Lexical Recoding via Bilingual Memory in Sight Interpreting: A Combined Eye-tracking and Corpus-assisted Study

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This paper reports the results of a triangulated study that combined eye-tracking and corpus-assisted methods on lexical recoding via bilingual memory in sight interpreting of cultural specificity (CF) from English (L2) into Chinese (L1) by student interpreters. The results show that the patterns of eye-tracking and those of the experimental corpus both indicate that CF causes processing load to increase lexical recoding, and the fact that the two patterns converge on one another implies that lexical recoding relies also crucially on bilingual memory. Moreover, we argue that a theoretical element should be an integral part of triangulation. To a larger extent the theory may reflect the underlying bilingual-processing process for translating and interpreting, the more feasible it is in offering a unified account for experimental as well as corpus-extracted data patterns. Further research is needed.

Keywords: eye-tracking and corpus-assisted interpreting study, sight interpreting, lexical pairing via memory, translating-interpreting as bilingual processing

1. Introduction

As is well-known, triangulation is applied in marine or land navigation as a practical way of converging two bearings (usually taken from two different points) on a third point (stationary or moving). It was introduced in social sciences research where it simply means application of two or more methodologies to the same case study (see the review by Jakobsen 1999). This is also how it was introduced in translation process research (TPR) by Jakobsen (1999) who tried to combine the key-logging method and think-aloud protocols (TAPs) and compare data from both sources to infer how information might have been processed while a translation task was accomplished. His original point and insight was that in order to conduct TPR successfully, theoretical hypotheses needed to be tested by combining the analyses of quantitative data (e.g., of key-logging) and qualitative data (e.g., of TAPs) harvested from the same translational event (Jakobsen 1999: 19). Or reversely, different types of data about the same translational event need to be uniformly accountable to a theory of sufficient explanatory adequacy.

Although the call for applying multi-methodological approaches to TPR was echoed by other researchers, as in Shreve and Angelone (2010: 6) who remarked: "Triangulation is the use of two or more data acquisition methodologies within a single study to improve the quality, validity, and reliability of research findings … [and it] has come to be regarded as a desirable 'best practice' in process-oriented research," the original insight of Jakobsen appears to have been lost. From previous studies we may see that, firstly, "triangulation" was used more as a metaphor rather than a logically formulated and strictly applied approach (see Alves 2003: vii; and his edited volume 2003); secondly, when applying different data acquisition methods, previous studies seemed to lack a coherent theoretical account of sufficient explanatory adequacy for data patterns, as in Hansen (2002) comparing key-logging and experimental corpus data to infer the covert process of production; Angelone (2010) using screen recording and TAPs to compare problem-solving behaviour between professional and student translators; Dragsted (2010) combining key-logging and eye-tracking data to explore how differently professionals and student translators had coordinated source language comprehension and target language production processes; Hvelplund (2011) using eye-tracking, key-logging and retrospective interviews to infer how different translation tasks might have impacted on the way the translator resorted to cognitive sources; Sjørup (2013) using eye-tracking, key-logging and retrospective interviews to infer the cognitive endeavour of a translator rendering metaphors; Jiménez-Crespo (2015) using corpus data and behavioral patterns of online translations by student translators to test the so-called explicitation hypothesis in translation. Although those studies claimed to have applied triangulation, none had conformed to a coherent methodological and theoretical framework. Moreover, as far as we are aware of, there has been no application of triangulation to interpreting studies.

For those reasons and with Jakobsen's (1999) initial legacy in mind, we have initiated the current study. It includes two fresh points. Firstly, we propose a formal triangulation approach which includes three elements: an experiment, an experimental corpus built with the target (oral or written) deliveries produced by the participants during the experiment, and a bilingual processing theory that accounts for experimental and corpus patterns respectively as well as in a correlated manner, as visualized in Figure 1. Secondly, we propose that the theory should specifically target the underlying neurocognitive processes of translating and interpreting as bilingual processing at the brain level rather than as a general metaphysical and/or metalinguistic process (e.g., the Relevance Theory used in Alves and Gonçalves 2003, 2013 and in Alves and Magalhães 2004). As a result, it should be sufficiently explanatory for all types of data: corpus-assisted textual data, experimental behavioural or electrophysiological data.

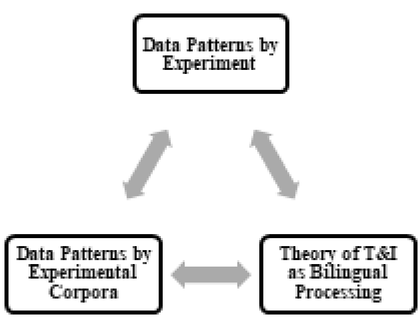


Figure 1. The Modified Triangulation Approach

The methodological niche of the approach is three-fold. Firstly, it combines process-driven and product-driven studies. The former is based on either a behavioural or an electrophysiological study by experimental methods, for instance, eye-tracking or key-logging for behavioural studies and fMRI, fNIRCWS, EEG and PET for electrophysiological studies. The latter is based on a textual-pattern study using bilingual parallel experimental corpora. Secondly, the participants in an experiment are unaware of any descriptively-identifiable translating or interpreting strategy patterns they have formulated when producing the target output (oral or written) during the experiment. Therefore, a comparison between the experimental data patterns and the strategy patterns descriptively extracted from the corpus (built with the experimental output) may further affirm the validity of the former and help infer the underlying neurocognitive processes when the participants produce the target output. Thirdly, as stated earlier, it aims to offer a unified theoretical account for process-driven (experimental) data as well as product-driven (corpus) data.

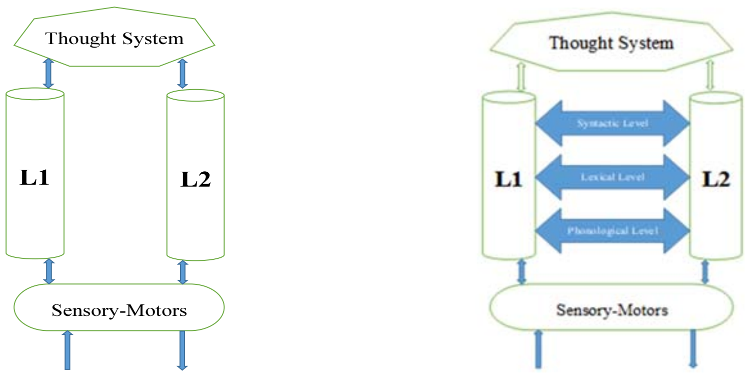
In this context, the theory is feasible only if it may explain: (a) the participants' behavioural patterns via, e.g., eye-tracking or key-logging; (b) their neuroimaging patterns (or neural activation patterns) when electrophysiological methods are used; (c) their translating or interpreting strategy patterns via experimental corpora; (d) the (a)/(b) type and the (c) type of data patterns in a correlated manner. For this purpose, the more focused the theory is tuned on the underlying neurocognitive processes of translating and interpreting as bilingual processing, to a larger extent it is able to correlate behavioural or electrophysiological patterns to corpus patterns and, with the support of the joint data patterns, enables us to reasonably understand the underlying neurocognitive processes themselves.

Methodologically, both methods of data acquisition in triangulation can be experimental, or say that the corpus part is replaceable by another type of experiment. Moreover, any theory accountable for neuroimaging (or neural activation) patterns need to have a neurological and pathological element in addition to the self-contained theoretical framework. Those issues have been discussed separately elsewhere (e.g., Diamond and Shreve 2010; Moser-Mercer 2010; De Groot 2011; García 2013; Tymozcko 2012, 2016; He and Li 2015; He 2016, 2017) and have wider ramifications and are beyond our immediate concerns here. For the current study, we applied eye-tracking and corpus-assisted studies only.

In the following, we will report a triangulated study (as prescribed in Figure 1) on lexical recoding via bilingual memory in sight interpreting from English (L2) into Chinese (L1) by student interpreters. We will first outline the bilingual processing theory of translating and interpreting; we will then present the results of the eye-tracking experiment and the related experimental interpreting-corpus patterns; finally we will offer a unified theoretical account for those results and patterns and briefly discuss their implications.

2. Translating and Interpreting as Bilingual Processing

The theory of "translating and interpreting as bilingual processing" has been developed over the past two and half decades. The prototype was formulated in Paradis (1994) and revised by others (see De Groot, 1997: 29-32; 2011: 319-321; Christoffels and De Groot, 2005: 460; He and Li, 2015; He, 2017). The framework we present below is based on He (2017). In brief, translating and interpreting are special cases of bilingual processing at the brain level. "Special" refers to the nature and properties of translating and interpreting essentially being interlingual reformation, i.e., the source input in L1 (or L2) is recoded as the target output in L2 (or L1). Such a process is via two major routes: conceptually-mediated and interlingual routes: as visualized in Figure 2:



Conceptually-mediated Route   Interlingual Routes

Figure 2. Interlingual Reformation Routes

In principle, speech production and perception are subserved by three systems: (a) Thought System (also known as the Conceptual-Intentional System) which internalizes the speaker's thoughts about the world; (b) Language Faculty which computes the speaker's thoughts (with the help of a mental lexicon embedded in memory) into outgoing speeches and parses incoming ones; (c) Sensory-Motors (also known as the Articulatory-Perceptual System) which verbalizes outgoing speeches and identifies incoming ones via sounds, writing or signs (see Berwick et al., 2013; Friederici et al., 2017). For a bilingual speaker, each of the above three subsystems contains relevant and necessary content of L1 and L2.

In translating and interpreting, the source input is picked up by sensory-motors and parsed by the L1/L2 system. At this point, if the semantic-pragmatic content of the parsed input goes to the Thought System and is conceptually mediated there before it is recoded by the L2/L1 system as the target output, the Thought System becomes the conceptual mediator between the input and the output. Or, if the linguistic content (phonological, lexical or syntactic) goes directly to the target language system (L2 or L1, depending on the input) and is recoded there, the Thought System is bypassed and the recoding is via an interlingual route at the phonological, lexical or syntactic level. As visualized in Figure 2, while the conceptually mediated route looks like going bottom-up and then top-down, the interlingual routes are in contrast between the two language systems. Thus, the former is dubbed as vertical translation and the latter horizontal translation (De Groot, 1997: 29-32; 2011: 319-321).

According to Paradis (1994) and De Groot (2011: 320), while all bilinguals (young children and trained or untrained adults) deploy conceptual mediation as a priori when translating or interpreting, the interlingual routes are deployed much more frequently by professional translators and interpreters and are thus considered to be of a “translating-interpreting-specific” property, which pathologically means forming neural circuits for direct interlingual reformation after a long time of patterned translating-interpreting behaviour by the bilingual speaker reaches its critical mass. For the current study, we are concerned only with lexical recoding. At this level, words are by definition memory items and L1→L2 or L2→L1 recoding mean bilingual lexical pairing in Mental Lexicon. But the so-called “pairing” does not mean that a pair of L1→L2/L2→L1 words is stored as an inseparable unit, but rather it means that while the words are stored as individual items, there is such a low threshold of activation when one of them presents itself as the source word that it will simultaneously activate the other as the target word. According to one study, it takes 200ms for the brain “to distinguish translation direction [L1-L2 or L2-L1]” and around 300ms to activate meaning after target onset (Christoffels et al. 2013: 659). As such, lexical recoding via bilingual memory bypasses the Thought System as well as structure-oriented computation (required for phonological or syntactic processing) altogether and relieves pressure from time- and load-constraint in interpreting more than in written translation. Experimental evidence shows that beginner-translators improved task performance compared with non-translators, suggesting a neural circuiting change in translation-trained bilinguals (García et al. 2014; García 2015).[1)]

1) Although no study has been done so far on exactly how long it takes for memory recoding to happen, it could be tested out experimentally. Different stimulus sets could be built with different levels of “equivalence strength” between L1-L2 pairs, and their prominence/frequency of appearance in translating/interpreting could be measured in the ensuing target products (Adolfo García, personal communication).

3. The Eye-tracking Experiment and the Experimental Corpus

The goal is to investigate how student-interpreters with an average of 2.07-years' translation-interpreting training perform in lexical recoding via bilingual memory in sight-interpreting in an eye-tracking experimental environment. The performance is not set on a comparison with untrained bilinguals or with professional interpreters but rather on the content of the task itself. The task is for the participants to interpret an audio input of a 151-word length in natural (non-manipulated) English (L1) into Mandarin Chinese (L2) while looking at the script appearing on the screen at the same time. The content of the input contains both cultural and non-cultural specificity at the lexical level, alias culture- and non-culture-specific items (henceforth CSIs and non-CSIs). Experimentally, we wish to find out if there are any differences in the eye movement patterns between interpreting CSIs and non-CSIs.

In addition, the participants' target audio output is transcribed and built with the source script into a parallel experimental corpus from which the interpreting strategies (subconsciously) deployed by the participants are descriptively extracted. Descriptively, we wish to find out if there are any differences in the strategy patterns between interpreting CSIs and non-CSIs.

Furthermore, by comparing the eye movement patterns and the corpus-extracted strategy patterns, both statistically averaged out of the output by individual participants, we infer the underlying neurocognitive processes of the sight-interpreting in question within the theoretical framework presented in Section 2.

3.1 The Eye-tracking Experiment

The experiment included a preparation, a warm-up and a formal session. There was no interval in between. The experiment was run on one participant at a time and continuously for seven days (till all participants were available and faulty experimental processes were excluded).

Participants: 15 postgraduate students of translation studies (12 females and 3 males) with similar L2 competence and educational background, all late bilinguals with Mandarin Chinese as L1 and English as L2; average age: 25.4 (SD=1.7); average years of interpreting training received: 2.07 (SD=0.7).

Equipment: Tobii TX300 Eye Tracker; the participant sat at in a fixed chair, seated 55-65cm from the eye tracker and wearing a pair of earphones to receive the audio input; a pen-shaped microphone was positioned invisible to the participant to record his/her interpreting output; the same source of artificial light was on throughout the experiment, maintaining the level of light at 400-420lux.

Task: To simultaneously sight-interpret a 70sec-long audio input of an English speech into Mandarin Chinese;

Stimuli (for the formal session):

1. Audio: 70sec-long audio input by earphones of an English speech by a British adult male at approximately 130 words per min;
2. Visual: picture-framed on-screen English script (151 words, Tahoma font 17, double spacing); background (white); pixel 1100 *775;
3. Special feature: 8 lexical CSIs; 8 lexical non-CSIs;
4. Nonrandom selection of CSIs and non-CSIs against the total numbers of words of the script, but with no significant difference detected between CSIs and non-CSIs in terms of frequency ($p=1>0.05$), familiarity ($p=0.69>0.05$) or orthographic length ($p=0.90>0.05$).

Procedure:

1. Preparation: the participant entered the lab and was given an A4 size print-out of an English script in a picture-frame (151 words, Tahoma font 17, double spacing), the same as to appear on the screen in the formal session; he/she had 10min to prepare for the eye-tracking sessions that followed, including accessing (if needed) online references and dictionaries to comprehend the script and practice sight-interpreting it in free-seating position away from the eye-tracker;
2. Warm-up: the participant sat at in front of the eye tracker and listened to a 30sec-long audio input of an English speech by an adult male with the British accent at approximately 130 words per min while the script

(different from that for the preparation and thus new to the participant) was shown on the screen; the participant simultaneously sight-interpreted the speech; the gazing position, the audio input volume, etc. were adjusted where necessary;

3. Formal session: the participant listened to a 70sec-long audio input of an English speech by the same British male while the script (same as the one for the preparation) was shown on the screen; he/she simultaneously sight-interpreted the speech;
4. Follow-up interview: asking the participant if and where he/she felt it was difficult to interpret the speech in the formal session (we return to this in Section 4).

The current study used gaze sample to fixation percentage (GFP) as a criterion for evaluating the quality of eye-tracking data and only included the data from interpreters whose GFP scores was equal to or higher than 80%. A sample of gaze plot from a qualified participant is shown in Figure 3:

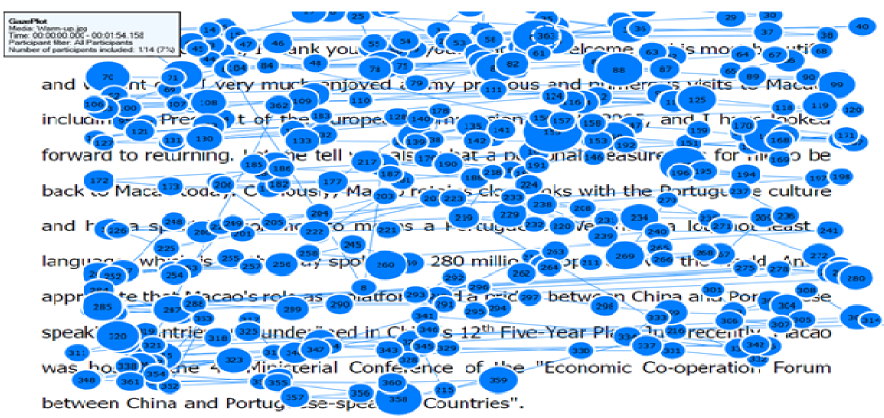


Figure 3. Sample of Gaze Plot

The distribution of first fixation duration (FFD) is shown in Figure 4 where CSI (mean) = 3.02s (SD=0.65) and non-CSI (mean) = 2.74s (SD=0.57):

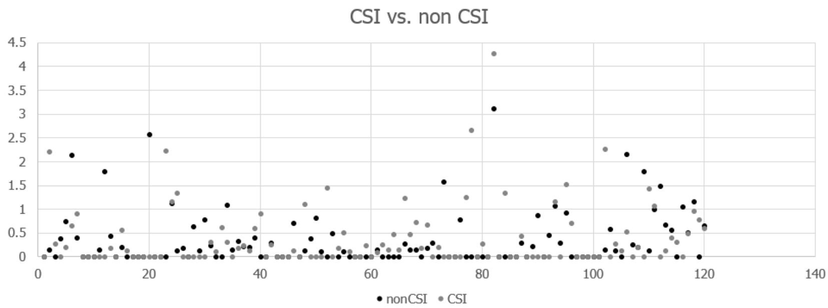


Figure 4. First Fixation Duration (FFD)

The total fixation duration (TFD) is shown in Figure 5 where CSI (mean) = 5.11s (SD=1.00) and non-CSI (mean) = 4.09s (SD=0.88):

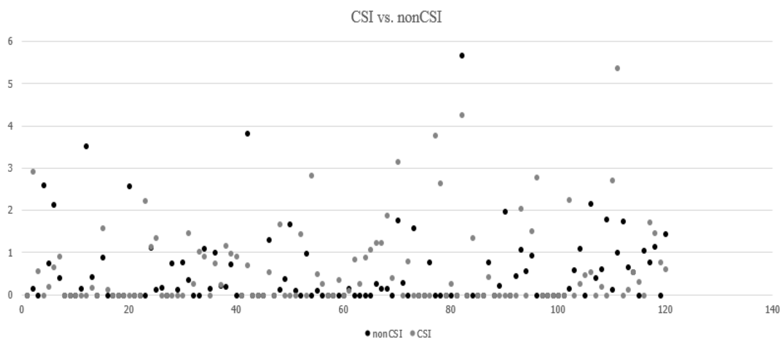


Figure 5. Total Fixation Duration (TFD)

The total fixation count (TFC) is shown in Figure 6 where CSI (mean) = 8.53 (SD=1.43) and non-CSI (mean) = 6.33 (SD=0.94):

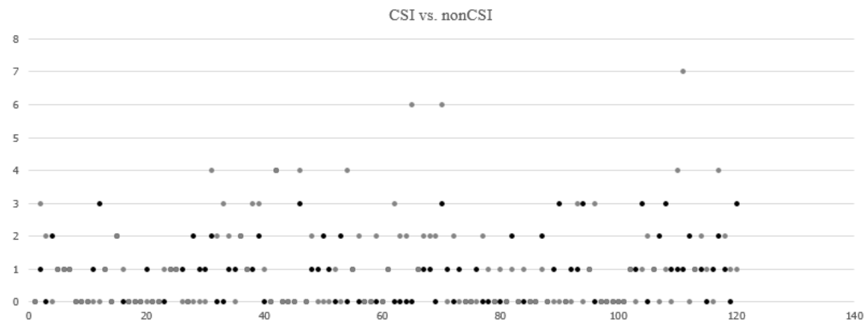


Figure 6. Total Fixation Count (TFC)

A two-tailed paired-sample t-test was conducted with the results shown in Table 1:

Table 1. FFD, TFD and TFC of CSIs and Non-CSIs

	First Fixation Duration		Total Fixation Duration		Total Fixation Count	
	mean	SD	mean	SD	mean	SD
CSI	3.02	0.65	5.11	1.00	8.53	1.43
Non-CSI	2.74	0.57	4.09	0.88	6.33	0.94
p-value	0.613		0.249		0.053	

The differences between CSIs and non-CSIs in terms of FFD and TFD do not appear to be significant (*$p<0.05$, **$p<0.01$), except for the TFC where p-value was 0.053, slightly higher than *$p<0.05$ but far lower than *$p<0.1$ (a level of practical reference for a very small sample size like ours).[2)]

3.2 The Experimental Corpus

The participants' audio output was recorded and transcribed verbatim as 15 target deliveries. A small-scale bilingual parallel multi-interpreting corpus was constructed[3)] with the source

2) As is well-known, p value is affected by the sample size. When $p>0.05$ but <0.1, it might be indicative of some significance in explanatory experiments with very small sampling in case studies.

3) In sight-interpreting (or script-aided simultaneous interpreting), the audio input, not the script, is the

script systematically segmented and aligned with the target texts[4], as shown in Figures 7-8:

Figure 7. Part 1 of Bilingual Parallel Multi-interpreting Corpus

Figure 8. Part 2 of Bilingual Parallel Multi-interpreting Corpus

major source because it compels the interpreter to follow its speed while delivering the oral target output. When the oral output is transcribed verbatim into a text and built into a parallel corpus with the source script, the text-based corpus is also called a translational corpus. For non-scripted simultaneous interpreting, both the audio input and the oral output are often than not transcribed for research purposes. In fact, interpreting corpora in the sense of audio input vis-a-vis oral output are rare and technically difficult to make use of, as far as we are aware of.

4) Textual sentences punctuated by period, semi-colon, colon, exclamation mark, question mark, dash and ecliptic mark in the source text are segmented and then aligned up with the target text(s) (cf. He 2010).

8 lexical metaphors (= CSIs) and 8 literal words (= non-CSIs) in the source script (as shown in Table 2) vis-a-vis their translating strategies in the target texts were manually tagged. The total number of instances of translating 8 CSIs or non-CSIs respectively by 15 participants is 120. Descriptively, only three strategies, i.e., paraphrasing, omission and lexical pairing (also known as *lexical transcoding* or more traditionally called *literal translation* whereby a source word is transcoded into its target equivalent) were identified for the current study (though the number may vary in other studies). A sample of concordance search is given in Figure 9 and the translating-strategy patterns were established by searching the self-supporting corpus, as shown in Table 3 ($^{*}p<0.1$, $^{**}p<0.01$):

Table 2. List of CSIs and Non-CSIs

8 CSIs (=words used as lexical metaphors)	bridge, gracious, host, links, platform, resonance, underlined, vibrant
8 non-CSIs (=words used with literal meanings)	city, European, forum, ministerial, numerous, retains, returning, welcome

Figure 9. Sample of Concordance Search

Table 3. Interpreting-strategy Patterns

	CSIs	Non-CSIs	Mean
Paraphrasing	34/28.33%	34/28.33%	68/28.33%
	E.g. underlined→裡面寫的/被列入了/一個重點 (back-translation: written in it/was listed in/ a priority)	E.g. return→ 故地重遊/回來澳門/回來這裡 (back-translation: visited the old haunt/returned to Macao/came back here)	
Lexical Pairing	66/55.00%	77/64.17%	143/59.59%
	E.g. bridge→橋樑(=bridge)	E.g. city→城市(=city)	
Omission	20/16.67%	9/7.50%	29/12.08%
	E.g. resonance→Ø(=no output)	E.g. forum→Ø(=no output)	
Total	120 /100%		240/100%
p-value	0.08		

The gap between the two patterns by Chi-square test ($p=0.08$) is higher than the usual *$p<0.05$ but still quite lower than *$p<0.1$ (a level of practical reference once again for a very small sample like ours).

Theoretically, we also assume that the descriptively-identified interpreting strategies in the target texts (as shown in the above Table 3) are correlated to the relevant bilingual processing routes (as presented in Section 2) in such a way as shown in Table 4 below. Such theoretical assumptions are vital because the bilingual processing at the brain level does not "recognize" or operate in terms of what we may descriptively identify as textual strategies.

Table 4. Bilingual Processing Routes Correlated to Descriptive Strategies

Neurocognitive		**Descriptive**
Conceptually-mediated Route		Paraphrasing
		Substitution
		Omission
		Etc.
Interlingual Routes	Lexical Recoding via Bilingual Memory	Lexical Pairing/Transcoding
	Syntactic Recoding via Structural Cues	Phrasal/Clausal Transcoding
	Phonological Recoding via Acoustic Cues	Transliteration

4. Discussion

The major findings of the experiment are as follows: two expected differences were observed regarding the eye-tracking and the experimental corpus patterns. First, the eye-tracking patterns show that the FFD, the TFD and the TFC of CSIs are higher than those of non-CSIs, with the gaps in between respectively at 0.28s, 1.02s and 2.20. Second, the corpus patterns show that lexically paired CSIs are (9.17%) lower than those of non-CSIs, with the totals of 55% vs. 64.17% (mean=59.59%). On the other hand, adopting *p=0.1 as the reference for small sampling like ours, only the gap in the TFC (p=0.053) might be statistically meaningful, as stated earlier, while the gap between the corpus patterns (p=0.08) suggests much less statistical significance.

Even so, the eye-tracking patterns in terms of TFC still indicate an increased processing load for CSIs over non-CSIs, suggesting that CSI-processing requires more neurocognitive resources than non-CSI content. In other words, non-CSIs were more easily paired up in lexical recoding than CSIs. This is supported to certain extent by the fact that lexically paired CSIs are (9.17%) lower than those of non-CSIs in the corpus patterns. In this sense, the eye-tracking and the corpus pattern converge on one another. Also, the mean of lexical pairing of CSIs and non-CSIs (at 59.59%) is high enough to imply that both can be paired up to a significant extent in sight-interpreting in an experimental environment.

Theoretically, the high level of averaged lexical pairing in the target output of the current study could be attributed to several factors: (a) it was sight-interpreting (i.e., script-aided simultaneous interpreting) in an experimental environment where the level of lexical pairing was presumably higher than otherwise; (b) it was very small sampling (only 8 items of each category, CSI and non-CSI) and there was a preparation session, hence (long-term and working) memory might have played a major role; namely, if the participants had already remembered the words, it was not difficult to retrieve them for recoding during the experiment; (c) lexical CSIs were found more likely to be omitted than non-CSIs, implying that if not stored as memory items, CSIs had to be conceptually mediated before recoded and this process would have increased processing load and might have resulted in non-verbalization (i.e., omission) in time-constrained simultaneous interpreting. This is supported further by two facts. Firstly, although aided by the screen-script, the interpreting was of a simultaneous nature and the participant had to keep pace with the audio input and deliver the vocal output within 75sec or less. Thus, under the circumstances that lexical pairing via memory was unavailable and conceptual mediation meant more processing load for recoding, non-verbalization became an economical option for output under time-constraint. Secondly, in the follow-up (retrospective) interviews in which we asked the participants specifically how they felt about interpreting the words which we listed as CSIs in Table 2 but without telling them what CSIs were, 12 participants could not recall how they had interpreted the words. This could be interpreted as either the words were not special to them in any way or the participants were subconscious of lexical pairing via memory. Either way, it affirms the high mean of pairing. 3 participants (2 females and 1 male) did say that they did not know how to interpret at two places which were “hard” or “difficult” and that there was “not enough time”, suggesting that non-verbalization did result from costly conceptual mediation under time-constraint.

Further implications can be drawn from comparing the current findings with previous studies, empirical and theoretical. Firstly, the current findings (lexical CSI pairing: 55.00%; omissions: 16.67%; Table 3) are similar to the performance by professional interpreters in real simultaneous interpreting situations. For instance, the study of simultaneous interpreting by professional interpreters (L2-L1 [E-C] and L1-L2 [C-E]) by Lang (2017) using larger corpora shows that lexical CSI pairing was of 59.18% (mean of 3 interpreters in both directions) with omission of 29.83% (mean of 3 interpreters in both directions).[5] While the pairing rates are similar, the omission variations might be due to the sample sizes and the difference between real and experimental environments, assuming that the real on-site interpreter is interpreting a longer speech and therefore under tighter time-constraint and therefore

5) Corpora sizes are 80,000-words and above for interpreting and 500,000-words and above for written translation.

(subconsciously) more pressure on organizing neurocognitive resources.

Secondly, while the current study and Lang (2017) both found a relatively high lexical pairing of CSIs in interpreting, other corpus-assisted studies on written translation of both L2-L1 (E-C) and L1-L2 (C-E) directions found a lower lexical pairing than syntactic transcoding (e.g., He, 2004, 2009, 2010, 2011; Ge, 2014; Chou et al., 2016; Hou, 2017; Huang, 2018). In Lang (2017), phrasal transcoding was only 6.43% (mean) and that there was no clausal transcoding. In contrast, the study of multiple C-E translations of both L2-L1 and L1-L2 directions by Hou (2017) shows that lexical pairing of CSIs was of 27.92% (mean) and phrasal and clausal transcoding were of 38.77% (mean) and of 37.22% (mean) respectively. Although the current study did not test on syntactic transcoding, its findings still fit in two theoretical assumptions: (a) syntactic transcoding applies much more in written translation than in interpreting (De Groot, 1997: 31); (b) lexical pairing via bilingual memory works to the advantage of the interpreter but not syntactic transcoding (He, 2017).

Thirdly, the current findings that implicate an increased neurocognitive load at the brain level when processing CSIs are echoed also by other experimental studies on interpreting or translating metaphors. In one study on the so-called "sight translation" in which the participants interpreted an English (L2) script on the screen into Chinese (L1) without audio input or eye-tracking and in which the length of time on completing the task and descriptive criteria for assessing the quality of interpreting were used as indicators, it was concluded that "sight-translating" metaphors was cognitively more costly than non-metaphors (cf. Zheng and Xiang, 2013). Similar conclusions also reached in a combined eye-tracking and key-logging study on translating metaphors form English (L2) into Danish (L1), with a differentiation between comprehension and production phase during the translating process in which, while comprehension of metaphors was not necessarily cognitively more effortful than of non-metaphors, production certain was (cf. Sjørup, 2013). Qualitatively speaking, those studies seem to be in agreement with the current findings on L2-L1 sight-interpreting lexical metaphors as well.

5. Conclusion

Returning to designed goal of the experiment, we did find that regarding the eye-tracking patterns, the TFC of CSIs was higher than that of non-CSIs, suggesting an increased processing load at the brain level for CSIs and thus echoing the corpus patterns that lexically paired CSIs were lower than those of non-CSIs. In other words, the eye-tracking and the corpus patterns appear to converge on one another to some extent. On the one hand, the results may imply that it is less costly in neurocognitive terms to process non-CSIs than CSIs and on the other they may also imply that at lexical level, pairing via bilingual memory is potentially an economical recoding route for both categories in sight-interpreting with pre-event preparations. However, the current study was based solely on the performance of student interpreters in an experimental environment with a very small sample size. Although it appears to some extent to echo the performance by professional interpreters in real simultaneous interpreting (such as those studied by Lang 2017), whether it has any wider implications for, e.g., larger samples, different groups of bilinguals, different types of cultural specificity and so on, remains to be verified further.

Methodologically, it is our view once again that a theoretical element is an integral part of the triangulation approach to translating and interpreting process research. It is vital that the theory needs to be sufficiently explanatory to offer a unified account for data patterns of different sources, be it experimental and corpus-assisted. To a larger extent the theory may reflect the underlying neurocognitive processes of translating and interpreting as bilingual processing, the better it may achieve this goal. Further research is needed.

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