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Abstract

Natural output data of professional translating and interpreting are sampled, and the data patterns are examined with reference to the interlingual-systems theory of bilingual reformation. Asymmetrical performances were found in favor of forward direction (L1 → L2) across three modes (written translation, consecutive and simultaneous interpreting), particularly when the source input contained conceptual content alien to the target output. This finding complements previous studies where asymmetrical performances were found in favor of backward word translation (L2 → L1) by beginner bilinguals. In either case, the asymmetrical performances suggest that there are interlingual routes between L2 and L1 that are an integral part of neurolinguistic organization of a bilingual’s two languages, and those routes play a crucial role in the reduction of the processing load during translation, albeit in opposite directions and at different stages of L2 maturation.

Keywords: theories of bilingual reformation, translational directionality, L2 balancedness, L2 maturation

1. Introduction

A bilingual who can communicate receptively and productively in L1 and L2 separately can translate between them ([1], p. 320). A professional translator or interpreter on a job generally translates faster and more accurately than a non-professional. Nevertheless, no matter who translates between whichever languages, translation is not possible without the interlingual reformation process that takes place in the bilingual brain, that is, the input language is first decoded and its content is then recoded in the output language. For this reason, to gain a better understanding of the underlying interlingual reformation process during translation has long been part of psycholinguistic, neurolinguistic and neurocognitive bilingualism research to shed light on L2 acquisition from the translating perspective. How a bilingual performing a translation task has been used also as a tool to assess how balanced her/his L2 is likely to be, compared to L1 (see Section 6).

Laboratory-based investigations, behavioral and neurophysiological, have the advantage of methodological precision as well as the disadvantage of suffering loss of
ecological validity for using single words and artificially edited sentences as the input stimuli and harvesting the output responses under controlled conditions. Although they are perfectly valid in their own right, questions have been asked about how much they represent of what is happening in the brain of professional translators and interpreters on a job [2–4].

The balance as we see it is between methodological precision and ecological validity. An attempt we make to address the issue in this chapter is to apply the cross-tagging methodology to data sampling using bilingual parallel corpora which contain natural texts and oral-deliveries of professional translating and interpreting. Data patterns are formulated and used to assess how balanced the L2 of a professional translator or interpreter is likely to be at the point of delivery (comprehension or production), compared to her/his L1. The assessment results are then used to implicate L2 acquisition in terms of L2 maturation of a bilingual.

We will lay out the methods for data collection and the data patterns after the introduction of theories of interlingual reformulation for translation.

2. Theories of interlingual reformation

The way to go about them is divided into two areas of research. One has to deal with those neurofunctional subsystems that are related directly to language processing, such as mental lexicon and language faculties. The other deals with subsystems that make language processing possible in the first place, such as the conceptual systems (where the speaker internalizes her/his environments by way of conceptualization, intentionalization and contextualization), the sensorimotor systems, the activation-inhibition systems, the executive control systems, and so on.

As said earlier, a gift or instinct of a bilingual is the ability to translate. However, this translational ability may suffer functional deficits (due to conditions or injuries to the brain which we will not discuss here). See Table 1 [5–7].

The so-called paradoxical translation, also known as the fifth type of bilingual aphasia,1 is perhaps the best-known translational deficit that has motivated the theorization of interlingual reformation for translation. A clinical case was first reported in 1982 [8], where an Arabic-French bilingual who had suffered brain

<table>
<thead>
<tr>
<th>Deficits</th>
<th>Linguistic characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inability to translate</td>
<td>Inability to translate from one language into the other</td>
</tr>
<tr>
<td>Translation without comprehension</td>
<td>Translate without understanding what is being translated</td>
</tr>
<tr>
<td>Spontaneous translation</td>
<td>Producing involuntary translations of utterances that they have said or heard</td>
</tr>
<tr>
<td>Paradoxical translation</td>
<td>Able to translate into one language in which they cannot initiate speaking while unable to translate into the other language in which they can initiate speaking. The two situations alternate in irregular time intervals.</td>
</tr>
</tbody>
</table>

Table 1. Translational deficits found in a bilingual.

1 The other four types are: pathological language mixing, selective recovery, sequential recovery and differential recovery ([1], pp. 295–296, 448).
injuries displayed paradoxical translational deficits when comprehension of both languages was normal. Similar clinical cases were reported also in Italian-French and Portuguese-Cantonese bilinguals [9, 10]. A prominent characteristic of paradoxical translation is its double dissociation of neurofunctions ([1], p. 296). Namely, the ability to translate into one language in which the patient cannot initiate speaking while unable to translate into the other language in which she/he can initiate speaking. And the two situations alternate in irregular time intervals. Neurologically, double dissociation is caused by asymmetric impairment of closely related or mirror-imaged neurofunctions ([11, 12], pp. 273-280).

There are two major theories trying to unlock the mystery of paradoxical translation, Michel Paradis’ theory of interlingual systems in 1984 [13] and David Green’s theory of differential inhibitions in 1986 [5, 14, 15].

2.1 Theory of differential inhibitions

Table 2 shows the core of the theory.

It is postulated that inhibition differentiates itself externally and internally. In spontaneous speech in one language, the other language that is not output is inhibited externally, that is, outside the language system itself. On the other hand, when translating, the language that is not output is inhibited internally, that is, within the language system itself. Consequently, when L1 and L2 are asymmetrically inhibited as output of spontaneous speech or translation as a result of inhibition impairment and alternate recovery, paradoxical translation occurs.

2.2 Theory of interlingual systems

Figure 1 outlines the theory. It is re-drawn based on Michael Paradis’ 1984 paper [13] and subsequent studies of his own ([16, 17], pp. 189–190, 225–227). The core of the theory is that within the Language Faculty of a bilingual there are not only L1 and L2 systems but also interlingual systems between them, L1 $\Rightarrow$ L2 and L1 $\Leftarrow$ L2. There are 4 output routes (yellow arrows), 2 from Conceptual Systems to Language Faculty and 2 from Language Faculty to Sensorimotors. Theoretically, Conceptual Systems instruct Language Faculty to construct a linguistic expression in L1 or L2 when the bilingual is stimulated by environments in which she/he is. The

<table>
<thead>
<tr>
<th>External Inhibition</th>
<th>Spontaneous Speech</th>
<th>Internal Inhibition</th>
<th>Translation</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1</td>
<td>L2</td>
<td>L1</td>
<td>L2</td>
</tr>
<tr>
<td>Healthy Bilingual</td>
<td>Normal</td>
<td>$\checkmark$</td>
<td>Normal</td>
</tr>
<tr>
<td>Paradoxical Translation</td>
<td>$+$</td>
<td>$-$</td>
<td>$x$</td>
</tr>
<tr>
<td></td>
<td>$-$</td>
<td>$+$</td>
<td>$\checkmark$</td>
</tr>
</tbody>
</table>

$+$ = inhibition is functional; $x$ = output language is inhibited.
$-$ = inhibition is impaired; $\checkmark$ = output language is not inhibited.

Table 2.
Differential inhibition and Bilingual language functions.

---

2 Some terminologies differ from the initial theory but the theoretical core remains intact.
actual verbalization or utterance of the linguistic expression relies on all 4 output routes being fully functional. We already know that a bilingual suffering from the fifth type of aphasia can produce spontaneous speech in L1 or L2. So, the output routes from Language Faculty to Sensorimotors are presumably in good working order. The problem has to do with the output routes from Conceptual Systems to Language Faculty. If those output routes suffer from asymmetrical impairment and alternate recovery of inhibition functions, due to pathological conditions of, or injuries to, the brain, then the intended expression is verbalized in irregular time intervals, depending on for how long those conditions sustain themselves. Specifically, when spontaneous speech in L1 is blocked due to the output route from Conceptual Systems to Language Faculty being impaired, the interlingual system L1 $\rightarrow$ L2 is still functional, and as a result, translation in the direction of L2 $\rightarrow$ L1 remains to be possible (shown in blue arrows). Likewise, when spontaneous speech in L2 is blocked due to the output route from Conceptual Systems to Language Faculty being impaired, the interlingual system L1 $\Rightarrow$ L2 is still functional, and translation in the direction of L1 $\Rightarrow$ L2 remains to be possible. This therefore results in paradoxical translation.

Crucially, Michel Paradis stipulates that a threshold of neural activation is required for neuronal networks to function properly. When the threshold falls below the level of what is required, it is the state of inhibition ([17], pp. 28–30). Therefore, asymmetrical impairments and alternate recoveries of closely related or mirror-imaged neurofunctions are caused by the activation threshold alternating between self-sustaining and failure, resulting in a functional state of double dissociation ([1], pp. 296, 448). No matter what those closely related or mirror-imaged neurofunctions are, whether they be the external and internal inhibition functions as suggested in the differential-inhibitions theory or the L1 and L2 output routes from the Conceptual
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Systems to Language Faculty as suggested in the interlingual-systems theory, is not our concern. Here, we are concerned only with how a theory may help us better understand the interlingual reformation for translation.

2.3 Two routes of interlingual reformation

It was Michel Paradis himself in 1994 who had first proposed to apply the interlingual-system theory to implicating the interlingual reformation processes in translation [16]. The proposal is refined in his later work, too ([17], pp. 189–190, 225–227). A number of studies have followed this initial lead, all trying to do the same but with different approaches ([1, 18–20], pp. 319–321).

Return to Figure 1. Take forward translation as an example. Two decoding-recoding routes are available for translation. One is L1-decoding $\rightarrow$ Conceptual Systems $\rightarrow$ L2-recoding, and the other L1-decoding $\rightarrow$ interlingual systems $\rightarrow$ L2-recoding. The first route is known as the conceptually mediated route, or mediation for short. The second is known as the transcoding route, or transcoding for short.\footnote{Mediation is known also as vertical translation or meaning-based interlingual transfer, and transcoding as horizontal translation or form-based interlingual transfer [1, 18].} Mediation goes by the conceptual systems that intervene between L1 and L2 systems. It is the most natural way of translating for all bilinguals, especially children and untrained adults ([1], pp. 319–320).

Transcoding on the other hand goes by the interlingual systems and bypasses the conceptual systems. While there is consensus in the field that transcoding does occur in interlingual reformation, there have been different views on the possible reasons behind it ([1], pp. 320–322). An early view is that it happens owing to the translator lacking professionalism and expertise [21]. Later views are exactly the opposite that the ability to subconsciously deploy transcoding is the signature of professionalism and expertise of skilled and experienced professional translating and interpreting ([16, 17, 22], pp. 189–190). The professionals are believed to possess a relatively large stock of well-established translational items in memory and apply them to transcoding ([1], p. 321). Such memory items are activated in pairs, one item as input and the other as output. The more frequently and more recently two items are used in this way, the more likely that they will form a memory pair through the neural learning process of “what fires together wires together” ([23], pp. 62–69; [1], p. 297). Lexical items paired up in this way could be stored in declarative memory and structural items in procedural memory ([17], p. 173–180; [24–26]).

There is also the processing load to consider. The more mental resources a neurofunctional process requires, the higher the processing load of that process. In interlingual reformation, mediation is believed to require more mental resources than transcoding ([1], p. 322). Transcoding then serves as a convenient secondary route (or “short-cut” as Michel Paradis calls it [16]) for the reformation process when the processing load overwhelms the systems due to environmental changes, for example, the translator or interpreter getting tired or stressed [27].

3. Environmental parameters

There are environmental parameters inherent to translation. One of those is directionality. L2 $\rightarrow$ L1 (or backward direction) means that input (or comprehension)
is in L2, and L1 → L2 (or forward direction) means that output (or production) is in L2. Directionality is sensitive to how balanced the translator’s L2 is, compared with her/his L1. We return to this issue later in Section 6.

Another parameter is the type of source message being translated. One type is shared by the source and the target speech community, and another is unique to the source speech community and alien to the target speech community, thus also called alien sources. An example of shared message is “drink some water” for English-Chinese bilingual speakers regardless of the language forms either way. On the other hand, “Three scores and ten is the Bible limit” is each a message unique to the English and the Chinese speech community respectively, or to say, each message is alien to the other speech community. Bilinguals as members of two speech communities presumably have stocks of conceptualized messages of both shared and alien content in memory. There were studies showing that alien content in the source needs more conceptual mediation than shared messages.

Yet another parameter is the mode in which the source is rendered. Is it by written translation, consecutive or simultaneous interpreting? One observable trait between the modes is whether the translator or interpreter has time to revisit the source and for how long. In written translation, the translator usually has time to revisit the source and the time lapse is basically unpredictable from her/him starting to read the source to penning down the target text. The consecutive interpreter revisits the source by taking notes for 10–30s on average before verbalizing the target output. The simultaneous interpreter, who is usually restricted by an ear-voice span of a few seconds, has little chance to revisit the source. There were studies showing that the form of recently encountered grammatical structures in the source language may subconsciously help determine the choice of the same or similar target language grammatical structures.

4. The cross-tagging methodology

Tagging is a technique in corpus linguistics that is used to mark out individual textual units (called Tokens) representative of a selected textual feature (called Type). Different type-token ratios in a text or across texts are used to characterize their linguistic and/or stylistic features. Monolingual corpora containing translated texts were introduced in the 1990s to investigate their unique textual features. Cross-tagging is a technique specifically designed for tagging the source text across its multiple target texts which are aligned in a bilingual parallel corpus. It was initiated in Chinese-English and English-Chinese bilingual parallel corpora in the 2000s. The core notion is that the source tagging will lead to the target tagging but the tagging on each side represents a different type. Tagging on the source side represents a message type (shared or alien) but it represents a type of descriptively-defined translation strategy on the target side (see Tables 3 and 4). Figure 2 illustrates this process (ST = source text; M_Type = message type; TT1/TT2/TT3 = multiple target texts; TS_Type = strategy type).

Cross-tagging enables the researcher to see how the same number of source tokens of a message type differentiates in the ways in which they are rendered across multiple target texts. Or to say, it enables us to see the tangible textual changes in the

---

4 The symbol <> means that the texts of different languages on either side of it are essentially of the same meaning and mutually translatable.
target output vis-à-vis the source input. The rationale is that the translator may not be consciously aware of which strategy is used to translate which source token, and that when different translators render the same source token, they often apply different strategies largely because each translator creates her/his own context in which the rendition occurs. Consequently, different translators translating the same number of source tokens of a message type create different distributions of strategies in their target texts. The researcher’s task is to identify those distributions and use them to implicate the underlying neurocognitive routes of interlingual reformation.

Translation strategies are descriptively defined for their universal nature. They remain unchanged no matter whoever is translating between whichever languages. For the sake of space, we use only Chinese-English (CE) examples to illustrate how relevant strategies are descriptively characterized. See Tables 3 and 4.

<table>
<thead>
<tr>
<th>Token</th>
<th>Source</th>
<th>Strategy</th>
<th>Target</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>CE</td>
<td>Word</td>
<td>Paraphrasing</td>
<td>Swallow a liquid</td>
<td>Rendering the meaning of the source token</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Literal Translation</td>
<td>Drink</td>
<td>Word-to-word rendition</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Omission</td>
<td>No rendition</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Phrase</td>
<td>Paraphrasing</td>
<td>Come on and have some water</td>
<td>Same as above</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Literal Translation</td>
<td>Come and drink a bit of water</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Omission</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3. Strategies for translating shared messages.

<table>
<thead>
<tr>
<th>Token</th>
<th>Source</th>
<th>Strategy</th>
<th>Target</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>CE</td>
<td>Word</td>
<td>Paraphrasing</td>
<td>his words made her uncomfortable</td>
<td>Rendering the meaning of the source token</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Literal translation</td>
<td>his words sting-pained her</td>
<td>Word-to-word rendition</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Substitution</td>
<td>his words pained her</td>
<td>Rendering by similar metaphoric token of the target language</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Omission</td>
<td>No rendition</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Phrase</td>
<td>Paraphrasing</td>
<td>It is rare to live a life of 70 years</td>
<td>Same as above</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Literal Translation</td>
<td>Human life of 70 years is rare since ancient times</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Substitution</td>
<td>Three scores and ten is the Bible limit</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Omission</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4. Strategies for translating alien messages.
Paraphrasing, literal translation and omission are three strategies across the board for translating shared as well as alien messages. In addition, substitution is a strategy that is used only in translating alien messages. The strategy characteristics are self-explanatory in Tables 3 and 4. To exemplify the strategy deployment, the source tokens “喝” (drink) and “来喝点水吧” (come drink some water) convey messages that are shared by both Chinese- and English-speaking communities. In contrast, the source tokens “刺痛” (sting-pain) and “人生七十古来稀” (human life 70 rare ancient since) convey messages unique to the Chinese-speaking communities and hence alien to the English-speaking ones. Regardless, the same Chinese source token (a word or a phrase) can be rendered into different English target versions, or none at all, depending on which strategy is used.

The descriptively-defined translation strategies thus enable us, firstly, to characterize how a target text is rendered in terms of how different strategies are deployed in principle. For instance, in the scope of shared messages, a phrase is rendered either literally or by paraphrasing. A word is usually literally rendered. It is rare to render a word by way of paraphrasing because it amounts to giving a dictionary definition as rendition. This does not happen unless there is no corresponding target word in the bilingual mental lexicon. An example is that there is no Chinese counterpart to the English word “enthrone”. Thus, it has to be conceptually paraphrased as “make someone a king”. In the scope of alien messages, a source metaphor may be replaced by a home-grown target substitute, depending on whether or not such substitute is available in the target language. If it is and is in the translator’s L1, substitution occurs only when she/he is able to retrieve it from memory in time. If it is in her/his L2, she/he may have acquired it yet. If she/he has, again, she/he has to retrieve it from memory in time. In all cases of strategy deployment, a certain strategy is often than not induced by the target context which the translator creates herself/himself, especially true of omission.

Secondly and more important to us in the current study, we may characterize, as has been stated earlier, how a target text is rendered in terms of strategy distributions so as to implicate the underlying interlingual reformation processes. Theoretically, the descriptively-defined strategies can be converted with reference to the neurocognitive routes of interlingual reformation. See Table 5.

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5 The English content in parentheses is gloss translations for the Chinese source tokens. Proper translations are illustrated in Tables 3 and 4.
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The conversions thus establish a conceivable link between what we can textually observe and what we cannot at that level, that is, the underlying interlingual reformation processes. In the current study, lexical and phrasal metaphors unique to the source speech community are tagged as tokens of alien source messages. Those are in limited numbers in a source text, ranging from dozens in an oral speech to a few hundred in a lengthy written text (e.g. a book). After tagging the alien tokens, the same number of tokens of shared messages are tagged in the source text, too. They also match the alien tokens in lexical and phrasal forms (e.g. a verb for a verb, a verb phrase for a verb phrase, etc.). After cross-tagging is complete on the side of the target texts, the results need cross-checking by at least two researchers independently. Error rates by random sampling must not exceed 0.1%.

5. Data patterns

A total number of 6 bilingual parallel corpora was built, with 2 each for written translations, consecutive and simultaneous interpreting respectively. All output was produced by translators and interpreters aged between 28 and 60 with 15 or more years of L2 acquisition (English or Mandarin Chinese) and 6–15 years of professional and/or occupational translating and/or interpreting experience.

As is well known, forward and backward translations from the same source can only be achieved by translators or interpreters with different L2s. Natural output of this kind is hard to come by. The second best is to get translations in opposite directions from different sources. In order that there is a reliable degree of compatibility and comparability between such translations in opposite directions, we in the current study make use of the parameter of message types as the baseline for comparison. So, even though translations in opposite directions were not from the same source, they are compared for being translated from the same type of message.

Tables 6–8 show nominal and numeral categories of the corpora.

<table>
<thead>
<tr>
<th>Strategies</th>
<th>Routes</th>
<th>Target text characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paraphrasing</td>
<td>Conceptual mediation</td>
<td>No trace of source language structures.</td>
</tr>
<tr>
<td>Substitution</td>
<td>Transcoding</td>
<td>Target language items equivalent to those of source language.</td>
</tr>
</tbody>
</table>

Table 5. Descriptive strategies vs. interlingual reformation routes.

Two patterns emerge across modes and directions. Firstly, shared messages solicited higher transcoding rates than alien ones. Secondly, within the same scope of messages, shared or alien, some groups of translators or interpreters produced higher transcoding rates than others. These patterns thus provide us with a basis on which to assess how balanced the L2 is likely to be of a group of translators or interpreters and to implicate L2 acquisition from this perspective.

6 Consecutive interpreting data in backward direction is lacking, to be desired in future studies.
6. Discussion

Our focus will be on how transcoding rates differentiate across the data sets of each translational mode. Theoretically, transcoding in professional translating and interpreting is driven by neural economics to reduce the processing load (see Section 2.3). Higher transcoding rates in the same direction for the same type of message would suggest that the translator’s L2 is relatively balanced than otherwise. This is demonstrated in consecutive interpreting data in forward direction (Figure 4). As we see, C3 solicited a higher transcoding rate than C4 for shared as well as alien messages.
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These firmly suggest that the C3 group of interpreters probably had a relatively more balanced L2 than the C4 group.

It is harder to assess written translation data and simultaneous interpreting data (Figures 3 and 5). In both cases, translating shared messages solicited just about the

(C3_S vs. C4_S; C3_A vs. C4_A). These firmly suggest that the C3 group of interpreters probably had a relatively more balanced L2 than the C4 group.

<table>
<thead>
<tr>
<th>Cps_ID</th>
<th>TT_Tk_N</th>
<th>Trans</th>
<th>Med</th>
<th>mean</th>
<th>SD</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>609</td>
<td>427</td>
<td>182</td>
<td>304.5</td>
<td>173.2</td>
<td>3.1481E−23 ***</td>
</tr>
<tr>
<td>C1</td>
<td>609</td>
<td>233</td>
<td>376</td>
<td>304.5</td>
<td>101.1</td>
<td>6.8463E−09 ***</td>
</tr>
<tr>
<td>C2</td>
<td>1359</td>
<td>946</td>
<td>413</td>
<td>679.5</td>
<td>376.9</td>
<td>2.2219E−47 ***</td>
</tr>
<tr>
<td>C2</td>
<td>1359</td>
<td>316</td>
<td>1043</td>
<td>679.5</td>
<td>514.1</td>
<td>4.2293E−86 ***</td>
</tr>
<tr>
<td>C3</td>
<td>128</td>
<td>87</td>
<td>41</td>
<td>64</td>
<td>32.53</td>
<td>4.7855E−05 ***</td>
</tr>
<tr>
<td>C3</td>
<td>128</td>
<td>55</td>
<td>73</td>
<td>64</td>
<td>12.73</td>
<td>0.11161177 NS</td>
</tr>
<tr>
<td>C4</td>
<td>178</td>
<td>111</td>
<td>67</td>
<td>89</td>
<td>31.11</td>
<td>0.00097397 ***</td>
</tr>
<tr>
<td>C4</td>
<td>178</td>
<td>62</td>
<td>116</td>
<td>89</td>
<td>38.18</td>
<td>5.1774E−05 ***</td>
</tr>
<tr>
<td>C5</td>
<td>61</td>
<td>20</td>
<td>41</td>
<td>30.5</td>
<td>14.85</td>
<td>0.00717149 **</td>
</tr>
<tr>
<td>C5</td>
<td>61</td>
<td>10</td>
<td>51</td>
<td>30.5</td>
<td>28.99</td>
<td>1.525E−07 ***</td>
</tr>
<tr>
<td>C6</td>
<td>153</td>
<td>50</td>
<td>103</td>
<td>76.5</td>
<td>37.48</td>
<td>1.8291E−05 ***</td>
</tr>
<tr>
<td>C6</td>
<td>153</td>
<td>8</td>
<td>145</td>
<td>76.5</td>
<td>101.1</td>
<td>6.505E−31 ***</td>
</tr>
</tbody>
</table>

SD = standard deviation; NS = not significant.

*** 0 < p < 0.001; ** 0.001 < p < 0.01; * 0.01 < p < 0.05; NS p > 0.05.

Table 8. Statistical analyses.

![Figure 3](image)

Written translation.

(C3_S vs. C4_S; C3_A vs. C4_A). These firmly suggest that the C3 group of interpreters probably had a relatively more balanced L2 than the C4 group.

It is harder to assess written translation data and simultaneous interpreting data (Figures 3 and 5). In both cases, translating shared messages solicited just about the
same transcoding rates, but in opposite directions (C1_S & C2_S; C5_S & C6_S). This suggests that the translators and interpreters in those groups achieved a balance between forward L1 comprehension and backward L2 comprehension, as well as between forward L2 production and backward L1 production, implying that the L2 of both groups was relatively balanced at this point in time.
However, as measured by translating alien messages, differential transcoding rates did emerge. Respectively, C1 in forward direction solicited a higher transcoding rate than C2 in backward direction (C1_A vs. C2_A). The same happened with forward C5 and backward C6 (C5_A vs. C6_A). The question is how the differential transcoding rates between opposite directions bear on the L2 of the translators and interprets.

Theoretically, more mental resources are required for processing alien messages and it means a higher processing load (see Section 3.0). This higher processing load exerts itself presumably more on L2 than on L1 (unless it is completely balanced to L1, which is rare). To reduce the processing load, a relatively balanced L2 is presumably more useful in production than in comprehension. The reason is that when L1 comprehension is in place, all that the translator needs is a relatively balanced L2 to reduce the processing load for production. This appears to be reflected in higher transcoding rates in forward direction (C1_A and C5_A). On the other hand, when L2 is in for comprehension, it cannot help underperforming (compared to L1), so that the processing load is not reduced as successfully as in L1 comprehension. This assumption appears also to be reflected in lower transcoding rates in the backward direction (C2_A and C6_A). Thus, it seems conceivable that the C1 group of translators and the C5 group of interpreters probably had a relatively more balanced L2 than the C2 group in written translation and the C6 group in simultaneous interpreting respectively.

To reiterate, as we have seen, those groups who solicited higher transcoding rates for alien messages in forward direction than in backward direction are assessed as demonstrating a “relatively more balanced L2”. And those groups who solicited higher transcoding rates for both shared and alien messages in forward direction are assessed also as demonstrating a “relatively more balanced L2”. In short, there is asymmetrical performance in favor of forward direction in those professional translators and interpreters. What are the possible causes for this?

Our answer can only point to the intrinsic trait of L2 maturation. As is tacitly recognized in the field, time is needed for maturation of the L2 language system itself in the brain as well as the related conceptual systems. Unless L2 acquisition synchronizes with that of L1 at a very young age, a bilingual’s L2, a professional or otherwise, is unlikely to be completely balanced to L1. As far as we know, although our professional translators and interpreters are considered to be highly-balanced bilinguals, they did not begin their careers as child bilinguals. Therefore, it is not surprising that their L1 still outperformed L2 for comprehension on a job.

To appreciate the trait of L2 maturation, we may approach it also from beginner bilinguals’ perspective.

A well-known lab-based study three decades ago found an asymmetrical performance in favor of backward word-translation with beginner bilinguals [35], and this result was consistent with other similar studies [36–38]. It was then hypothesized that a beginner bilingual recoded an L2 word into its L1 semantic counterpart via the interlingual route between L2 and L1 without comprehending the L2 word conceptually, for her/his L2-related conceptual system was to be developed yet. In comparison, forward word-translation would automatically involve L1 conceptual comprehension before L2 recoding. As a result, forward word-translation appeared slower.

A more recent lab-based study found that while there was a directional asymmetry in favor of backward word-translation with unbalanced bilinguals as well as bilinguals without any formal translation training, such asymmetry was markedly reduced with relatively balanced bilinguals and bilinguals with formal translation training [39]. In other words, the asymmetrical advantage in backward word-translation reduces itself
with L2 becoming progressively balanced either by longer periods of L2 acquisition or by translation training. Or simply, directional asymmetry in favor of backward translation is reduced with L2 maturation.

Return to the findings of the current study, that is, highly-balanced bilinguals like professional translators and interpreters performed asymmetrically in favor of forward translation. It thus seems conceivable to stipulate that if measured by translations in opposite directions, there is a shift from unbalanced bilinguals who perform asymmetrically in favor of backward (word-)translation, through relatively balanced bilinguals who perform in no marked favor of either backward or forward (word-)translation, to highly balanced bilinguals like professional translators and interpreters who perform asymmetrically in favor of forward translation of natural texts or speeches.

In making the above stipulation, we assume that it is the extent to which L2 has maturated that governs translational directionality shift, either in word translation or otherwise. We also assume that although the lab-based studies measure translational directionality by methods different from the current study, the principle in either type of study is the same. What is measured by lab-based methods as being translated “faster” is taken as via the interlingual routes, and “slower” as via the conceptual routes [35–39]. We apply exactly the same principle, only with different “measures” so to speak. Higher transcoding rates imply that what was translated had probably been via the interlingual routes, and lower transcoding rates imply that what was translated had probably been via the conceptual routes.

7. Concluding remarks

It is an undeniable fact that professional translators or interpreters do their routines on the job faster and more accurately than other bilinguals. It is also a fact that professionals have been trained and have gained skills and experience on the job for a considerably long period of time, for example, 5 years or longer on the job after training. This implies that their L2 acquisition takes different shapes and forms from other bilinguals, if not longer periods of time. Those include attending specially-designed courses, working as trainees shadowing senior colleagues, consolidating learning on the job, etc.

It is found that professionals consistently produce asymmetric output in favor of forward direction (L1 \(\rightarrow\) L2) across three modes (written translation, consecutive and simultaneous interpreting). This implies that their L1 consistently outperforms L2 in the underlying processes of interlingual reformation during translation and interpreting. In contrast, beginner bilinguals appear also consistently to produce asymmetric output in backward direction (L2 \(\rightarrow\) L1) in word translation. This contrast thus provides some support to: (a) there are interlingual systems between L1 and L2 in the neurolinguistic organization of a bilingual’s two languages; (b) the interlingual systems play a crucial role in the reduction of the processing load during translation, albeit in opposite directions and at different stages of L2 maturation. Further studies are needed.

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