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Spotlight on the reader: methodological challenges in combining translation process, product, and translation reception

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Abstract: This contribution addresses methodological challenges in integrating translation process, product, and reception data, and explores intricate relationships between translator's cognitive effort, translation quality, and the readers' cognitive effort. The interplay is examined with an eyetracking experiment in which participants read professional L2→L1 translations (whole texts) of varying quality (high vs. low). The analysis focuses on meaning integration and re-processing during L1 reading, operationalised through three eyetracking measures: dwell time, number of runs, and re-reading dwell time. The texts read are either high-quality translations (an end-product of a translator with many years of professional experience) or low-quality translations (delivered by a less experienced professional translator). Each L2→L1 translation consists of eight sentences. Each sentence in the text thus has a record of each reader's cognitive effort (eyetracking measures), and a record of translator's cognitive effort operationalised as the time taken by the translator to deliver a translation of a target sentence. Results reveal a significant interaction effect: readers exert more cognitive effort when reading low-quality translations, particularly when the translator's effort is lower, whereas high-quality translations elicit increased reader's effort when the translator's effort is higher. Moderated mediation analyses further show that readers' proficiency in the source text language (L2) mediates the relationship between the number of years they use their L2 and cognitive effort invested in reading L1 translations, but only in the case of low-quality translations. These findings underscore the complex dynamics between translation production and reception, highlighting the role of individual differences in shaping cognitive processing. The study contributes to the growing body of research in Cognitive Translation and Interpreting Studies by bridging process- and reception-oriented approaches, and by offering insights into how translator's effort and decisions impact reading processes.

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1 Introduction

The intersection of *Translation Studies* and *Reception Studies* has ushered in lines of research which brought the reader, viewer, and listener from backstage into the dazzling spotlight. This shift from the periphery to centre is particularly evident in latest research trends in Cognitive Translation and Interpreting Studies (CTIS), both in terms of the scale of empirical interest and the diversity of research methods used to examine the recipient's experience (Walker 2019, 2021; Whyatt et al. 2023). Even though the turn towards reception in Translation Studies (TS) may seem strikingly contemporary and fresh, as Muñoz Martín (2024) points out, reception-oriented research has long been part of the scholarly tradition in CTIS, albeit encountered in diverse forms also from the perspective of the translator.

Within an act of translation, the translator assumes more than one role: the reader of the source text (ST), the writer of the target text (TT), often the first reviewer, reviser, and proofreader of the initial TT draft. This multi-layered engagement with the text further foregrounds the intricate relationship between TT production, its quality and reception, and – since we deal with human translation and human reception – we need to consider individual differences brought to the process of translation and reading.

Reading research and reception-oriented translation studies rest on the assumption that there is a link between visual attention and information processing (Just and Carpenter 1980). A word (phrase or sentence) that is more difficult to process, garners more visual attention. The reading process, defined as "the processing of textual information so as to recover the intended meaning of each word, phrase, and sentence" (Rayner et al. 2016: 5), serves as a mirror that may reflect the purpose of reading task (e.g., scanning, reading-for-comprehension; see Ho & Tsai, this volume), text type (e.g., functional, expressive), text complexity, and quality.

The eyes lingering on text segments containing errors or inaccuracies may manifest as an increased number of fixations or regressions to the words, longer fixation durations, taken to reflect higher *cognitive effort* required to access the mental lexicon to construe and integrate the underlying meaning of the text (see Clifton et al. 2016; Rayner 1998). In this way, higher reading effort – as expressed in more or longer fixations, regressions, and, as a result, longer dwell time (i.e., total fixation duration) – can indicate low quality of the text (text containing many errors that disturb the reading process).

All the same, low-quality features of the text (e.g., errors, problems with logic) may become more (or less) salient depending on the reading task and levels of text processing it entails (Rayner et al. 2016). Textual features are also filtered through the reader's profile (e.g., their language proficiency, background, reading habits), potentially modulating cognitive effort exerted in reading. In this way, the reading effort may reflect the interaction of the (bottom-up) text quality and the reader's (top-down) individual differences.

Translations offer yet another layer of features that may impact the reading process, and thus provide even more angles for exploration. The very possibility of testing the effectiveness of the translator's keystrokes and pauses (recorded during the translation process) with the readers' eye movements opens up another door to translation quality evaluation. Moreover, the potential effects of the translator's effort and translation quality on the process of reading TTs may not 'shine through' in the reading process in the same way for all the readers, who enter into the reading process with their individual linguistic backgrounds.

The present contribution examines the correspondence between the *translator's effort* exerted to translate a text (operationalised as the total time taken by the translator to produce a target sentence in a text, see Table 1 in §3.1) and the *reader's effort* exerted to read the final outcome of the translation process. Since research at the interface of *translation process – product – reception* is still scarce, initial sections of this contribution discuss the selected methodological challenges that may emerge in attempts to integrate the translation process and product with translation reception. Part of the challenges stem from the difficulties associated with defining the underlying key constructs in this equation: *cognitive effort, translation quality, translation expertise,* and *language proficiency and use*. The second part of this article tests the interaction of these constructs and reports on the experimental investigation of how the professional translator's effort, translation quality, as well as readers' ST-language proficiency and exposure (L2 proficiency and L2 use) shape the reception of the TT captured with eyetracking during reading.

2 Methodological challenges in combining translation process, product, and reception

Shifting the concept of *reception* from the periphery to the forefront of the scholarly focus in CTIS has opened new research avenues elucidating the effects of the translator's decisions on the reader. Meanwhile, the key concepts aimed at capturing the granularity of the link between translation process, product, and reception – cognitive effort, translation quality, the role of translation experience,

and the background and traits of the reader (here, the focus on linguistic background) – have remained relatively elusive. Below they are closely examined as they pose challenges for translation reception studies.

2.1 The many shades of the reader's and translator's cognitive effort

The construct of *cognitive effort* has been addressed across many disciplines studying the mind and the brain. The broad research scope and proliferation of terms often used interchangeably (e.g., mental effort, processing effort, mental workload, cognitive load) reflect its relevance in understanding mental processes and their associated costs. In his influential theory on attention and effort, Kahneman (1973) understands cognitive (mental) effort as the amount of attention allocated during task performance, thereby disambiguating it from physical effort. This understanding of cognitive effort resonates across Reading Studies (RS) and CTIS today.

2.1.1 The choice of proxies for cognitive effort

At the heart of methodological challenges in combining cognitive effort studies in translation and reception lies identifying valid and reliable measures capable of gauging cognitive effort invested in a translation task by the translator and in a reading task by the TT reader. The selection of appropriate measures is based on how cognitive effort is defined and operationalised.

Across RS, *cognitive effort* is often understood as attention or mental-resource allocation, cognitive load, processing difficulty, fluency disruption, and engagement in higher-order processing (e.g., Alter and Oppenheimer 2009; Kahnemann 1973; Sweller 2011). In CTIS, it remains a central construct, often conceptualised as the amount of mental resources exerted to produce a translation (e.g., Hvelplund 2011; Krings 2001; Vieira 2014). Using a broader understanding, the cognitive effort of the translator may be defined as "[t]he total effort that the translator expends during the translation task [and] the target text (TT) is then the product of this translator effort" (Hunziker Heeb 2020: 48), and researched analysing its different representations as indicators of the same cognitive effort, rather than technical, temporal, or cognitive efforts (see Hunziker Heeb 2020; Pietryga 2025).

Cognitive effort invested in performing a task by the translator and the reader lends itself to indirect measurement with 'online' *verbal descriptions of thoughts* (TAPs), *retrospective rating scales* (evaluating the subjective feelings of effort), *comprehension accuracy* (more inaccurate answers on text comprehension

questions indexing high cognitive effort), *brain waves* (changes in the selected alpha or theta waves indexing changes in cognitive effort), *physiological signals*, *reading times* (longer time indexing higher effort), and *eye movements* – higher values of measures such as a number of fixations, regressions, and dwell time indexing higher effort (Gile and Lei 2020: 269–273). Its distribution across translation tasks is also investigated with *hesitation pauses* (Lacruz and Shreve 2014; O'Brien 2006) and *eye-key span* (Dragsted and Hansen 2008; Pietryga 2025), with longer pauses and longer time lags taken to reflect enhanced cognitive effort. Within CTIS, data registered with keystroke logging, screen-capture techniques, and eyetracking – today often used in triangulated and mixed-methods designs – are further interpreted within frameworks mainly developed for post-editing such as Krings's (2001) temporal, technical, and cognitive indicators.

Eye-movement control models in reading (e.g., the E-Z Reader model) implicitly assume that "the link between eye movements and cognition is quite tight" (Reichle et al. 2003: 511), and that the distribution of visual attention aligns with information processing (the *eye-mind hypothesis*, Just and Carpenter 1980). To analyse this distribution across the tasks involving reading, researchers readily apply Rayner's (2009) framework, where specific eye-movement measures are assumed to reflect specific stages of processing during reading. Early-stage eye-movement measures are taken to reflect initial lexical access (low-order visual encoding and initial lexical processing) and primarily include *first-pass fixation duration, gaze duration* (sum of all first-pass fixation durations), and *saccade length*. Late-stage eye-movement measures, assumed to reflect post-lexical access (higher-order processes thereof: semantic integration, comprehension), include *regressions* and *re-reading time,* and *number of passes (runs)*.

Dwell time (total fixation duration) – a more global measure – reflects the total cognitive effort exerted over a specific AOI (Walker 2021). Although the exact labels for eyetracking measures vary, a prevailing view emerges: their higher values recorded to AOIs (a word, phrase, sentence, excerpt, or whole text) are taken as proxies for the increased cognitive effort invested in processing the AOIs. The research hypothesis will guide the choice of measure (early, late, or global) that is relevant to addressing the research question.

2.1.2 The choice of experimental stimuli to gauge cognitive effort

Another challenge of integrating translation process, product, and reception scopes lies in the choice of experimental stimuli. When the same experimental material (e.g., a text) is utilised in a translation-process-and-product study and the subsequent reading study, many decisions are mutually dependent and thus become more complex. Cognitive effort is sensitive to the lexico-semantic, syntactic, and stylistic

features of the text (Frazier and Rayner 1982; Rayner and Duffy 1986). More cognitively taxing are infrequent, abstract, or ambiguous words; unconventional metaphors; long, syntactically complex, unpredictable sentences; texts lacking in coherence (Staub and Rayner 2007). Since cognitive effort is tied to specific features of the text, a ST will to some extent affect the outcome of translation process (the TT), and the TT – when used as an experimental text in a reading study – will modulate readers' cognitive effort.

Insights into the reading process, advanced by studies on single-word and sentence processing, show cognitive effort to be affected by word- and text length (e.g., Cop et al. 2015). In empirical attempts to tie cognitive effort in translation production with translation reception, measures independent of text length may be more accurate to consider, as they allow for between-studies comparisons of the invested processing effort (see O'Brien 2010). Character-adjusted eye-movement measures have already been employed to quantify cognitive effort in entire-text reading experiments: to examine repeated exposure effects (Hyönä and Niemi 1990), text readability (O'Brien 2010), processing of foreignised elements (Kruger 2013), and translation reception (Walker 2019; Whyatt et al. 2025).

This solution makes comparisons possible between the amounts of cognitive effort invested in reading texts, despite variability in text length. In an exploratory proof-of-concept experiment marrying the translation process to reception, Whyatt et al. (2023) use character-adjusted dwell time and fixation count as proxies for cognitive effort. In studies that tie the reading process to translator's effort, including spaces as additional characters in calculations seems justified – effortless as pressing the spacebar may appear, it contributes to the translator's technical effort (Krings 2001). Yet, across CTIS and RS, the decision to include or exclude spaces in such adjustments varies depending on the research problem and methodological design. As a case in point, research questions that address language processing in a single language tend to exclude spaces from the total count of characters in a sentence or in a text. In such cases, there is no need to adjust for the word length that may typologically vary across the explored languages (e.g., Polish, as an inflected language, has richer morphology than English).

Another factor reported to modulate cognitive effort is text complexity. That may be assessed within the methodological framework of grammatical intricacy and lexical density (Yu and Wu 2019). Complex syntactic patterns (e.g., object relative clauses) and dense information integration in a text (e.g., many content words, uncommon lexical items) increase readers' reaction times and gaze durations (Singh et al. 2016). While readability formulas have been reported to successfully predict the processing effort involved in translating and reading (e.g., Vieira 2014), it appears that high-complexity-but-high-quality translations might still be less cognitively taxing to read than low-complexity-but-low-quality translations (Whyatt et al. 2023,

2025). Readability metrics should therefore be employed with caution as predictors of cognitive effort in reading TTs of varying quality.

What tends to be associated with specific levels of text complexity are text types. In CTIS, some studies found text type to predict the translator's time and processing effort invested in translation: different text types were associated with different processing efforts (e.g., Wang and Daghigh 2024; Whyatt et al. 2021). The choice of text type (e.g., descriptive, functional, literary, a news story) as experimental stimuli seems then pivotal. Expressive literary texts appear to allow for more emotional and cognitive engagement and hence might be more taxing to process, translate or read than descriptive texts. When translating literary texts, the translators may use more creative translation strategies (e.g., less frequent vocabulary or unusual grammar structures to convey the intended tone), which overall may increase cognitive effort involved in reading, yet it does not necessarily reflect the translation quality. Functional descriptive texts are assumed to be more standardised in terms of lexis than more creative texts (Tomczak and Whyatt 2022: 126) and thus potentially limited as to their effects on readers.

On the other hand, texts with language for special purposes can be rich in low frequent terms which would increase cognitive demands. In a reading experiment with excerpts that could pass as both news or literary stories, Zwaan (1994: 930) established that, when the participants believed to be reading a news story, they allocated "more resources to the construction of a causal-situation model," and exhibited shorter reading times. Readers who believed to be reading literary stories allocated "more resources to surface-level and textbase-level processes," which manifested in longer reading times. Minimising unwanted variability and potential confounds stemming from the choice of text allows for a more controlled exploration of the reading process, and thus raises confidence in ascribing the captured cognitive effort to the investigated factor rather than other factors.

2.1.3 The choice of experimental task to gauge cognitive effort

Task effects serve as a considerable source of variability in the processing effort (Horiba 2000). Shreve et al. (1993) found that anticipation of translation problems involved in reading-for-translation somewhat slowed down the reading process, as compared to careful reading-for-comprehension. An eyetracking study by Schaeffer et al. (2017) revealed that the total reading time, and the number of fixations and regressions approximately doubled while reading for translation, when compared to reading for comprehension. The authors argue that this lends support to the assumption that the reading purpose and task instructions have effects both on lexical access and meaning integration processes. Hvelplund (2017) examined the distribution of cognitive effort across four types of reading during translation: ST

reading, ST reading while typing, TT reading while it is emerging, and then when it is complete. Reading of the emerging TT was found to be most cognitively demanding (longer fixations), followed by reading the existing TT, ST reading (without typing), and ST reading while typing which attracted shortest fixations.

Ingrained in the translation task, translation directionality has often been shown to modulate cognitive effort of translators. Translating into L2 tends to be more demanding than translating into L1 (Buchweitz and Alves 2006; Ferreira et al. 2016) and invites more extensive use of online resources (Kuznik and Olalla-Soler 2018; Whyatt et al. 2021). In reading studies, a considerable portion of variability in data can be attributed to the choice of language (here, readers' L1 or L2) for the reading task and the purpose of reading. As evidenced by psycho- and neurolinguistic research, reading in L2 is more cognitively taxing than reading in L1. It typically involves longer reading times than L1 reading (e.g., Cop et al. 2015; Nahatame 2023).

Studying the effects of task on cognitive effort presents challenges, as it remains difficult to isolate them from other cognitive processes that become co-activated during task performance. To tease apart entangled cognitive processes involved in the translation task or reading task, and limit the extraneous factors to ensure valid and reliable measurement of cognitive effort, methodological rigour remains a priority (Fleming et al. 2023: 290). On the other hand, highly controlled studies carried out in experimental settings are, by definition, often limited in their ecological validity. Thus, reconciling high control of potential confounding variables and high ecological validity remains an ever-green challenge in itself.

2.2 The curious case of translation quality

As noted by Gile and Lei (2020: 265), examining translator's effort warrants attention because of its nuanced relationship with the quality of the TT. While the link is not strictly linear, a TT where the translator is assumed to have exerted low cognitive effort most probably exhibits inaccuracies, errors, and other language imperfections that compromise translation quality. With a greater amount of invested cognitive effort (e.g., more thorough information collection and ST analysis, more self-revision) visible in the amount of time spent to produce each target sentence in the text, the overall quality of the translation has been found to improve, affecting text comprehension and reception experience of the readers.

Tracing the correspondence between translator's effort and translation quality depends on the definitions and assessment metrics of both. As discussed by Koby et al. (2014), definitions of translation quality can be located with respect to the two axes: the axis of *scope* (narrow-to-broad) and the axis of *specifications* (absolute-to-

relative). A broad view of translation quality includes accuracy, fluency required for the purpose and the audience; it acknowledges the end-user and complies with specifications negotiated between the requester and provider. A narrow definition of translation quality, on the other hand, focuses on the complete transfer of the ST message (including its connotation, denotation, nuance, and style) into a culturally appropriate TT, often with the expectation that it reads as an original. A vast array of translation quality assessment methods proposed to date include intuitive assessment, error analysis, corpus-based evaluation, rubrics-referenced and scale-based scoring, item-based assessment, comparative (expert) judgement (review in Han 2020).

While unveiling the power of the reading process to bring insights about the quality of TTs has not been extensively applied, recent studies suggest that text comprehension accuracy, feedback about engagement in reading, and – most interestingly – reading fluency tested with eye movements, may all reflect translation quality. In their exploratory study Whyatt et al. (2023) found no straightforward effect of the translator's effort but rather a visible effect of translation quality on the process of reading a product description text: the low-quality translation (involved text type: descriptive) required more cognitive effort to read than the high-quality translation, as evidenced by readers' longer character-adjusted dwell time. The experiment was conducted with a modest sample size and was exploratory in its nature. Treating readers' eye movements as indirect accurate measures of translation quality acknowledges the reading stage as an integral part of the quality assessment of the translation process and product. This wide-angle view looks beyond the edges of the translation process and product, and perceives the reading of the TT as the proof of the translation process in itself.

2.3 The unbearable lightness of language proficiency and translation expertise

This last section brings forward the role of the translator and the reader in experimental studies of the translation process and in reception studies. Alongside task- and stimuli-specific effects, differences in participant characteristics are one of the major sources of variability in information processing data produced by human beings. Where translators and readers are involved, their performance differences (including cognitive effort) are shaped by their language proficiency and exposure, domain expertise, specific cognitive abilities, age, and years of experience, to name but a few. Language proficiency and exposure are factors contributing to both the reader and translator profile. While for translators L2 proficiency is tacitly assumed

to be a part of their translation expertise, in reading studies the language background of the reader has often been overlooked.

CTIS have mostly tested their research hypotheses with participants of varying levels of translation expertise. What is meant by translation expertise and how it affects translation task performance in terms of cognitive processing are questions that have fuelled a substantial area of scholarly enquiry and thought (e.g., Massey 2017; Muñoz Martín 2014; Shreve 2006; Shreve et al. 2018; Tiselius and Hild 2017). As a multifaceted concept, translation expertise has witnessed "almost as many definitions (…) as the number of researchers studying the subject" (Muñoz Martín 2014). As "a unique combination of experience, knowledge and skills" (Whyatt 2018a: 65), it evolves through sustained efforts and practice over the timespan of professional experience (Massey 2017; Shreve et al. 2018) to ensure high-quality work performance.

From a methodological standpoint, in CTIS translation expertise is thus often linked to years of professional experience (Tiselius and Hild 2017: 430), and thus the labels *professional, expert, experienced* are equally often used interchangeably to refer to participants. The lines of consistent empirical enquiry in CTIS using eye-tracking and keylogging have found professional translators to exhibit fewer but longer fixations, fewer regressions, shorter pauses during translation than the less experienced translators (Hvelplund 2011), and more efficient coordination of the reading and writing processes during translation (Dragsted 2010).

While CTIS often examine professional, experienced, and expert translators, psycholinguistic bilingual reading studies often engage highly proficient users of their languages (L1, L2) as participants to investigate cross-language dynamics. With more than one definition of language proficiency and language exposure, visual-world eyetracking experiments have revealed activation of the L1 during L2 processing (e.g., Duyck et al. 2007), and – more intriguingly – activation of the L2 during L1 processing (e.g., Spivey and Marian 1999). Crucially, L2 proficiency has been reported to significantly modulate these cross-language activation (CLA) patterns.

Yet, research findings pointing to L2 proficiency affecting L2→L1 CLA remain somewhat contradictory and inconclusive: higher L2 proficiency leads to stronger and earlier L2→L1 CLA reflected as interference effects (e.g., Mishra and Singh 2016) or higher L2 proficiency has been found to reduce L2→L1 CLA, yet with higher L2 exposure observed to strengthen L2→L1 CLA (e.g., Berghoff and Bylund 2024). The L2 proficiency effects are inherently intertwined with age of L2 acquisition and L2 exposure. The complexity of this relationship becomes particularly salient when examining L2 activation during reading of texts in L1 and – most interestingly – texts translated into one's L1 where the ST language is one's L2. The major question is then whether the levels of L2 proficiency and L2 exposure modulate the strength of CLA

when reading translations from L2 into L1. The study reported below embraces the above challenges to combining the translator and the reader, the translation process, its product, and its reception.

3 The study

3.1 Main objectives, research questions, and variables

The main objective of this study is to further our understanding of (1) how the translator's cognitive effort and translation quality affect the cognitive effort that the reader invests in reading a TT, and (2) how the quality of the TT – coupled with the reader's background (*L2 proficiency* and *the number of years of L2 use*) may be related to translation reception, indexed by the reader's cognitive effort at reading the translation. This contribution draws on eyetracking attempts to combine the translation process and product with translation reception process (Whyatt et al. 2023, 2025), and further investigates this interface with a larger sample size. To this aim, the following research questions are addressed:

RQ 1: Is there a relationship between the *translator's cognitive effort* when producing the translation, *translation quality*, and the *reader's cognitive effort* invested in meaning integration? More specifically, do the *translator's cognitive effort* invested in producing the translation and *translation quality* affect the *reader's cognitive effort* involved in re-reading the translation (dwell time, re-reading dwell time, and the number of runs)?

Bearing in mind the importance of individual differences that readers bring into the reading process, in the second step, the aim is to explore the intricate interplay between *translator's cognitive effort*, *translation quality*, and the *reader's cognitive effort* involved in reading the TT, and the selected individual differences regarding the use and proficiency in the ST language (i.e., years of L2 use, L2 proficiency) of the readers. To this aim, the following research question is addressed:

RQ 2: Is the mediation relationship between *L2 years of use – L2 proficiency – reader's cognitive effort* (indexed by a late-stage-of-processing eye-movement measures: number of runs, re-reading dwell time, as well as total reading dwell time) different for the low-quality (LQ) translation and high-quality (HQ) translation?

The operationalisation of the investigated variables is presented in Table 1.

Table 1: The investigated variables operationalised.

Proxy for	Measure	Comments	Data collection or assessment method
Translator's cognitive effort	*Total time* taken by the translator to produce a TT (each sentence in the TT is a separate value). Following Hunziker Heeb (2020: 48), the translator's cognitive effort is understood as "[t]he total effort the translator expends during the translation task [and] the target text (TT) is then the product of this translator effort."	Character-adjusted (i.e., divided by the number of characters in a given sentence in the TT, including spaces)	Keylogging (Translog II)
Translation quality	The translation quality of the TT. Categorised as low quality (LQ) and high quality (HQ).	All corrections made by proofeaders and accuracy evaluator were classified into the following categories: vocabulary, grammar, orthography, style, cohesion, spelling, punctuation, vocabulary, sense-nonsense error, cultural adaptation, and accuracy. The lower the number of points, the better the translation quality. See Whyatt (2019) and Whyatt et al. (2023) for details about types of corrected errors and criteria of translation quality evaluation.	Evaluated by two proofreaders who did not have access to the ST and focused on scoring language and cultural adaptation Additionally, evaluated by one experienced professional translator who focused on evaluating only accuracy of the translations (who had access to the ST) The proofreaders and the accuracy evaluator were instructed to correct the TT to make them publishable (to correct the TTs when they felt it was necessary).
Reader's cognitive effort invested in meaning integration	*Dwell time (total fixation duration)* – the sum of the duration of all fixations in the area of interest (AOI). Character-adjusted (the sum divided by the number of characters in the AOI, including spaces).	Each sentence in the text serves as a separate AOI. Hence, 8 AOIs in each text. Dwell time is a more global measure exerting the total cognitive effort exerted over a specific AOI (Walker 2021).	Eyetracking (EyeLink 1000 Plus)

Table 1: (continued)

Proxy for	Measure	Comments	Data collection or assessment method
	Re-reading dwell time – first-run dwell time deducted from total dwell time in the AOI. *Number of runs (passes)* – the number of times each AOI (each sentence) was entered and left.	Re-reading dwell time and number of runs are taken as late-stage cognitive effort measures, linked to re-processing and meaning integration (Inhoff et al. 2019; Rayner 1998). Not character-adjusted.	
Reader's L2 proficiency (English)	The average score computed out of four language skills (reading, listening, speaking, writing). Since each skill was self-rated using a 7-point Likert scale, the total score (the mean value) for each participant's L2 proficiency is the average score calculated out of the four skills divided by 7. This mean value ranges from 0 (minimum) to 1 (maximum).	Self-rated L2 stands for English, which is the language of the source text (ST) of the translation into Polish (L1).	Questionnaire LHQ ver. 3.0
Reader's number of years of L2 use (English)	The reported total number of years spent using English (following the instructions after Li et al. 2020, "you may have learned a language, stopped using it, and then started using it again. Please give the total number of years.")		

3.2 Participants

The readers (n = 67) who took part in the eyetracking study (the applied pre-screening inclusion criteria) were speakers of Polish as L1, highly proficient in English as their L2 (and the ST language), with normal or corrected-to-normal vision. All participants

Table 2: Descriptive statistics for the group of readers (Polish users of English).

Profile	Unit	Mean	Median	SD	Min.	Max.
Years of L2 use (L2 exposure)[a]	years	14	14	2.31	7	19
English L2 proficiency[a]	score	0.84	0.86	0.09	0.43	1.00
English L1 proficiency[a]	score	0.94[c]	1	0.09	0.61	1.00
English L2 proficiency[b]	score	81.07[d]	81.25	9.00	62.5	100
Age[b]	years	20.52	20.00	1.38	18	25

[a]LHQ, self-reported; used to profile the group of participants and in the subsequent data analyses. [b]LexTALE test; used only to provide a more detailed profile of the participants. [c]Based on 61 participants (incomplete datasets). [d]CEFR= C1/C2.

(47 women, 9 men, 5 non-binary, 2 non-relevant) were university students of English and were remunerated for their time (app. 1 h; vouchers or course credits). Four datasets had to be discarded because they were either incomplete or of very low quality of eye-tracking records. As a results, the 63 datasets were suitable for statistical analysis involving data collected with an eyetracker and participant profiling instruments (see §3.3.1). The participants were relatively homogenous regarding their reading habits (self-declared avid readers, 81 %; read most often in digital format, 58.5 %; more details on their reading habits in Whyatt et al. 2025). Table 2 shows a more detailed group profile.

3.3 Instruments, materials, and experimental tasks

3.3.1 Instruments used to profile the participants

The participants completed the *Language History Questionnaire* (LHQ 3.0, Li et al. 2020), used to gauge their self-reported language proficiency in L1 (Polish) and L2 (English – the language of the source text in the translation-process-and-product study), the number of years of L2 (English) use, age of L2 acquisition, language dominance, language background, exposure and use. They also took the LexTALE test (Lemhöfer and Broersma 2012) that provided more information about their L2 (English) vocabulary knowledge and filled out a survey about their reading habits, which both helped to provide more information about their profiles.

3.3.2 Experimental texts

The data recorded for two texts of different translation quality (high vs. low) were submitted to statistical analyses to answer the two primary research questions. Both

texts were Polish translations of English product descriptions (L2→L1) by professional bidirectional translators in the EDiT project (see Tomczak and Whyatt 2022; Whyatt 2018b). A descriptive text type (describing a ceiling fan) was selected for further analysis for its lower potential to evoke emotional engagement in reading, which could otherwise bias the investigated relationship between the translator's effort, translation quality, and reader's cognitive effort.

The TT requiring extensive correction by proofreaders (17 corrections in total) was classified as low-quality (LQ); the counterpart TT requiring minimal correction for publication (only 2 minor errors) was classified as high-quality (HQ) – details on proofreader corrections and quality assessment in Whyatt (2019: 86) and Whyatt et al. (2023). Two uncorrected TTs were used in the reading experiment. They differed in terms of word- and character length (including spaces): LQ TT (1011 characters, 136 words, 8 sentences), HQ TT (1138 characters, 145 words, 8 sentences), as compared to the ST (941 characters, 162 words, 8 sentences). The readability measures (*jasnopis.pl*) reveal that both translations are difficult to read, with a higher index of difficulty for the HQ TT (*the text-level FOG index* = 19.11) than for the LQ TT (*the text-level FOG index* = 13.86), both more difficult to read than the ST in English (*the text-level FOG index* = 12.57).

The two TTs (English→Polish) of different quality were end products by two professional bidirectional translators. Demographics and data records of the translation process collected in our previous project (EDiT using keylogging, eye-tracking, screen capture) show that the LQ translator had fewer years of professional experience than the HQ translator (3 years vs. 25 years), lower proficiency in English (LexTALE score = 71.25 vs. 91.25), allocated considerably less time to revision (20 s vs. 479 s) and drafting (578 s vs. 830 s), but comparable time as the HQ translator to orientation (50 s vs. 57 s). Each translator produced one TT, in the next stage evaluated by the two proofreaders and one professional translator (see Table 1 in §3.1) as a TT of LQ or HQ. Each TT contained 8 sentences, reflecting the structure of the 8-sentence ST. The translator's effort was recorded using keylogging (Translog II) and factored in and analysed at sentence level, with varying amounts of effort put into translating each sentence. As a result, the LQ TT contained 8 sentences into which the less experienced translator put varied effort (including low and high). In the same vein, the HQ TT contained 8 sentences into which the more experienced translator put varied effort (including low and high).

3.4 Apparatus, task, and procedure

Participants were familiarised with the procedure and study set-up, tested for eye dominance (due to monocular tracking), entered calibration, and completed reading-

for-comprehension tasks. They read five texts, each on a separate screen, each followed by comprehension checks (four true/false statements) to ensure careful reading (Kaakinen et al. 2003). The reading experiment (approx. 10 min) began with a baseline text (a product description of a mop cleaning set), followed by four texts, with a product description text (the experimental text – description of a ceiling fan) shown as first.

In this contribution, we analyse the data collected to a product description translation in its two variants: LQ and HQ. The between-subjects design was used with random condition assignment: reading the HQ versus LQ TT. Each text was displayed on a single screen (a 24-inch monitor, 1920 × 1080 resolution, 10 lines per text, 2.5 line spacing, Arial 25 pt.) in a self-paced mode. After the reading experiment, the participants provided feedback on their reception experience of the texts, and completed a battery of questionnaires.

The experiment was programmed and conducted using the EyeLink 1000 Plus eyetracker (SR Research) in the eyetracking Laboratory for Research in Language (EYE-LANG) at AMU Faculty of English, Poznań. The experimental protocol was approved by the Ethics Committee for Research Involving Human Participants at AMU, Poznań. Prior to the experiment, all participants provided written informed consent.

3.5 Statistical analyses

The drift-corrected eyetracking data collected in the reading experiment were submitted to statistical analyses (at sentence level), alongside both translators' total time taken to produce each target sentence in the translations (analysed at sentence level). The translation process data come from two translators recorded in a separate translation experiment (part of the EDiT project, described in Tomczak and Whyatt 2022). Data Viewer software (SR Research) was used for drift correction, and Jamovi software (ver. 2.3.28) for statistical analyses.

To answer RQ1, a linear mixed-effects (LME) analysis was conducted with five fixed effects: *translator's cognitive effort*, *translation quality*, and *the interaction of translator's effort and translation quality*, *reader's L2 proficiency*, and *their number of years of L2 use* (henceforth, *years of L2 use*), and with *participant* as a random effect. Following Whyatt et al. (2023), translation quality had two levels (low vs. high) and the translator's cognitive effort was character-adjusted and entered into the analyses at sentence level: to produce a TT each translator (the more experienced, the less experienced) translated 8 sentences. In the case of L2 proficiency and years of L2 use, L2 stands for English, which is the language of the ST of the translation into Polish. The reader's cognitive effort (reception effort) is assumed to be reflected in three

dependent variables (eyetracking measures): *dwell time*, *number of runs* and *re-reading dwell time*. The latter two are late-stage processing measures taken as proxies for cognitive effort involved in re-processing and meaning integration (Inhoff et al. 2019; Rayner 1998). As re-reading and regressing to the part of text is less systematic and occurs as a response to processing difficulties (e.g., Inhoff et al. 2019), these two measures are not character-adjusted. All the same, dwell time – a more global measure of reading – is character-adjusted (including spaces) to match the character-adjusted translator's effort and to make the variable independent of text length.

To answer RQ2, a moderated mediation analysis was performed, where translation quality was tested as a moderator of the mediation relationship between *years of L2 use – L2 proficiency – dwell time,* with character-adjusted dwell time indexing reader's cognitive effort at a more global level. The readers' L2 proficiency was tested as a mediator in this relationship. The same model was tested for the late-stage processing eye-movement measures (not character-adjusted): the *number of runs* and *re-reading dwell time.*

3.6 Results

The following sections provide a detailed presentation of the results of the statistical analyses performed to address the two investigated research questions (RQ1, RQ2). To ease the reading of the detailed results, what follows is a brief overview of the key findings. Both LQ and HQ TTs comprised 8 target sentences produced by each translator with varying effort recorded at sentence level (e.g., there were sentences in both LQ and HQ TTs where the translator's effort was lower or higher). The analyses reveal statistically significant interaction effects: readers' dwell time, number of runs, and re-reading dwell time is higher for reading the low-quality than the high-quality translation (LQ > HQ) but only when reading sentences into which the translators put low effort. When the translator's effort is high, readers show longer dwell time and re-reading dwell time for reading HQ versus LQ TT (HQ > LQ).

The effect of the number of years of L2 use was significant for re-reading dwell time and number of runs, with more years of L2 associated with lower reader's cognitive effort. Translation quality was found to moderate the relationship between readers' L2 proficiency and their dwell time, re-reading dwell time, and the number of runs. Readers' L2 proficiency mediates the relationship between readers' years of

L2 use and their cognitive effort but only for the LQ TT. Their number of years of L2 use is positively related to their L2 proficiency, and their L2 proficiency is negatively related to the investigated proxies for readers' cognitive effort.

3.6.1 Significant interaction effect of translator's effort and translation quality on TT readers' dwell time

Linear mixed-effects (LME) analyses tested the statistical significance of the investigated effects on *dwell time* and yielded no significant effect of *translator's effort* nor of *translation quality* (b = –0.006, SE = 0.005, t = –1.199, p = 0.231; b = –3.837, SE = 2.782, t = –1.379, p = 0.172, respectively). However, a significant interaction effect of *translator's effort* and *translation quality* on the reader's *dwell time* (b = 0.022, SE = 0.010, t = 2.261, p = 0.024) was revealed, indicating that the way translator's effort and translation quality affect reader's dwell time is more complex. Interestingly, the examined simple effect of translator's effort on the reader's dwell time reached significance only for reading the high-quality translation (b = 0.005, SE = 0.002, t = 2.147, p = 0.032), and not for reading the LQ TT (p = 0.075). What follows, in the TT which was evaluated by proofreaders as high-quality, those sentences into which translator put more effort, showed higher reading dwell time among the readers (b = 0.005, SE = 0.002, t = 2.147, p = 0.032). Moreover, the readers' dwell time was higher for reading the LQ than HQ TT (LQ > HQ) only for those sentences in the TTs into which the translators put low effort (b = –10.863, SE = 3.555, t = –3.056, p = 0.003). Neither L2 proficiency (p = 0.825) nor years of L2 use (p = 0.109) reached significance in the tested LME model (see Figure 1).

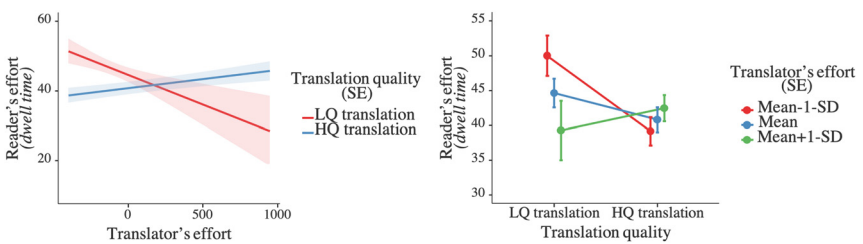

Figure 1: Plots for the simple slope analyses for the significant interaction effect of the translator's effort and translation quality on the reader's effort (indexed by *eye-movement dwell time*).

3.6.2 Significant interaction effect of translator's effort and translation quality on TT readers' number of runs and re-reading dwell time

Two eye-movement measures taken to reflect late-stage cognitive processing (meaning integration) were examined: *number of runs in the text* and *re-reading dwell time.* The LME analyses performed for the *number of runs* are reported first. Significant effects were found for the invested *translator's effort* (b = –0.001, SE = 0.0001, t = –2.423, p = 0.016), and for its interaction with *translation quality* (b = 0.002, SE = 0.001, t = 2.563, p = 0.011). In general, when the translator's effort invested in translation was low, the readers re-visited the TT more frequently (i.e., showed a higher number of runs). However, this general finding is driven mainly by one level of the independent variable: LQ TT (b = –0.002, SE = 0.001, t = –2.573, p = 0.010), not HQ (p = 0.797). The difference in the readers' number of runs to sentences (AOIs) in the HQ and LQ text was significant only where the translators put less effort to translate the corresponding sentences (b = –0.523, SE = 0.256, t = –2.041, p = 0.043), with more runs in the LQ TT (LQ > HQ).

The tested effect of *L2 proficiency* on the *number of runs* did not reach statistical significance (p = 0.508). However, the effect of *years of L2 use* was significant (b = –0.093, SE = 0.045, t = –2.055, p = 0.044). The higher number of years that the readers had been using English turned out to be linked to the lower cognitive effort they exerted to read the text that was a translation from English into Polish (see Figure 2).

Next, *re-reading dwell time* was examined. The LME analyses yielded a significant effect of *translator's effort* on re-reading dwell time (b = –1.979, SE = 0.774, t = –2.557, p = 0.011), as well as a significant effect of the *number of years of L2 use* (b = –226.459, SE = 81.092, t = –2.793, p = 0.007). Overall, when translator's effort increases, the reader's effort decreases. Likewise, when the number of years of L2 use increases, re-reading dwell time decreases. The tested interaction effect of translator's effort and translation quality reached statistical significance (b = 5.117,

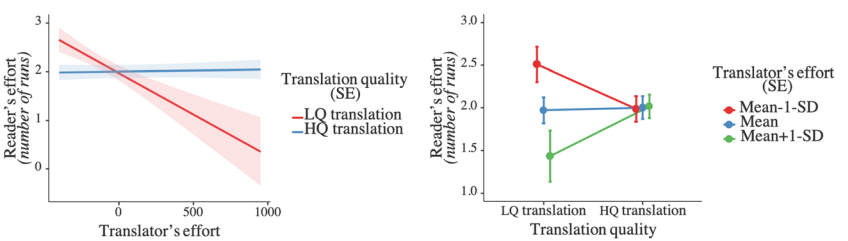

Figure 2: Plots for the simple slope analyses for the significant interaction effect of the translator's effort and translation quality on the reader's effort (indexed by *number of runs*).

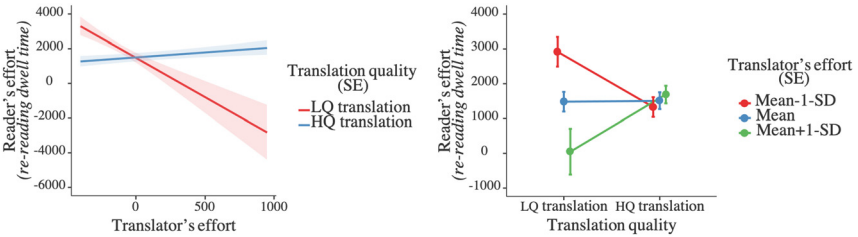

Figure 3: Plots for the simple slope analyses for the significant interaction effect of the translator's effort and translation quality on the reader's effort (indexed by *re-reading dwell time*).

SE = 1.548, *t* = 3.306, *p* = 0.001). As in the case of the number of runs, the simple effect of translator's effort is only significant for re-reading LQ TT (*b* = –4.537, *SE* = 1.500, *t* = –3.026, *p* = 0.003), not HQ TT (*p* = 0.131). When the LQ translator put more effort into translating sentences into L1, the readers spent less time re-reading those sentences.

Moreover, in the case of low effort invested by the translator into rendering sentences, the readers found it more cognitively taxing to read those in the LQ TT than in the HQ TT (LQ > HQ; *b* = –1593.927, *SE* = 512.086, *t* = –3.113, *p* = 0.002). When the translator's effort was high, readers showed lower re-reading dwell time (indexing lower cognitive effort) in the LQ than HQ TT (LQ < HQ) (*b* = 1643.926, *SE* = 706.102, *t* = 2.328, *p* = 0.020). Neither translation quality (*p* = 0.947) nor L2 proficiency (*p* = 0.697) reached significance in the tested LME model, indicating no significant impact of the two on participants' re-reading dwell time (see Figure 3).

3.6.3 Testing the moderated mediation model

We further investigated whether there was a relationship between *the number of years of L2 use, L2 proficiency,* and *dwell time* (more global eyetracking measure), and two late-stage processing eyetracking measures taken as proxies for cognitive effort involved in re-processing, re-analysis, and meaning integration: the *number of runs (passes),* and *re-reading dwell time*.

The moderated mediation analysis reveals that, in the tested mediation model *(years of L2 use – L2 proficiency – dwell time),* translation quality moderates the relationship between *L2 proficiency* and *dwell time* (*b* = 67.796, 95 % CI [10.039; 125.553], *β* = 2.585, *p* = 0.021). The indirect effect for the mediation model is significant for the LQ TT (*b* = –0.736, 95 % CI [–1.367; –0.106], *β* = –0.139, *p* = 0.022), but not for the HQ TT (*p* = 0.227).

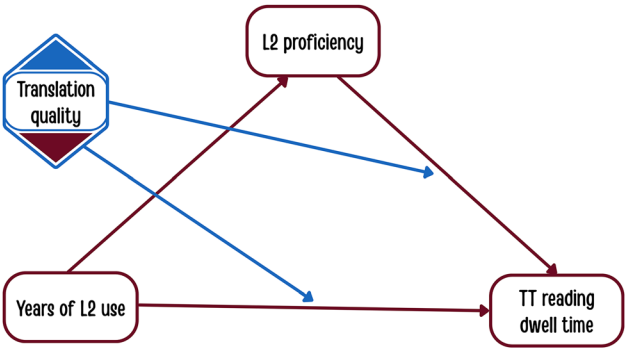

Figure 4: *L2 proficiency* as a mediator in the relationship between *years of L2 use* and (*total*) *dwell time* for reading the *low-quality* and *high-quality translation (TT)* – a moderated mediation model.

When the participants read the LQ TT, their *L2 proficiency* served as a mediator in the relationship between their *years of L2 use* and their *dwell time* invested in reading the text. In this relationship, their number of *years of L2 use* was positively related to their L2 proficiency (b = 0.015, 95 % CI [0.006; 0.025], β = 0.371, p = 0.002), whereas their L2 proficiency was negatively related to their *dwell time* (b = –48.864, 95 % CI [–77.137; –20.591], β = –0.376, p < 0.001). See Figure 4.

The moderated mediation analysis reveals that in the mediation model *(years of L2 use – L2 proficiency – number of runs)* translation quality moderates the relationship between *years of L2 use* and *number of runs* (b = –1.552, 95 % CI [–2.796; –0.308], β = –0.296, p = 0.015). Again, the indirect effect for the tested mediation model emerges as significant only for the LQ TT (b = –0.301, 95 % CI [–0.596; –0.006], β = –0.112, p = 0.046). When the participants read the LQ TT, their *L2 proficiency* mediates the relationship between their *number of years they use L2* and their *number of runs* they produced when reading the text. Moreover, *the number of years of L2 use* is positively related to L2 proficiency (b = 0.015, 95 % CI [0.006; 0.025], β = 0.371, p = 0.002), whereas their L2 proficiency is negatively related to the *number of runs* (b = –19.963, 95 % CI [–34.949; –4.976], β = –0.301, p = 0.009). In the case of the HQ TT, the investigated indirect effect was not statistically significant (p = 0.912). See Figure 5.

To further corroborate the answer to the research question.

Does the mediation relationship *L2 years of use – L2 proficiency – late-stage processing measures* differ depending on translation quality?

In the third step, the moderated mediation analysis for *re-reading dwell time* was performed. In line with the findings for the *number of runs,* the analysis reveals that in the mediation model *(years of L2 use – L2 proficiency – re-reading dwell time),*

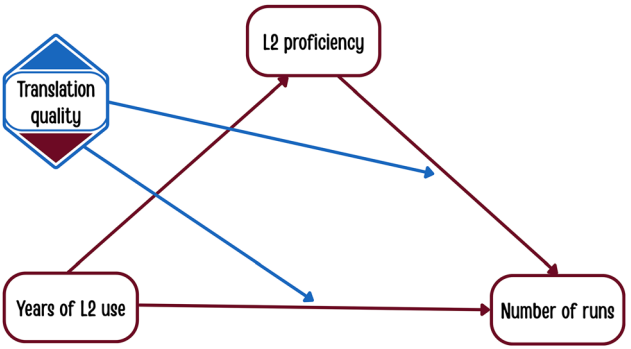

Figure 5: *L2 proficiency* as a mediator in the relationship between *years of L2 use* and *numbers of runs* for reading the *low-quality* and *high-quality translation (TT)* – a moderated mediation model.

translation quality moderates the relationship between *the number of years of L2 use* and *re-reading dwell time* (b = –2.553, 95% CI [–4.822; –0.284], β = –0.259, p = 0.027). Likewise, the observed indirect effect for the mediation relationship is significant for reading the LQ TT only (b = –0.647, 95% CI [–1.227; –0.067], β = –0.126, p = 0.029), not for the HQ TT (p = 0.983). In this model, the number of participants' *years of L2 use* was positively related to their *L2 proficiency* (b = 0.015, 95% CI [0.006; 0.025], β = 0.371, p = 0.002). Their L2 proficiency, on the other hand, was negatively related to their dwell time they invested in re-reading the text (b = –42.943, 95% CI [–70.270; –15.615], β = –0.340, p = 0.002).

4 Discussion

Moving from "translator-centredness" to "reader-centredness" (Gengshen 2004) in CTIS underscores that the translation process, or the mediated communication process (Halverson and Muñoz Martín 2020) does not end with the revision phase. It rather extends into *the translation reception phase,* in which the spotlight is shifted to the reader. The very possibility of testing the effectiveness of the translator's keystrokes and pauses with the readers' eye movements opens up another door to translation quality evaluation. Tracing the potential effects of the translated work on the reading process and readers entails examining their text comprehension, emotional response to text content, narrative engagement, or their cognitive effort involved in text processing. In this contribution, the focus is on the latter, with an assumption that cognitive effort of the translator, translation quality, and individual reader's background may 'shine through' in the reading process.

The LME analyses performed on eye-movement data recorded for reading a TT revealed a more complex interplay of the investigated factors. A significant interaction effect of translator's effort and translation quality was found for all three eyetracking measures taken to reflect cognitive effort. On the whole, readers' *dwell time, number of runs,* and *re-reading dwell time* were higher for reading the low-quality than high-quality translation (LQ > HQ) but only for the sentences into which the translators put low effort.

These results extend Whyatt et al.'s (2023) preliminary findings. With a smaller sample size allowing for a less robust statistical model, they observed that translation quality (and not necessarily translator's effort) affects readers' cognitive effort captured at a text level. Yet, their additional correlation analyses confirmed that translator's effort is negatively related (weak effect size) to the reader's effort only in the LQ TT condition. Whyatt et al.'s (2023) conclude that the relationship between the translator's production effort and reader's reception effort is not straightforward, and point to a more complex interplay between the examined variables that needs to be further investigated.

As reported here, this complex interplay emerges in the form of significant interaction effects between translator's effort and translation quality. Tested with more participants and alongside reader-related factors, *translator's cognitive effort* emerges as a significant factor when analysed through the prism of *translation quality:* the readers of LQ TT dwelled more on the text and revisited it more frequently when the translator's effort was low. Altogether, it seems that when reading the text of low quality, the readers show more processing difficulty when parsing sentences to which the translator devoted little time – the sentences translated with low time and therefore potentially low diligence were most effortful to process for the readers of the LQ text (evidenced by all three eyetracking measures).

Interestingly, when the participants read high-quality translation, they spent more time dwelling on sentences into which the translator invested high effort. At the same time, the sentences into which both translators put more effort, turned out to be more effortful to read when they were part of the HQ than LQ TT (as indexed by *re-reading dwell time*). Perhaps high-quality sentences translated with extra cognitive effort by the experienced professional translator were processed with more difficulty by the readers, because – compared to the corresponding target sentences in the LQ TT – their syntactic structure in Polish was denser and more complex (which holds especially for the second sentence in the TT). It may appear that the HQ translator refined some of the sentences too much, which overall lead to higher reader effort. In the case of these sentences, the invested higher translator's effort does not facilitate parsing for the readers, which also points to the importance of text-specific features.

The present contribution also tested whether reader-related factors, alongside the translator- and quality-related factors, are related to cognitive effort invested by the readers into reading the whole-text translation. Translation quality was observed to be a significant moderator of the mediation relationship *(L2 years of use – L2 proficiency – cognitive effort proxies)* for all three tested variables *(dwell time, number of runs, re-reading dwell time).* The investigated mediation relationship changes relative to translation quality. L2 proficiency (the proficiency in the language of the source text: English) was also found to mediate the relationship between the number of years of L2 use and the reader's effort (reflected in *dwell time*) depending on the translation quality. In fact, it emerged as a significant mediator only when the participants were reading the low-quality translation.

It therefore seems that *proficiency in the language of the ST* (readers' L2) has a facilitating effect on reading texts that contain errors and inaccuracies – it lowers readers' processing effort. With more years of L2 use, L2 proficiency increases, and higher L2 proficiency lowers the participants dwell time spent on reading the LQ TT. Its higher levels are related to lower cognitive effort involved only in reading texts riddled with errors, inaccuracies and other features of low-quality translation. The mediating effect of L2 proficiency on the readers' cognitive effort is corroborated in the analyses of the two late-stage measures: *number of runs* and *re-reading time*. Participants with higher proficiency in the language of the ST read the low-quality text with less effort. Higher L2 proficiency is also linked to more years of L2 use.

The readers participating in the eye-movement experiment were highly proficient users of English (their L2 and the ST language), with only nuanced differences in L2 proficiency. L2 proficiency effects, however, came to surface when they were challenged with a more strenuous task: reading a low-quality translation as if their proficiency in the source language helped them to see the intended meaning due to cross-language activation.

Just as stories can be mediated by narrators, the process of reading a TT will proceed with a ghostly presence of the translator. High degrees of translation expertise, developed over years of practice, help to navigate the translation challenges without compromising the quality of the end product. In this study, the experienced professional translator (25 years of professional practice) produced a high-quality translation. The considerably less experienced professional translator (3 years in the professional market) produced a text that required 17 corrections in total to make it publishable. Studies exploring the intersection of *translation expertise* and *cognitive effort* show that levels of translation expertise modulate the amount of cognitive resources allocated during a translation task (see Muñoz Martín 2014). However, as evidenced by shorter time devoted to translation and poor translation quality, the English→Polish translation task was most probably beyond the capacity of the less experienced translator, who seems not to have put due

diligence into the task, and – consequently – the TT reading task became more of a battleground for the readers.

The process of reading a translation (TT) appears to be constantly shaped by an intricate bidirectional interaction between the TT (produced by the translator) and the reader. It is a top-down process, which readers enter with their language proficiencies, reading skills and habits, and expectations, to name but a few. At the same time, it is a bottom-up process in which the readers receive the translation and respond to it (e.g., behaviourally, physiologically). The features of the translation may all affect the reading process, text comprehension, and interpretation. On this view, the reader's cognitive effort (modulated in a top-down manner through the prism of their individual differences) is modulated by the translator's bottom-up (affected by the features of the ST) and top-down processing during the TT production (shaped by their own expertise, professional experience, and other individual differences).

Insofar as the textual flaws in the translation that impact the reading process result from less optimal linguistic choices made by the translator, the interaction of the top-down and bottom-up processes appears even more inter-dependent and convoluted. Though a challenging task, integrating translation process, product, and reception of the translated text may thus afford a more comprehensive understanding of how the translator's cognitive effort and the quality of translation interact to shape the reader's cognitive effort involved in reading the translated text. Recognising that individual contributions of the factors discussed in the introductory part, which oftentimes remain challenging to isolate and control in the complex interplay, is an important step in CTIS research.

While this study offers a combined approach to looking at translation process, product, and reception data, several limitations must be acknowledged to guide future research. Firstly, the conscious reading-for-comprehension task, while ensuring careful reading, may not fully capture the natural reading behaviours that occur in real-world settings where translated texts are encountered and read (e.g., skimming for information, reading for pleasure; see Ho & Tsai, this volume). Additionally, participants were aware that their eye movements were being tracked. As a result, the generalisability of the findings reported in the present study to all reading scenarios is limited.

Secondly, the design of the reported study relied on the translations produced by only two professional (bidirectional) translators. Their translations represented the high-quality and low-quality conditions. While this allowed for a more detailed (sentence-level) analysis of the interplay between a translator's effort invested into producing a specific target sentence and the resulting reception of that target

sentence, it inherently conflates translation quality with individual translator profiles. Therefore, it is challenging to disentangle whether the effects observed as the reader's cognitive effort were driven by the textual features defining translation quality, translator's cognitive effort, reader's individual background, or by idiosyncratic aspects of the individual translator's style or profile (including experience, L2 proficiency).

Thirdly, it also remains an open question whether the same effects as found in the current study would be observed in a more general population of readers – for instance, with different reading habits, with a wider range of L2 proficiency. The pool of participants in the present study consisted exclusively of university students of English, who were highly proficient L2 users and avid readers in general. Keeping the participant pool homogenous was beneficial for controlling unwanted variability but – at the same time – limited the scope of conclusions and generalisations. The finding that L2 proficiency acted as a mediator between the number of L2 years and readers' cognitive effort but only for the low-quality translation might be specific to this particular demographic of skilled language users. In future studies, it is worth investigating whether the intricate interactions (found with highly proficient L2 users, avid readers) also hold for less specialised readerships.

By combining translation process, translation product, and reception of translated texts, the present contribution highlights a vital constant in an era of automation and rigorous experimental control: the human element. Beyond the advanced technologies, well-controlled experimental settings, and meticulous methodologies, it is the human translator who creates and the human reader who receives. This holistic approach weaving together three essential scopes on translation (process, product, and reception) helps to spotlight the irreplaceable role of the reader.

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