest in the interpreting process (Seeber and Kerzel 2012). The measurement of pupil dilation seems to capture lower-level cognitive processes involved in cognitive effort, which can complement the assessment of conscious, higher-level processes. Importantly, a number of studies suggest that pupil diameter increases when people process emotionally engaging stimuli (Bradley et al. 2008). Other potential confounds can be changes in ambient or computer screen light and the influence of caffeine as well as the familiarity of the surroundings (O'Brien 2010). Lower blink rates have also been attributed to fluctuations in cognitive effort (Brookings et al. 1996) and might allow individuals to take in more information.

When studying cognitive effort, the other physiological measure that is particularly interesting is heart rate because it accelerates as a reaction to stress (Lazarus et al. 1963). In addition to the heart rate itself, heart rate variability, which is understood as variation in time intervals between consecutive heart beats (Thayer et al. 2012), has been identified as a valid measure of stress (Choi et al. 2012). Heart rate measures have been used as markers of stress in a variety of different situations including simultaneous interpreting (Korpal 2017; Kurz 2003). New smartwatch devices are quite unobtrusive and can be used to record heart rate during tasks involving language processing without restricting an individual's movements or comfort.

Overall, the advantages of autonomic measures are that they are language independent, therefore comparable across cultures, and less subjective than self-report. They also provide a measurement of the individual's reaction to input in real time. However, for the purpose of assessing activity in the autonomic nervous system as indicative of cognitive effort, factors have to be carefully identified and controlled that could confuse the relation between the concept and the measure.

2.2.3 Behavioral measures

In investigations of language processing, behavioral measures have been used to derive the effort associated with multimodal communication, text comprehension, and text production. For example, Hunziker Heeb (2019) used an array of behavioral indicators based on the four translation process activities of writing, revising, information seeking, and pausing in order to investigate whether cognitive effort may be related to the translation direction. Such behavioral indicators allow us to analyze the number and patterns of translation process activities, the duration of and switches between activities, or the fluency in production, and to relate these to other measures of cognitive effort. Data can be collected with screen recording

while a translation or text production task is performed. Keystroke logging, a method long deployed in translation process research (cf. Jakobsen and Schou 1999), can also be used to document micro-movements in the text production process.

Moreover, gaze patterns from eye-tracking records have been employed fruitfully by numerous scholars to study translation and reading processes, especially when triangulated with keystroke logging and screen recording (e.g., Ehrensberger-Dow and Massey 2013). As the duration of eye fixations seems to increase with more effortful processing (Meganathan et al. 2014), gaze patterns can help us understand which parts of the text require increased attention and what strategies are used by translators to solve problems related to the induced cognitive load of the source material. Gaze patterns can also provide information about an interpreter's focus of attention, which allows inferences to be drawn about cognitive effort (e.g., Seubert 2019).

In addition to the measures mentioned above, another relevant type of behavior when studying cognitive effort is gesturing. Interpreting scholars have indicated that gestures have communicative as well as self-oriented functions and that the latter may impact on the interpreting process (Zagar Galvao 2009). More specifically, the psychological literature associates a higher than usual number of gestures with high cognitive effort. Theorists of embodied cognition argue that human cognitive processes are rooted in perception and action (Shapiro 2014) and, according to the gesture-for-conceptualization hypothesis (Kita et al. 2017), gestures are generated from the same cognitive system that initiates practical action. Gesturing is assumed to activate, manipulate, and explore spatio-motoric representations for the purposes of speaking and thinking and to facilitate the formulation of speech. Under high cognitive strain, gesturing has been interpreted as a mitigator in that it lowers the amount of cognitive resources needed for formulating speech (Goldin-Meadow et al. 2001). The quantity of gestures during a language processing task can therefore provide an additional indicator of cognitive effort, although high inter-individual and cultural differences in gesturing may be confounds and what counts as a gesture has to be clearly defined.

In addition, the facial expression of translators/interpreters, speakers/listeners, or readers/writers may reveal negative emotion and stress (Lerner et al. 2007) that can be related to a language processing task and the cognitive effort involved in it. A large body of research has studied facial expressions as signs of emotional states (e.g., Ekman et al. 1990), and specific emotions, such as astonishment or irritation, can be linked to comprehension problems with ELF input and can complement other measurements. Body posture and cognitive effort may also be related, although evidence is inconclusive as to whether postural sway

decreases or increases under high cognitive effort (Pellecchia 2003). Although the assessment of facial expression and body posture can provide insights into the cognitive effort involved in processing ELF content and take into account the multimodality of the communication of internal states, the analysis techniques are still under-specified. Coding systems for video recordings have to be developed and/or validated (Dael et al. 2012) and may require intense training of coders to ensure high inter-rater reliability.

2.2.4 Performance measures

Performance measures are based on the assumptions that the overall interpreting or translation quality or comprehension of a text may suffer when cognitive effort is high and that an overload on cognitive resources has a negative impact on performance in these tasks (Gile 2009 [1995]). Performance measures are, strictly speaking, a subgroup of behavioral measures, as they consider behavior with regard to particular performance criteria. For interpreters and translators, performance measures are related to the accuracy and speed in delivering the oral or written target text, respectively, and can be supplemented with subjective evaluations by experts (Meuleman and Van Besien 2009). For other multilinguals, the processing of ELF input can be assessed through questions directed towards text comprehension.

As regards interpreting, researchers have claimed that disfluencies, including filled and silent pauses, repetitions, repairs, drawn-out syllables, and false starts, are associated with production difficulties that may be related to cognitive effort (Chen et al. 2012; MacGregor 2008). These claims are based on the assumption that the distribution of disfluencies in speech is not arbitrary but reflects production difficulties (Bakti 2009) or otherwise coping with cognitive effort (cf. Levelt 1989). Disfluencies are therefore generally regarded as a means of indirectly examining cognitive effort. Similarly, pauses may be indicators of cognitive effort during translation (Kruger 2016). In addition, the complexity of the language output, for example the use of unique and different words in a translation or interpretation, seems to decrease as assumed cognitive load represented by the complexity of the stimuli increases (Chen et al. 2012).

Finally, there are other performance measures that could be used to assess the cognitive effort of processing ELF input. These include so-called secondary tasks like responding quickly to a visual or auditory signal while performing a primary task such as interpreting or translation. While secondary task measures are assumed to be reliable in terms of assessing cognitive effort invested in the primary task, they interfere with the execution of the primary task and are therefore less suited for studies which aim to preserve high ecological validity.

Since one of our main interests is how interpreters, translators, and other multilinguals cope with ELF input, it is important to us that research techniques are unobtrusive and do not interfere with language processing.

3 Authentic ELF material as input for interpreting and translation

Many ELF studies have been based on material similar to that contained in three major corpora (i.e., ACE, ELFA, and VOICE).[3] These corpus data primarily comprise recordings of discussions or conversations (Mauranen 2012; Seidlhofer 2011). As pointed out above, conference interpreters and translators usually work in non-interactive settings with monologic texts of higher levels of abstraction and technical complexity. Consequently, any ELF source input they deal with has the potential for higher cognitive load than processing ELF in conversational settings would have. In order to apply the methods described in the previous section to the situated activities of translation and interpreting, authentic ELF materials should be obtained from non-interactive contexts.

3.1 Sourcing authentic ELF material

Given the oft-cited ubiquitous use of English as a lingua franca, it might seem counterintuitive to suggest that sourcing authentic ELF material could be problematic. Almost any international setting in which English is used and, in the case of multilingual countries like Switzerland, even intra-national settings could provide opportunities to collect English language material in a "lingua franca language scenario" (Mortensen 2013: 36). However, ELF material has to fulfil several criteria in order to be usable as stimuli in studies on cognitive load in interpreting and translation. For example, the material needs to be roughly comparable in terms of genre and complexity to that typically encountered by professional translators and interpreters. With English as the current language of academia, especially in the Western world, widespread "collaboration across country boundaries, and an explosive growth in numbers of international research projects" (Mauranen 2017: 16), academic conferences provide good opportunities to source authentic ELF material. Another advantage of academic conferences is the possibility to obtain both written and spoken material from the same

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3 The acronym ACE stands for *Asian Corpus of English*, ELFA for *English as a Lingua Franca in Academic Settings* and VOICE for the *Vienna-Oxford International Corpus of English*.

researchers (i.e., abstracts and presentations), which allows direct comparisons between translation and interpreting. The use of ELF for intercultural communication in general includes native speakers of English, but expressions of concern by interpreters "mostly refer to its non-native use" (Albl-Mikasa 2017: 371). For the purposes of investigating cognitive load in translation and interpreting, authentic ELF material thus must be produced by someone whose first language (L1) is not English and whose texts and presentation scripts have not been proofread by a native speaker of English. Obtaining the cooperation of conference organizers and the timely consent of presenters to use their abstracts and have themselves recorded without making the latter overly self-conscious during their presentations are challenges that have to be dealt with sensitively.

Inevitably, there are differences in content and technical difficulty in texts collected from academic conferences with various themes, so the question arises as to the comparability of ELF and native English input. However, the cognitive effort in processing authentic ELF input can be compared with that of processing the same content in a version edited to conform to the conventions of native English, so the comparability between different texts is less important. The study design that we suggest counter-balances the content of two different texts, versions, and order of presentation across groups assigned to different settings (see Table 2). Measuring indicators of cognitive effort while study participants accomplish language processing tasks with ELF material and edited English versions allows both individual and group comparisons (e.g., across different levels of experience or background). For example, students can be compared with professionals, early-stage with experienced professionals, and T&I professionals with other multilinguals.

3.2 Preparing ELF input from authentic material

Authentic ELF material that is collected as described above can be analyzed for particular ELF phenomena to assess its suitability as input for measuring cognitive

Table 2: Order of text versions in a counter-balanced design.

Test setting	1st task	2nd task
1	Text A ELF	Text B edited English
2	Text A edited English	Text B ELF
3	Text B ELF	Text A edited English
4	Text B edited English	Text A ELF

effort in interpreting and translation tasks. We have found the categories proposed by Mauranen (2012) for her corpus analysis of spoken ELF very useful and have supplemented them with some derived from Andres' (2014) study on determining the difficulty of texts for interpreting training as well as from findings regarding ELF-based interpreting difficulties reported in Albl-Mikasa (2013b, 2014a) and Albl-Mikasa et al. (2017).

Preparing ELF input for translation or reading comprehension tasks from material such as abstracts written by non-native speakers of English is relatively straightforward once the research logistics imposed by the measurement methods have been determined. From our previous experience with translation process research (e.g., Ehrensberger-Dow and Massey 2013), we know that short texts like academic abstracts can be handled by translators within about an hour if technical and specific terms are provided in the form of glossaries and the brief is to produce a good first draft. Titles, headers, citations, and references can be removed or simply provided for reference if the focus is on the main body of the text, which makes it easier to prepare source texts of similar lengths.

Preparing appropriate ELF input for interpreting or listening tasks is some-what more challenging since speaker characteristics and accent can accentuate phenomena related to lexis, syntax, redundancy, cohesion, argumentative structure, and logic. However, speaker characteristics and accent are associated with both native and non-native speech and have already been studied elsewhere in detail (e.g., Cheung 2013; Kurz 2008; McAllister 2000). Our interest here is how to explore the possible impact of non-speaker-specific ELF phenomena (excluding accent) on cognitive effort during the performance of language processing tasks. Our solution to eliminating the confound of accent has been to have transcripts of presentations by ELF speakers recorded by a native speaker of general North American English. Reproducing transcripts of ELF exactly, including hesitation phenomena, and avoiding the temptation to automatically correct certain errors while reading is clearly challenging, so the speaker needs to be trained. We have found that it is easier for a speaker to record an ELF version before looking at the edited version. With respect to the speed of presentation, input rates of 100–120 words per minute are considered comfortable for simultaneous interpreting (Li 2010), but natural speech can be much faster. We have used a slightly higher target pace (i.e., 125–130 wpm) because we include hesitation phenomena in the word count. Markers indicating 2-min intervals can be incorporated into transcripts to aid speakers in maintaining the pace. In order to eliminate speaker effects, it would be important to have all of the transcripts used in a particular study read by the same native speaker of English with the same technical setup. If videos rather than simply audio recordings are used as input for interpreting tasks, then the setting, background, clothing, and general appearance of the speaker should be kept as

similar as possible. The benefits of controlled background conditions for the analysis of cognitive effort is a reasonable compromise for any potential irritation of interpreters' being faced with non-native input presented by a native speaker. The latter can be counteracted with an explanation in the task brief (e.g., all presentations re-recorded by the same trained speaker for the sake of consistency).

One of the challenges in using authentic spoken ELF material is related to the way processing phenomena are accounted for in word counts. Phenomena such as false starts, pauses, and vocalized hesitations are a natural characteristic of spoken language in general, especially if the speaker is nervous or inexperienced, but they may occur at disproportionately high frequencies in some ELF material, which seems to be relevant for interpreting difficulties and may contribute to interpreters experiencing such speech as "brain stoppers" (Albl-Mikasa 2014b: 23). This also applies to long unfilled pauses, which – although silent – do take up "space" in the duration of spoken material just as other hesitation phenomena do. We suggest retaining these common ELF features in input for interpreting tasks as well as including them in word counts, in order to assess their potential to affect ear-voice span and fluency. We attribute this type of spoken ELF phenomena relating to "speakers' moment-to-moment progression with words" (Mauranen 2012: 108) the same weight and prominence as other typical ELF phenomena (see also Mauranen 2012: 108–113, 229–230).

3.3 Creating edited English versions of ELF material

Comparing the cognitive effort of processing ELF input with that of native English input only makes sense if the input differs only with respect to the phenomena associated with ELF. The method we recommend to ensure similar propositional content, genre characteristics, and so on is to edit the material to eliminate the ELF phenomena in order to produce a version that conforms to English norms. As editing texts is a fairly subjective activity, it is crucial to determine the range of manipulation applicable to the authentic ELF material in order to create comparable edited English. It is essential to have a detailed understanding of the message the ELF speaker or writer intended to convey in order to produce a possible, and plausible, variant of what a native speaker of English might have said in an academic presentation or might have written in a conference abstract while otherwise staying as close to the original as possible. While this can prove very challenging with some material, conducting the above-mentioned analysis of ELF phenomena, researching technical details relating to the content of the texts, repeatedly listening to the recordings, comparing those to the abstracts, and even consulting the slides that often accompany presentations helps to reconstruct the

intended meanings of passages of abstracts and transcripts that might seem obscure upon first reading.

For interpreting and listening tasks, editing of transcripts also involves decisions about including or excluding processing phenomena present in original spoken ELF. Vocalized hesitations, unfilled pauses, repetitions, false starts, and slips of the tongue are natural features of all spoken language, with frequency varying between individual speakers, native and non-native alike. Some processing phenomena therefore have to be kept in edited English versions as well. Very unnatural sounding phenomena found in ELF material can be deleted or moved to different, more natural-sounding places in the respective utterances, although this necessarily remains quite subjective. As with any type of research, transparency can be achieved by being explicit about what the differences are between the authentic ELF material and the edited versions.

4 Concluding remarks

As Mauranen pointed out "[t]he cognitive load in ELF is unusually heavy on account of the variety and unpredictability of language parameters: interlocutors' accents, transfer features, and proficiency levels" (Mauranen 2012: 7). In this article, we have attempted to illustrate how the cognitive load associated with ELF and the cognitive effort to process it can be assessed by using a range of qualitative and quantitative methods more familiar to cognitive translation and interpreting studies and with material produced in the context of international academic conferences. Translation and interpreting are particularly interesting tasks because both the process and the product can be examined to understand how ELF phenomena might affect language processing and because spoken and written ELF can be investigated within the same research setup. These types of tasks and the academic domain are simply a few examples among the many domains in which ELF is common. In our current research, they are serving as the basis to explore the cost of ELF, its impact on the performance of translators, interpreters, and non-T&I professionals, and the potential of different types of expertise for the development of strategies to cope with the potentially additional cognitive load induced by ELF. We expect that this type of research will deepen our understanding of ELF on the one hand and of translation and interpreting in this new era of globalization on the other. At a very practical level, insights into the relationships between expertise, cognitive load, and stress when dealing with ELF input could be incorporated into undergraduate, graduate, and professional development programs in a wide variety of disciplines to better prepare the citizens of the future for the challenges that come with the global phenomenon of ELF.

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