

Problem solving and decision making in translation revision: two case studies

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Abstract:

This project investigates two young professional translators' problem-solving and decision-making behaviour during revision processes. It sets out to qualitatively describe the complexity of interplay involved in problem solving and decision making in translation revision, using think-aloud protocols as a research method. The data I elicited suggest that, for a revision point to occur, the translator first has to find a translation problem. However, the translation problem itself can evolve over time in the revision process, in either a divergent or convergent manner. In other words, a single translation problem can be subdivided into several smaller problems and be tackled individually. Meanwhile, the translator may choose to merge several problems into a single problem that requires a holistic problem-solving approach. In terms of decision making, the translator does not generally verbalise his/her reasons for choosing a translation solution. Nevertheless, s/he has an appropriateness threshold in mind, so that s/he can judge and compare the appropriateness of translation choices and make a decision accordingly. A tentative model of end-revision problem solving and decision making has been produced to summarise the findings of this project.

1. Introduction

Problem-solving and decision-making strategies are among the earliest and perhaps most fundamental issues addressed in translation process research. Tirkkonen-Condit states that ‘choice and decision-making are perhaps so fundamental in translation that almost any theoretical or research-oriented treatment is bound to relate to them in one way or another’ (1993: 8). Largely based on Corbin’s (1980) notion of decision making in cognitive psychology, Wilss (1996: 188) postulates that decision making should consist of the following six stages in translation:

- 1) Problem identification
- 2) Problem clarification (description)
- 3) Research on, and collection of, background information
- 4) Deliberation of how to proceed (pre-choice behaviour)
- 5) Moment of choice
- 6) Post-choice behaviour (evaluation of translation results).

However, Wilss (*ibid.*) himself admits that, in practice, translators’ decision making and problem solving may not be so streamlined, and many factors may interrupt each of these stages:

What if a problem is not (sufficiently) clarified in stage 2? How much information collection is required in stage 3, before the translator dares to proceed further? What determines the length of deliberation in stage 4; when and why does a translator stop these deliberations? And, what if there is no choice at stage 5? What if it turns out in stage 6 that a wrong move has been made?

(Wilss 1996: 188)

This study attempts to partially answer these questions empirically, using think-aloud protocols as a research method. It aims to investigate (or, indeed, describe qualitatively) translators’ problem-solving and decision-making behaviours in translation revision, particularly after the first draft. It is worth noting here that revision after the first draft is often

known as an ‘end-revision’ phase (e.g. Alves et al. 2010; Jakobsen, 2002: 193; Jakobsen 2003: 80) in the literature. In other words, this study focuses exclusively on translators’ strategic revision behaviours after they have produced a first draft, not during the production of a first draft. In particular, this study is designed to show the levels of interaction between decision-making and problem-solving behaviours in the end-revision phase. Before discussing problem solving and decision making in translation in more detail, I would like to first outline some decision-making and problem-solving models in cognitive psychology, which underpin the theoretical framework of this study.

1.1 Problem solving in cognitive psychology

This section introduces Newell and Simon’s classic problem-solving model. Newell and Simon (1972) see problem solving as involving two steps: (1) constructing problem space/representation and (2) searching for solutions. Constructing problem space means that a problem solver has to first identify an initial state and a goal state so that s/he can work out where s/he is now and where s/he aims to be. Searching for solutions means that a problem solver works to reduce the differences between the initial state and the goal state. A basic assumption is that these two steps interact frequently and continuously. In fact, it is a common belief that when an initial state and a goal state are clearly defined, a problem is half-solved, if not completely so.

According to Newell and Simon (1972), there are two strategies that a problem solver can use to search for solutions: ‘hill climbing’ and ‘means-end analysis’. During ‘hill climbing’, a problem solver wants to reach the top of a hill, but does not know which way to go. If s/he take a step north, it leads down, so s/he has to try going another way. S/he carries on like this until all steps lead down. This means that s/he has reached the top of the hill (Robertson 2001). Essentially, ‘hill climbing’ is a trial-and-error strategy. ‘Means-end analysis’ is a more systematic searching strategy. It is different to hill climbing because it introduces the concept of a recursive strategy. That is, a problem solver begins by analysing where her/his goal state is and works backward to create a few smaller, interim subgoals, in the hope that this will narrow the gap between the goal state and initial state. Newell and Simon’s problem-solving theory is a solid foundation for translation process research, not only because it introduces the

valuable concept of problem space construction but also because it includes subgoaling and the recursive nature of problem solving. However, one fundamental difference has to be borne in mind; that is, the ultimate goal of translation and revision is often difficult to define, and in practice the concept of an ideal translation is still debatable. This is part of the reason why there is a need to report translators' problem-solving behaviours descriptively. This research project aims to examine whether recursive subgoaling strategies exist in translators' end-revision processes.

1.2 Decision making in cognitive psychology

Decision making, a notion closely related to problem solving, is also an essential concept in this study. Three decision-making models will be reviewed in turn, as these models are seen to complement each other and help us understand decision making in the translation process.

The dominance search model was developed by Montgomery (1983, 1989; Montgomery and Svenson 1989). It comprises four phases: pre-editing, finding a promising alternative, dominance testing and dominance structuring. In a nutshell, this model views decision making as a process of searching for a dominant choice. It starts with a 'pre-editing' stage, where different attributes and alternatives are evaluated and selected. This screening process lasts until a promising alternative is found. This is where 'finding a promising alternative' fits in, although the distinction between these two phases is that, in the pre-editing stage, various alternatives and attributes are evaluated equally whereas, while finding a promising alternative, a preference or dominant choice has to be made during the screening process.

Once a dominant alternative has been found, the 'dominance testing' stage begins. In this stage, the dominant alternative is strenuously tested, and its advantages and disadvantages are compared and potentially weighed against those of the other options. If all the relevant information is evaluated and the decision-maker finds that an alternative is indeed dominant, then s/he has reached a decision and the process terminates. However, if the decision-maker still has some doubts regarding the dominant alternative, the process proceeds to the next stage, 'dominance structuring'. According to Montgomery (1983), 'the dominance structuring phase can be regarded as a subroutine to the dominance testing phase. The purpose of this

phase is to restructure the given information in such a way that a dominance structure is obtained' (Montgomery 1989: 25). This can be done in several ways, including de-emphasising, bolstering, cancelling and collapsing. De-emphasising means that disadvantages are 'de-emphasised' by a decision-maker, whereas bolstering implies that advantages are made stronger or more attractive. These two types of dominance structuring are interesting because they show that a decision-maker may not necessarily be rational when s/he makes decisions. Sometimes people justify their decisions on grounds that may not be objectively justifiable in the first place.

The differentiation and consolidation theory (the D&C theory) was developed later than the dominant model and is often seen as an improved version of it (Svenson 1992). The D&C theory sees a decision-making process as a combination of two clusters of processes, initiated by the differentiation process, followed by the consolidation process. The label 'differentiation process' indicates that 'a decision involves the selection and creation of a candidate that is sufficiently superior for a decision' (ibid.: 143). The differentiation process largely coincides with Montgomery's dominance model, where a dominant choice is evaluated and confirmed. The consolidation process is seen as a post-decisional process where a defending mechanism, operating perhaps on a subconscious level, is formed to defend the decision against potential threats to it. In Svenson's words, 'post-decision consolidation processes may involve the decision-maker unconsciously increasing her/his attractiveness appraisal of the chosen alternative on an important attribute' (ibid.: 145).

However, what distinguishes the dominance model and the D&C theory is that the D&C theory also emphasises what happens after the decision is made. The D&C theory 'explicitly links pre- and post- decision processes and considers pre-decision processes as a preparation for the post-decision future' (Svenson 1992: 143). This is very similar to step 6 (post-choice behaviour) in Wilss's (1996: 188) decision making in translation. In fact, this post-decision process can be seen as a kind of translation revision, since it indicates the evaluation of translation results.

As a critique of Montgomery's and Svenson's work, and based on the level of cognitive efforts involved, Jungermann et al. (2005; cited in Prassl 2010) divide decision-making

processes into four categories: routinised decisions, stereotype decisions, reflected decisions and constructed decisions. The first two indicate that a decision takes place unconsciously or automatically and requires little cognitive effort. Constructed decisions indicate that a decision involves the highest level of cognitive efforts, since its problem space was ill-defined in the first place. Reflected decisions can be seen as a halfway house between routinised/ stereotype decisions and constructed decisions, and may involve both conscious and unconscious cognitive efforts. For the purposes of this study, here I will focus on describing constructed decisions, where maximum cognitive efforts are required. Interestingly, Jungermann et al.'s definition of constructed decisions demonstrates that complex decision making cannot be separated from problem solving. This is also what the present study intends to explore: its purpose is to investigate the relationship between decision-making and problem-solving behaviours in translation revision, to fill the gap in our understanding of how these complex cognitive efforts are constructed in translation (end-) revision.

1.3 Problem solving and decision making in translation

This section will explain how problem solving and decision making are seen in translation studies. As mentioned at the beginning of this article, problem solving and decision making are among the earliest issues addressed by translation process researchers. In Krings's (1986) tentative model, the translation process is seen as commencing with identifying a translation problem and ending with finding a satisfactory solution (*ibid.*). Krings identifies four different sets of problem-solving strategies: retrieval strategies, monitoring strategies, decision-making strategies and reduction strategies. Retrieval strategies are procedures adopted by translators when they produce a translation equivalent in the first place. Monitoring strategies indicate evaluation procedures immediately after a translation equivalent is produced. Decision-making strategies are employed when there are at least two competing translation equivalents. Finally, reduction strategies indicate that the translator cannot find a satisfactory translation equivalent, and has had to resort to the compromise of reducing certain features of a source text segment. Interestingly, Krings sees decision making as a set of strategies embedded within problem-solving strategies. In many ways, Krings's model is parallel to Wilss's (1996: 188) six-stage decision making process (as mentioned earlier), which sees the identification of a problem as the first step in the decision-making

process. However, based on Krings's tentative model of the translation process, translators do not necessarily have to clarify or describe their translation problems before they proceed to the next stage; that of producing a solution. This is very different from Wilss's decision-making model, which includes a problem clarification step, where the problem concerned needs to be defined and explained. It will be interesting to find out whether this step exists in translators' problem solving and decision making in end-revision.

For the purposes of the present study, it is worth noting that Krings's pioneering study sees translation as a strategic and purposeful activity. Lörcher (1991) also adopts the notion of strategies in his study, as he labels translators' cognitive moves as being 'strategic elements' of the translation process. This notion of strategies is important in these early studies, since it lays a foundation for seeing the cognitive processes of translation as containing potentially conscious plans to solve translation problems. Again, Wilss summarises this well. According to Wilss (1996: 79), 'the concept of translation as a purposive behaviour can be linked to the concept of translation as a sequence of interrelated adaptive strategies designed to establish a functional equilibrium between ST and TT.' In other words, Wilss's remark implies that translation is a goal-oriented activity whose ultimate goal is to establish a 'function equilibrium', and there is, potentially, a series of strategic actions involved in pursuing this goal.

The above discussion focuses on the notion of strategic problem solving where decision making appears to be a subsequent step to these strategic behaviours. But the question remains, why do translators make a certain decision? On what criteria do they base their decision? Levý was one of the earliest researchers who attempted to answer this question. According to Levý (1967/2000), translators have 'selective instructions' that act as constraints or guidelines to direct their choices. He acknowledges that these 'selective instructions' may be controlled by translators' motivation or other external factors. However, Levý's idea is based on the game theory in cognitive psychology rather than on empirical data. Jääskeläinen (1989) also discusses decision-making criteria, but on the basis of her think-aloud protocol study. She indicates that translators' decision-making criteria are often related to translation assignments (translation briefs). She concludes that professional translators tend to make decisions based on their translation assignments, although such

processes are often automatised and hence difficult to verbalise in think-aloud protocols (TAPs). Similarly, Tirkkonen-Condit (1989) hypothesises that professional translators tend to make decisions based on non-linguistic world knowledge.

More recently, Zheng (2012: 177) looked into problem-solving incidences among novice, semi-professional and professional translators. In terms of the number of problem-solving incidences, inconclusive results were produced since a determining factor appears to be whether the text is routine or non-routine. In routine texts, professional translators identified fewer problems than novice and semi-professional translators whereas, in non-routine texts, there were no significant differences in the number of problems identified by all three groups of translators. What is more interesting is that, in terms of decision-making parameters, Zheng (2012: 203) indicated that a hierarchical relationship exists between different choices or between different translation equivalents. It seems that the later an option is produced, the more likely it is to be selected. This is because, when they produce different translation equivalents, presumably translators update their choices as well. Therefore, the last option they arrive at is, potentially, the best choice to solve the translation problem.

2. The study

Two case studies have been chosen from a corpus of ten professional translators' TAP data (Shih 2006a). They were chosen because these two subjects (who we will here call May and Joanne) had made extensive and complex revision efforts compared to other subjects in the data corpus, and were seen as representative to demonstrate the complexity of 'constructed decisions' (Jungermann et al. 2005, cited in Prassl 2010) in translation revision processes.

Both subjects worked as in-house translators at the time the TAP experiment took place. They were both relatively new to their profession: Joanne had been working as an in-house translator for just over a year, and May for four years. This could be a limitation of the present study, since both subjects are relatively young professionals. Joanne's educational background lies in languages and linguistics, and she completed an MA degree in translation in the UK prior to starting her in-house translation position in Taiwan. May, however, has no

professional translation qualification. In fact, she claimed that her English is largely self-taught. She has an undergraduate degree in physics and a Masters degree in aeronautics and astronautics, which partly explains why she worked as an in-house technical translator in an engineering company. Both translators were asked to translate a short non-technical text from English into Chinese (their mother tongue). There was no time restriction and restrictions on what kinds of reference materials they could use, in order to mimic a translator's natural working environment. The only experimental intervention was that they were asked to take a break (for at least 30 minutes) after producing their first drafts. This is an important experimental control, not only because taking a break is essential to combat potential fatigue (caused by thinking aloud while translating and revising) but also because the present study aims to investigate translators' end-revision processes – or, more precisely, their problem-solving and decision-making behaviours after their first drafts. These two subjects were given ample time and opportunities to practise thinking aloud while translating a different text prior to taking part in the experiment, in order to minimise the potential effects of unfamiliarity with the think-aloud procedure on the data elicited. For the actual brief and source text given to the subject translators, please see the appendices to this article.

3. Analysis and discussion

3.1 Problem solving in revision

The elicited TAP data suggest that, in contrast to what is depicted in Wilss's (1996: 188) decision-making model and the classic problem-solving and decision-making theories, a complex process is often involved in translators' end-revision processes. This is because translators often do not have readily available translation options to choose from. One may believe that when it comes to translators' end-revision processes, the matter should be much simpler since, at this stage, a translation equivalent should have been produced in the first draft and hence translators would only need to make up their mind to choose or approve a previously-sought translation solution. This may be the case in what Jungermann et al. (2005; cited in Prassl 2010) call routinised decisions and stereotype decisions. However, in constructed decisions, it is more complicated. In fact, according to my data, multiple problems are found to occur at different stages of the end-revision process. These problems may not remain static, but may evolve over time. Sometimes, a solution to a problem can generate another new set of problems or prompt a new decision-making process altogether.

To illustrate this, I have selected an example from Joanne’s third run-through. In this example, Joanne was revising the ST sentence, ‘*he engineers a huge expansion in natural history.*’ This sentence was translated as ‘在自然史上造成了強烈的影響’ (gloss translation: in natural history [it] causes strong influences). When this sentence was first translated, a substantial processing effort was made to produce this translation in the first draft. This sentence went past the second run-through without much change. In the third run-through, however, this sentence came back to haunt Joanne and appeared to be one of the most problematic sentences. As a matter of fact, the revision of this sentence accounts for roughly half of the verbalisation produced in the third run-through alone. Joanne’s TAP data are presented and discussed in detail below.

Original TAP data (in Chinese)	Back-translated TAP data
嗯 在接下來的二十年中 <i>Linnus</i> 在自然史上造成了強烈的影響	Um... ‘ <i>During the next twenty years, Linnus causes strong influences in natural history.</i> ’
造成了強烈的影響.. 我記得剛剛想了很久	‘ <i>Cause strong influences.</i> ’ I remember I thought about this for quite a while earlier.
喔 就是 <i>huge expansion</i>	Oh, it’s ‘ <i>huge expansion.</i> ’
<i>huge expansion</i> 到底是講什麼?	What is this ‘ <i>huge expansion.</i> ’ talking about?

Joanne recalled that she struggled with this particular text segment before making the following comments: ‘我記得剛剛想了很久’ (back translation: I remember I thought about this for quite a while earlier). However, at first she could not recall what had caused the difficulty. Then she realised that it had been ‘huge expansion’. Meanwhile, she tried to remind herself of the context of this phrase and why it had been a problem to translate. Gradually, she recalled that it was because ‘engineer’ was used as a verb in relation to its object (‘huge expansion’). Although not verbalised explicitly by Joanne, she seemed to think that ‘engineer’ and ‘huge expansion’ are unusual collocations.

Original TAP data (in Chinese)	Back-translated TAP data
我知道 <i>engineer</i> 可以講操縱 操縱一個 <i>huge expansion</i>	I know ‘ <i>engineer.</i> ’ I can say ‘ <i>manoeuvre.</i> ’ ‘ <i>Manoeuvre a huge expansion.</i> ’

那 在自然史上的一個 <i>expansion</i>	Right, ‘ <i>in natural history there is an expansion</i> ’.
可是 <i>expansion</i> 有沒有可能是 數量大量增加 還是什麼	But, ‘ <i>expansion</i> ’. Is it possible that this means quantity has hugely increased or what?
會是數量大量增加嗎?	Is it ... quantity is hugely increased?
Expansion (consulting dictionary) 擴張 膨脹 擴大 張 膨大	‘ Expansion ’. <i>Expand. Swelling. Enlarge. Expand. Inflate.</i>
那操縱一個 怎麼會這樣 要怎麼講?	‘ <i>Manoeuvre a ...</i> ’ How come? How do I render it?
擴張 擴大 嗯 那如果 <i>engineer</i> 不講操縱的話要怎麼講?	Expand. Enlarge. Um. If ‘ <i>engineer</i> ’ is not translated into ‘ <i>manoeuvre</i> ’, how do I render it?

It seems that Joanne first identified that there was a problem with rendering ‘huge expansion’, but later realised that there was another problem, which was how to render ‘engineer’. Soon after this, she worked out that these two problems were actually interrelated – they appeared to be one problem. The following shows evidence for this.

Original TAP data (in Chinese)	Back-translated TAP data
<i>Engineer engineer</i> I N E R (consulting dictionary)	-----
Engineer 設計監督 建造 指揮 技巧的處理	Engineer . <i>Design. Monitor. Construct. Command. Skilful arrangement.</i>
他技巧的處理一個 <i>expansion</i> 嗎? 他操縱了一個 <i>expansion</i> 嗎?	‘ <i>He skilfully dealt with an expansion</i> ’? ‘ <i>He manoeuvred an expansion</i> ’?
嗯 他操縱 他技巧的處理 他巧妙地操縱 一個 <i>expansion</i>	Um. ‘ <i>He manoeuvred</i> ’. ‘ <i>He skilfully dealt with</i> ’. ‘ <i>He skilfully manoeuvred an expansion</i> ’.
那應該怎麼講呢?	Right, how should I put it?

在膨脹可是 <i>expansion</i> 只有膨脹 第一個他都沒有講類似什麼反著的事情啊	<i>Swelling</i> . But, <i>expansion</i> . Only <i>swelling</i> . First of all, he did not talk about anything remotely opposite.
所以那應該不是數目上的膨脹	So, this should not mean swelling in terms of its quantity.
那應該是說 影響深遠 那還是說 <i>expansion</i> 讓我想一想	It should mean <i>great influence</i> . Or I shall say <i>expansion</i> . Let me think.
Expansion 找一下英英看看好了	<i>Expansion</i> . Check this word in the English-English dictionary.
Expanding expanded expansion expanded development . . . development 一個長度 Inspiration 增加 所以不只是說 數量的膨脹.. 增加 發展	<i>Expanding expanded expansion expanded development . . . development</i> . A length. Inspiration increases. So, this is not only talking about swelling quantity. Increase development.

In the above example, in particular, Joanne stated, ‘ He skilfully dealt with an expansion? He manoeuvred an expansion? Um. He manoeuvred. He skilfully dealt with. He skilfully manoeuvred an expansion’. While pondering these problems, she produced a series of translation solutions. Some of these came as a result of checking dictionaries, and other solutions came from Joanne’s own inferences. This agrees with Shih’s (2003) findings of novice translators’ overnight revision processes, where translation solutions were produced either based on ‘referencing strategies’ (i.e. consulting dictionaries), ‘inferencing strategies’ or a combination of the two.

In the example below, Joanne decided to render ‘expansion’ into ‘發展’ (back translation: development). This tentative solution was then rigorously assessed against its context, as shown below.

Original TAP data (in Chinese)	Back-translated TAP data
如果說把它當發展來看	If I say ‘ <i>development</i> ’

發展的話 我就把它講成說	' <i>Development</i> '. I can put it like this.
發展 那就跟之前想的強烈的影響 <i>A huge expansion</i>	' <i>Development</i> '. When comparing this with an earlier solution, ' <i>strong influence</i> '. ' <i>A huge expansion</i> '
那我把它當作等於 <i>development</i>	Now, I take it as an equivalent of ' <i>development</i> '.
嗯 在自然史上造成強烈的影響	Um.. ' <i>In the natural history this has caused a strong influence</i> '.
嗯 在自然史上 在自然史上 嗯 造成了極大的影響	Um. ' <i>In the natural history</i> '. ' <i>In the natural history</i> '. Um. ' <i>This causes an enormous influence</i> '.
極大的影響比較好 就不用講強烈	' <i>Enormous influence</i> ' is better. This way I don't need to say ' <i>strong</i> '.

But, later on, she came up with another solution for rendering 'expansion', which is '演變' (back translation: evolvment). Again, this translation solution was first assessed against its immediate context and then against other solutions, such as '影響' (back translation: influence) and '發展' (back translation: development). Before making a final decision, Joanne went back to the earlier problem, 'engineer'.

Original TAP data (in Chinese)	Back-translated TAP data
在自然史上造成了極大的...極大的 創下了 創下了 不是造成 而是創下了	' <i>In natural history, he causes enormous... enormous</i> '. .. ' <i>Establish</i> '. ' <i>Establish</i> ', not ' <i>cause</i> '. ' <i>Establish</i> '.
創下了可能比較接近	' <i>Establish</i> ' is closer to the original meaning.
創下了又比造成更像 <i>engineer</i>	' <i>Establish</i> ' is closer to ' <i>engineer</i> ' than <i>cause</i> .
創 我可不可以講... (consulting dictionary for 'expansion')	' <i>Establish</i> '. Can I say ... ?
可以講進展比較好啊!	I can say ' <i>progress</i> '. It's even better!
創 進展可能真的比較好喔!	' <i>Establish</i> '. ' <i>Progress</i> ' is really better!

在接下來的二十年中 <i>Linnus</i> 在自然史上創下了...	<i>'During the next twenty years, in natural history, Linnus establish...'</i>
可是進展 我還是要講創下嗎?	But, <i>'progress'</i> . Do I still say <i>'establish'</i> ?
進展 喔... 嗯...	<i>'Progress'</i> . Oh... Um...

It was at this stage that a new alternative solution to 'engineer' appeared. Instead of rendering 'engineer' into '造成' (back translation: cause), Joanne came up with a new alternative, '創下' (back translation: establish). However, she realised that '創下' (back translation: establish) does not necessarily collocate with any of the renderings previously produced for 'expansion'. After some deliberation, she created a new solution, '進展' (back translation: progress) at the last minute, before finalising the revision of this sentence, where '進展' (back translation: progress) collocates well with '創下' (back translation: establish).

To summarise this example, at first Joanne stopped at a single sentence and decided that it was worth revising, partly because she had remembered having difficulty in translating it in the first draft/run-through. Initially, she tackled a few individual problems at word or phrase level. After a few re-rendering attempts, Joanne recognised that a coherent approach was required to solve individual problems, since a satisfactory translation cannot be achieved at the word or phrase level alone; it has to function at a higher level as well. It is as if these smaller lexical problems gradually merged into a new and single collocation problem. This demonstrates that translators' revision behaviours can evolve over time, which may happen in both a divergent and convergent way.

Referring again to Newell and Simon's classic problem-solving theory (1972), it is clear that, just like the problem solvers in the classic theory, translators divide their translation revision problems into smaller problems and tend to solve each of them individually – at least initially. Nevertheless, there is a crucial difference between the two since, in translation revision, typically, translators do not construct their problem space nor do they define their goal state and initial state. At least, there is no evidence to suggest that this is the case in my TAP data. It seems that, for my translators, it is not that important or relevant for them to define their

exact problem, since defining a problem may not necessarily lead them to a final solution. They would rather spend their time on producing and testing potential solutions to their problems. In this study, it was noted that the translator worked on individual problems without a clearly defined goal. Interestingly, while solving each individual problem, the translator also recognised that a consistent and coherent solution/approach is required to tackle several individual problems.

A metaphor of treasure hunting (without a map) may be used to explain translation revision problem solving. The translator proceeds with a fairly vague goal in mind (i.e. finding treasure) and tries to solve individual problems en route. However, the goal is to actually reach a piece of treasure worth having, rather than to reach a specific piece of treasure on a map. After all, all professional translators work under the constraints of limited time and resources available to them, and their job is to successfully unearth satisfactory translation solutions under such constraints, not to find the only, and ultimate, solution to their problems.

In terms of decision making, translators often have a dominant, or preferred, translation alternative/solution, which they can assess at any given moment in their revision process. Yet new translation solutions can occur at any time during (or after) a long and laborious assessment of a number of translation solutions. By the end of an assessment, if a translator decides that a translation solution is not worth pursuing, there are two potential routes. One is to go back to the cycle of producing a new translation solution. The other is for the translator to temporarily postpone making a decision and come back to it at a later stage.

3.2 Decision making in revision

What really prompts translators to choose a particular translation alternative over the other? To suggest that there are only a few criteria for this appears to be naïve, since there are so many different circumstances in translation revision decision-making processes that it is difficult to list them all. It is certainly the case in the two TAP case studies that there are very few clearly verbalised decision-making criteria. However, there are a few exceptions. The following table offers an example of this.

Original TAP data (in Chinese)	Back-translated TAP data
當他開始植物的研究時 首先從調查拉布蘭地區所有花科植物	<i>'When he began plant studies, initially from investigating Lapland's all the flowering plants'.</i>
首先從拉布蘭地區所有花科植物的調查開始	<i>'Initially, from Lapland's all the flowering plants, the investigation began'.</i>
首先從調查拉布蘭地區所有花科植物開始	<i>'Initially, beginning from investigating Lapland's all the flowering plants'.</i>
好吧 調查放前頭好像比較順	Right, putting <i>'investigating'</i> at the beginning seems to be more fluent.

(Excerpt from May's second run-through)

In this case, May was revising the TT rendering of the ST sentence, 'he began his green studies with a survey of all the flowering plants of Lapland...' May reread two versions of the TT: '首先從拉布蘭地區所有花科植物的調查開始' (gloss translation: Initially from Lapland's all the flowering plants, the investigation began) and '首先從調查拉布蘭地區所有花科植物開始' (gloss translation: Initially, beginning from investigating Lapland's all the flowering plants). She then concluded that she would keep the latter, because she thought it sounded more fluent in the TT. In other words, May indicated that fluency was her decision-making criterion in this instance. Considering that 'fluency' was one of the factors most commonly checked for during translation revision in Shih's (2006b) interview study, it is no surprise that May made her revision decision based on the same criterion. It has to be pointed out, however, that in the majority of decision-making situations, my translators did not verbalise the concrete reasons for making their decisions.

There is another example of this in May's second run-through. In this example, May was revising the ST sentence, 'Smell is the forgotten sense.'

Original TAP data (in Chinese)	Back-translated TAP data
容易忘記很奇怪	<i>'Easily forgotten'</i> . This is rather strange.
不容易記得 Okay	<i>'Not easy to remember'</i> . Okay.
改成不容易記得好了	Change this into <i>'not easy to remember'</i> .
喝茶	Drink tea.
嗯 味覺是一種容易忘記的感官 他是容易忘記呢 還是不容易記得 因為他 一下子就被 聞過就忘記了嘛	Um. <i>'Taste is a kind of easily forgotten sense'</i> . Is it <i>'easily forgotten'</i> or <i>'not easy to remember'</i> ? Because he smelled something very quickly and it is forgotten soon after the smell!

(Excerpt from May's second run-through)

In the example above, it can be seen that May was clearly making a decision between the following two renderings: '容易忘記' (back translation: easily forgotten) and '不容易記得' (back translation: not easy to remember). She decided to choose the latter. However, the only reason for her choice was that '容易忘記' (back translation: easily forgotten) sounds strange. There is no explanation of why this sounds strange. In other words, there is a level of vagueness involved in the translator's decision making. There are two possible reasons for this. First, the translator may not be consciously aware of the reason for her choice. It may not be important that she understands it either, since it is a spontaneous decision and presumably what really counts is that she decides that one choice is better than the other. The other possibility is that there may be a more logical reason behind her choice, which she has been unable to verbalise.

Another aspect worth pointing out, related to both of the above examples, is that my data seem to confirm Zheng's (2012: 200–208) findings that translators tend to choose a later translation solution. According to Zheng, translation choices are not all created equally. There is a level of logical progression between translation solutions. The later a translation

solution is found, the more likely it is that it will be a better solution – since later solutions are potentially improved and revised versions of earlier solutions.

This coincides with the elimination strategy of classic decision-making theory, as illustrated earlier. This is because we found that, in May’s second run-through, she chose between two translation solutions. By eliminating one solution, she was automatically left with the other translation solution. This elimination strategy was conducted by addressing or emphasising the negative aspects of a translation choice. This also partially reflects Levy’s (1967/2000) description of the decision-making process in translation, where a list of competing alternatives would gradually be narrowed down into one final decision.

Conversely, in Montgomery’s decision-making theory, ‘bolstering’ is a common decision-making strategy. In other words, instead of emphasising the negativity of a translation choice, a decision-maker can be found to ‘bolster’ or reiterate positive aspects of a translation choice. In practice, a combination of elimination and bolstering strategies are used in translation revision. The following example demonstrates this.

Original TAP data (in Chinese)	Back-translated TAP data
嗯 味覺是人類最誘人 <i>Seductive</i>	Um. ‘ <i>Taste is human’s most tempting ...</i> ’ ‘ <i>Seductive</i> ’.
除了翻成誘人 還可以翻成什麼 <i>Seductive</i> 除了可以翻成誘人 還可以翻成什麼 剛剛 應該要寫下來的	Apart from ‘ <i>tempting</i> ’, what else can I translate this into? <i>Seductive</i> . Apart from ‘ <i>tempting</i> ’, what else can I translate this into? I should have written them earlier.
<i>Seductive</i> (Consulting dictionary)	-----
C <i>seduc</i> 最誘惑 最吸引人的 最吸引人的好 了 也不一定啊	C <i>seduc</i> ... ‘ <i>The most tempting</i> ’. ‘ <i>The most attractive</i> ’. ‘ <i>The most attractive</i> ’ is all right. Well, not necessarily.
聲音也是可以很吸引人啊	Voice can be attractive as well!

好了 那就 最吸引人 最誘人 好了	Right, I will take ‘ <i>attractive</i> ’ . . . no... ‘ <i>tempting</i> ’, then.
還是最誘人好了 比較有那個 比較有那個 意境嘛!	‘ <i>Tempting</i> ’ is still better. It has that proper feeling to it.

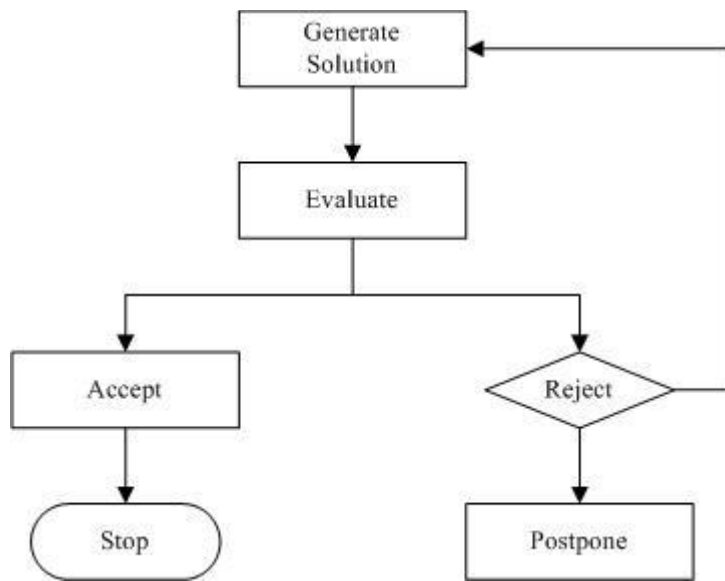
(Excerpt from May’s second run-through)

In the above example, May began by identifying a problem, the rendering of the ST word ‘seductive’ in the ST clause, ‘Smell is our most seductive and provocative sense’. This word was first rendered into ‘誘人’ (back translation: tempting). However, May soon realised that this was not a satisfactory translation, by asking, ‘What else can I translate it into? ... I should have written them down earlier.’ May seemed to recall that she had come up with other translation alternatives in her first run-through, but she could not remember them now because she had not written them down. She was now faced with the problem of finding an alternative rendering of this ST word. She decided to resort to her dictionary and then indicated that ‘attractive’ seemed to be a good solution. But, soon afterwards, she decided that ‘attractive’ was not an ideal choice, because ‘voices can be attractive as well’. In other words, she indicated a negative aspect of this choice by saying that ‘attractive’ is not exclusively used to describe humans’ sense of smell. She then looked into the original rendering, ‘tempting’. This time she bolstered a positive aspect of this choice by saying, ‘tempting is still better. It has that proper feeling to it.’

To sum up, my translator was found to eliminate a translation solution by emphasising its negative aspects and also (re-)confirmed a translation choice by bolstering its merit.

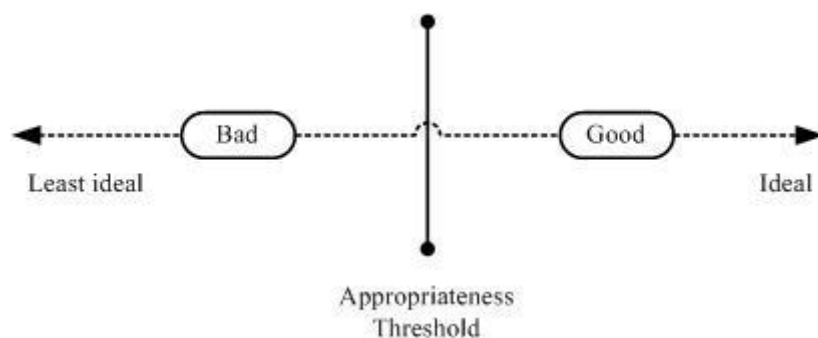
This study also found that translators normally focus on evaluating one dominant translation solution at a time. In fact, it found that translators follow the cycle of evaluating solutions one by one until they find a satisfactory solution or, alternatively, they may decide to postpone their quest for a satisfactory solution, at least temporarily. This cycle is shown in Figure 1 below.

Figure 1: Cycle of evaluating solutions



This study found that translators are only occasionally able to verbalise their reasons for making a certain decision. Some of these reasons are directly related to translators' general revision maxims, e.g. fluency (Shih 2006b). However, even in cases where translators are able to verbalise their decision-making reasons, I found that these reasons are often relatively vague and often intuitive. This could be because the two translators were relatively new to their professional career and their strategic competence was less developed than that of more experienced translators (Göpferich 2013: 65). However, it may also be that the two translators are aware of their decision-making criteria but simply do not verbalise them. Notwithstanding the reasons behind this, I found that translators made several relevant comments in conjunction with decision making in translation revision. Although translators do not usually pinpoint their reasons for choosing one translation solution over another, they are able to judge whether one solution is better than the other. Thus, there seems to be an 'appropriateness threshold' that lies along the continuum of translation revision decision-making. Figure 2 illustrates this.

Figure 2: Appropriateness threshold



Ultimately, the appropriateness threshold can direct translators in making their choices without clarifying an ideal goal. It means that the translator can judge the appropriateness of any given translation solution, presumably based on certain decision-making criteria that are not necessarily explained or spoken aloud. Translation solutions that appear on the left of the appropriateness threshold are deemed to be unacceptable, whereas solutions that lie on the right of the threshold are considered to be acceptable. This explains why, unlike other problem-solving activities, there is no such thing as a definite goal state or an ideal translation. It also explains why translators do not verbalise a concrete reason for making a choice; since, cognitively, they may be busy evaluating their translation choices on a relative scale.

4. Conclusion

This study aims to depict the complex interplay of problem solving and decision making in translators' end-revision processes. It found that, first of all, unlike the classic problem-solving theory and Wilss's decision-making model, translators do not normally define their translation problems before solving them. This is a crucial difference because, since translators do not define an ultimate goal, they cannot work backward to create interim subgoals. In other words, instead of working backward (or recursively), they work forward with problems they have identified, dividing these problems into smaller sub-problems in the hope of tackling them individually. Nevertheless, sometimes after a series of deliberations during intense problem solving, the translator may find that some sub-problems are interrelated and cannot be dealt with individually. It is as if the translator came to realise that only a coherent strategy or solution can solve these interrelated individual problems. This shows that these individual problems are somehow amalgamated into one bigger, more

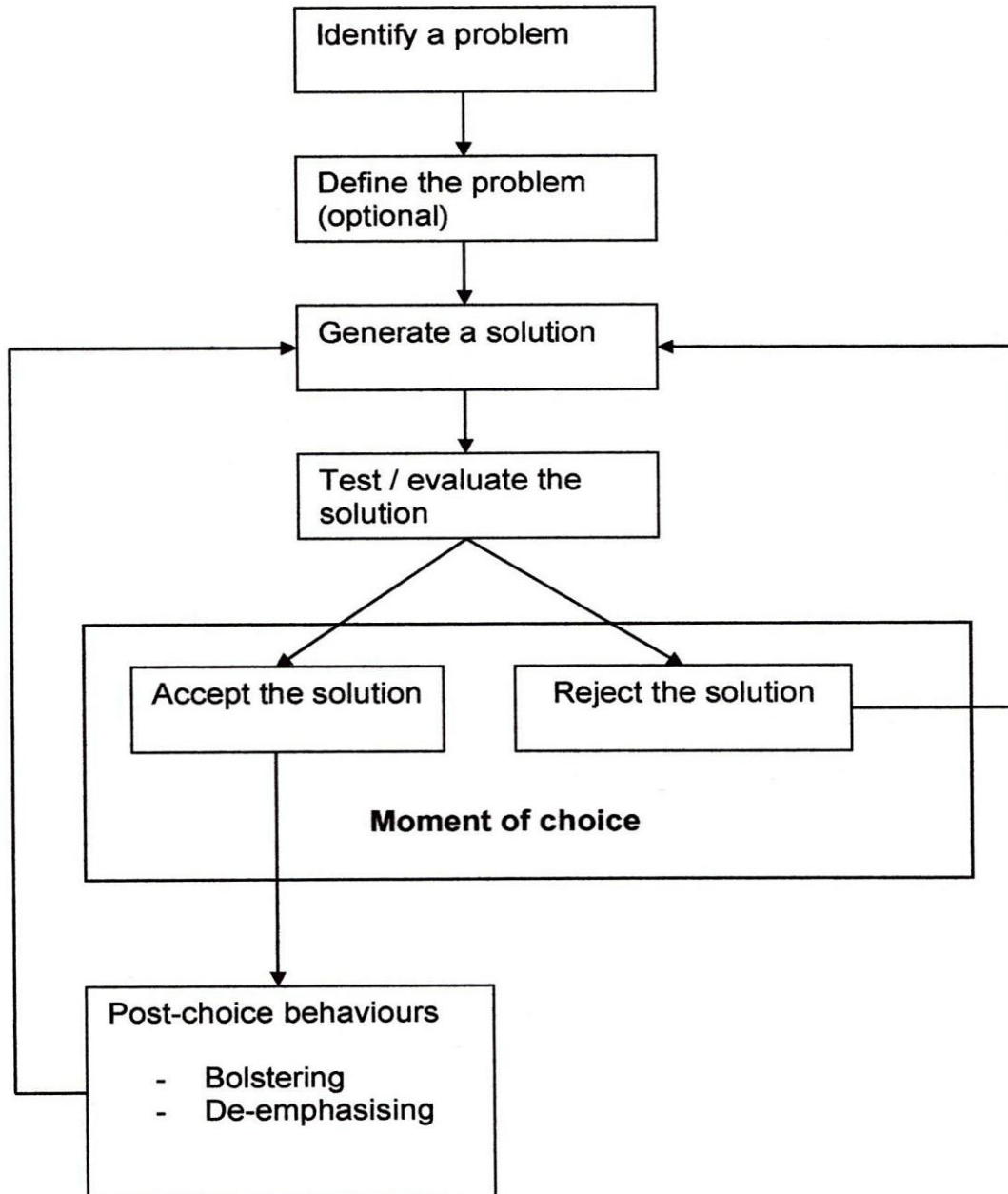
holistic, problem. In other words, translation problems can evolve in a divergent or convergent way.

In terms of decision making, this study found that decision-making models seem to serve decision making in translation revision well, with the precondition that there has to be at least two competing translation solutions to choose between. If this precondition does not exist, the translator has to go back to the problem-solving cycle to produce a satisfactory translation solution. Translators are also found to either eliminate a translation choice/solution by emphasising its negative attributes or confirm a translation choice/solution by bolstering its positive attributes.

In terms of decision-making criteria, this study found that the two translators infrequently verbalised their reasons for making their translation revision choices. Instead, they were found to make evaluative comments of whether a translation revision choice is good enough or not. This shows that translators may have some form of internalised decision-making criteria in their mind, even though these criteria are not clearly verbalised. The fact that translators are found to make evaluative comments and assess one or more translation revision choices on a relative scale of appropriateness indicates certain degrees of strategic awareness. From a pedagogical perspective, this strategic awareness is fundamental in developing translators' competence, since professional translators are found to have a tendency to manage their translation process more strategically compared to novice translators (Göpferich 2013).

Wilss's (1996) model of translation decision making is not intended to illustrate translators' end-revision processes. However, this sequence of procedures can be seen to characterise, to a certain extent, the interaction between decision making and problem solving in end-revision. Therefore, a modified version of Wilss's model is shown in Figure 3.

Figure 3: A tentative model of end-revision decision making and problem solving



As illustrated in Figure 3, for a revision point to occur, the translator must first find a translation problem. Then, the translator may decide to define or clarify the problem (although, more often than not, this step is skipped). Then, s/he may immediately generate a solution and evaluate it, using various strategies to evaluate the solution. For example, s/he may employ ‘monitoring strategies’ (Krings 1986) or Lörcher’s (1991) ‘strategic elements’ (as briefly defined in Section 1.3) to evaluate one translation solution after another until s/he finds a dominant or satisfactory solution. If there are competing translation solutions, the translator may also employ bolstering strategies (Montgomery 1989) or elimination strategies

(Levy 1967/2000; Krings 1986) to determine which solution to keep. If all solutions are rejected, the sequence reverts to an earlier state where a (new) solution needs to be generated, although it has to be borne in mind that the solution-generation and evaluation process can evolve in either a divergent or convergent manner. But, if a dominant solution is accepted, then the revision sequence can either stop or proceed to the post-choice stage, where the translator reassesses the choice s/he has made. In exceptional situations, where the result of this reassessment proves to be negative, the process may start again in search of a new solution. To sum up, this model incorporates classic cognitive decision-making and problem-solving theories, existing models in translation process research, and my empirical data to illustrate the complex interplay of decision making and problem solving in translation end-revision processes.

Many future research directions may lead on from this research project. For example, different language combinations may be examined to determine whether such end-revision phenomena are universal to all language pairs. It would also be very interesting to see how – and to what extent – text types, or whether the source text is routine or non-routine, may impact on translators’ revision behaviours. It would be even more interesting to investigate whether professional and novice translators carry out translation end-revision differently using newer research methods, such as key logging, screen recording and eye tracking technology.

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Appendix 1: Think-aloud protocol instruction (no. 1)

What is a think-aloud protocol (TAP)?

- TAP is translated in Chinese as 「放聲思考」 (literally, ‘to voice your thinking’); in other words, to verbalise your thoughts. In this case, you are asked to say whatever comes into your mind when doing a translation. This may not be easy to start with; therefore, you are advised to practise it by translating the following paragraph.

It’s simple, it’s powerful and it works. A great scent really can lift your spirits instantly— and when you feel good, you look great, too. A survey conducted by the Olfactory Research Fund in the US recently confirmed what our instinct has always told us— the majority of scent wearers consciously splash it on to feel better about themselves and invoke a positive sense of wellbeing. Now, there’s evidence that perfume can give your image a youth boost, too. Yet another US study, this time at Duke University, suggests that the confidence surge from a spray of scent can help us side-step midlife crisis, cope with personal milestones and live up to society’s ageist demands.

(Good Housekeeping, November 2001)

Reminder

- In this task, you are asked to produce a **FIRST DRAFT ONLY**. However, there is no time limit. Please take your time.
- All dictionaries provided on your desk can be used for reference. However, you are not advised to consult the researcher once you have begun the translation.
- Since your translation will be tape recorded, please do not murmur, but speak clearly and audibly.
- Please use a pen in **BLACK** or **DARK** ink rather than a pencil. Also, **DOUBLE-SPACE** your translation.
- Before starting the translation on the next page, please read the brief carefully.

If you have any questions, please ask the researcher now.

Appendix 2: Think-aloud protocol instruction (No. 2)

Reminder

- Please REVISE your first draft and produce a FINAL VERSION for publication.
- When revising your first draft, please use a single line to cross out the previous translations – do not make them invisible.
- Again, you are reminded to speak clearly and audibly. There is no time limit.
- You will be interviewed after the revision.

If you have any questions, please ask the researcher now.

Ready? Here it comes!

Appendix 3: The Translation Brief

The following text is an excerpt from a book, *Jacobson's Organ: The Remarkable Nature of Smell*, which you have been asked to translate by a publisher in Taiwan. Your target audience is the general public.

Smell is the forgotten sense. There are no agreed measures of its nature, no societies dedicated to its appreciation, no descriptions of it except those borrowed from our overbearing sense of sight.

Smell is our most seductive and provocative sense, invading every domain of our lives, providing the single most powerful link to our distant origins. But it is also mute, almost unspeakable, defying description and collection, challenging the imagination. All that stops it slipping entirely through the net of language is a few brave attempts to pin it down – beginning with the work of a very tidy-minded Swede.

*Carolus Linnaeus (1703–78) was the Great Indexer. He studied medicine at Uppsala University, but his heart was always in botany. He began his green studies with a survey of all the flowering plants of Lapland, completing this task in 1737 with the aid of a revolutionary new system of defining and describing every species. And during the next twenty years he engineered a huge expansion in natural history, publishing his *Systema Naturae* and docketing everything in sight, changing forever the way we think about the world around us.*