

# A COGNITIVE INVESTIGATION INTO TRANSLATION THINKING AND TRANSLATION INSTRUCTION<sup>1</sup>

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## ABSTRACT

A major objective of translation instruction is to improve the efficiency of translation thinking. To this end, the research on translation thinking becomes a prerequisite. In light of cognitive psychology, cognitive linguistics and psychology of thinking, this paper first explicates the characteristics of translation thinking process, the types of transfer thinking as well as the qualities and the structure of translation thinking. Then it goes on to summarize the structural differences in translation thinking between novice and expert translators. On the basis of these research findings, this paper proposes that the the priority in translation instruction should be given to the optimization of thinking habits and the development of the ability of monitoring thinking. Suggestions on translation instruction are finally provided.

**KEY WORDS:** cognitive perspective; translation thinking; translation instruction

## 0. Introduction: Translation Thinking and Translation Instruction

Traditional “text-centered” translation instruction always focuses on various translation skills and imposes “right” answers on students. It cannot meet learners’ requirement of efficiently developing their translation competence. Directed at this problem, this paper, from a cognitive perspective, proposes that the priority in translation instruction should be given to optimizing habits of translation thinking and developing the ability of monitoring thinking about translation process.

It is commonly believed that translation process is meanwhile a complex thinking process (Neubert, 1991: 25; Shreve & Koby, 2003: xi; Dimitrova, 2005: 2; Tu & Li, 2007: 16). In addition, an expert translator must experience a stage of thinking training, but the established thinking pattern always influences his/her translation process (Tu & Li, 2007:16). Therefore, if we want to teach learners how to translate, we should firstly guide them to learn how to think procedurally and efficiently when translating. A common phenomenon is that many novice translators often think at random and thus are eager to know about certain effective methods of thinking about solving different types

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of translation problems. In this light, it is obvious that effective translation thinking becomes the basis of developing translation competence.

According to developmental psychology of thinking, education is the dominant approach to thinking development (Zhu & Lin, 1986:102). Therefore translation thinking can be well developed and optimized by systemically-designed training. Developing thinking ability is a major objective of education, which is as important as knowledge acquisition.

The previous researches into translation thinking in China mainly involve the following issues: (1) the importance of sciences of thinking in translation studies (Fang, 1992); (2) some thinking patterns and their characteristics (Feng, 1994); (3) certain differences of thinking underlying the differences between Chinese and English in translation studies (Zhang, 2001; Wang, 1992; Wang, 2001); (4) certain aspects of translation thinking ability in translation instruction (An, 2001; Wen, 2005; Zeng, 2006). In summary, the first three issues seldom refer to translation teaching although they can be beneficial to it. The last aspect for now is only confined to the discussion of translation skills, with little concern with certain guiding principles and methodologies of translation instruction.

Therefore, the present situation of the research into translation thinking and translation instruction needs to be greatly improved, especially when we are facing increasing social requirements for qualified translators and interpreters. With this aim, we propose that instructors must design translation syllabi and curricula on the basis of a systematic methodological guidance in order to change the existing “text-centered” didactics and finally increase the efficiency of translation instruction. The research on translation thinking can exactly provide efficient methodological guidance for translation instruction.

The main research purpose of this paper is to help both translation instructors and learners to acquire systematic knowledge of translation thinking and use it as effective guidance in the organization of their teaching and learning. It will facilitate the development of translation competence. To this end, in this paper we firstly research on translation thinking with an interdisciplinary approach involving the following fields: translation studies, cognitive psychology, cognitive linguistics, and psychology of thinking. The main researched contents involves the basic characteristics of translation thinking process, the types of transfer thinking, the qualities and structure of translation thinking, and the structural differences in translation thinking between novice and expert translators. Further, applying those research findings to translation instruction, this paper puts forward certain guiding principles and methodological suggestions on the training of translation thinking.

## 1. Basic Characteristics of Translation Thinking Process

### 1.1 Cognitive Models of Translation Thinking Process

According to Psychology of Thinking, as a senior cognitive activity, thinking involves not just such junior cognitive activities as sensation, perception, and memory but the senior capability of generalization and inference (Shao, 2007: 1). The main approaches of the modern psychology of thinking involve Gestalt psychology (thinking is constant adaptation of the Gestalt), behaviorist psychology (thinking is silent language and behavior as well), information processing model (thinking is serial information processing), as well as connectionism model (thinking is parallel information processing of the neural network). Among them, the information processing model and the connectionism model have established relatively greater influence in recent years.

In the late 1970s, with the rapid development of cybernetics, information theory and computer technology, the paradigm of information processing became a popular approach to human cognition. Applying the information processing model to the translation thinking process thereby became an important research method. Fig. 1 (cf. Liu, 2007: 7) presents the information processing model of translation thinking.

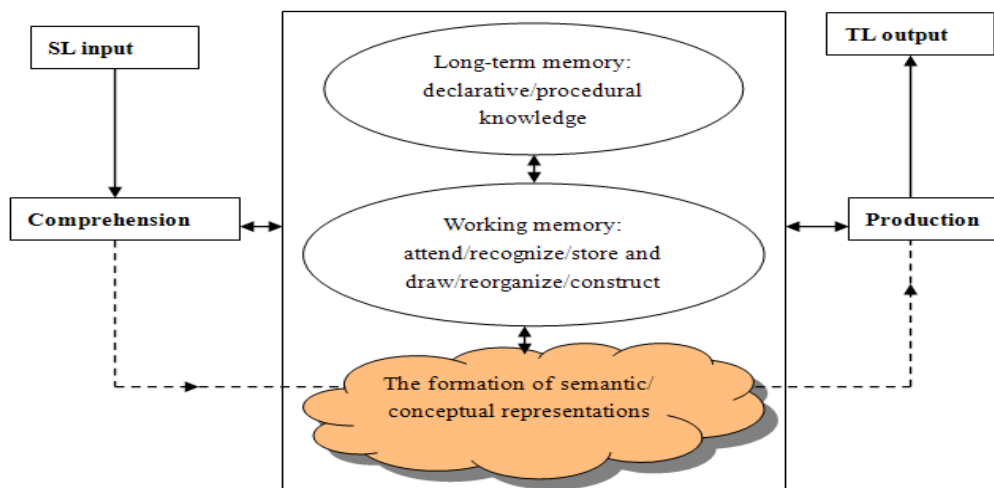


Figure 1: The information processing model of translation thinking process

Fig. 1 displays the serial information processing from SL input to TL output.<sup>2</sup> The thinking process of translation in this way forms a process of information transference and reconstruction from comprehension to production with the cognitive system as the supporting mechanism.

In the mid 1980s, the connectionism model of cognitive psychology was in its bloom. Different from the serial feature of information processing, connectionism highlights the parallel feature of it. The neural network of connectionism model involves three levels of neural units: the input level, the latent level, and the output level. Its structure can be

<sup>2</sup> Here SL is the abbreviation of source language. Besides, there are other abbreviations in this paper: TL—target language, ST—source text, TT—target text, TAPs—think aloud protocols.

defined as topological, which by nature presents the correlations of the whole neural network. The connectionism model of translation thinking process can be illustrated by Fig. 2 (ibid: 16).

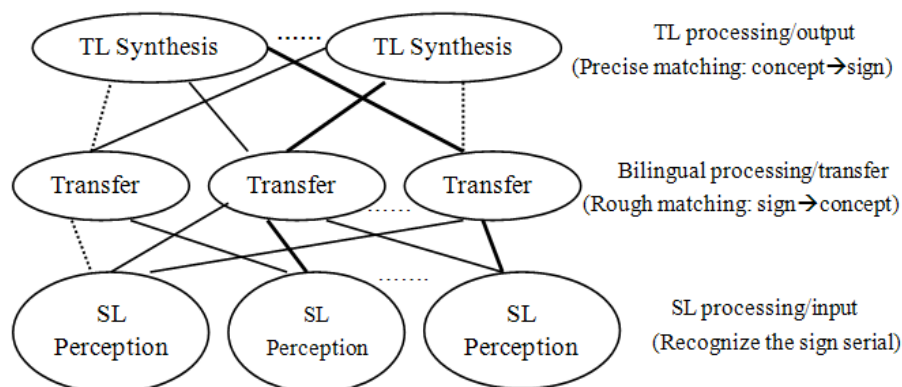


Figure 2: The connectionism model of translation thinking process

Fig. 2 indicates that the three levels of neural units constitute a complex process of information process, which displays the characteristics of both the work division and the correlation of the three neural levels. In Fig. 2, the three kinds of connection (broken lines, thin lines, and thick lines) reflect the power differences in connection between the three levels of neural units, and meanwhile indicate that there exist both positive and negative connections in the whole neural network. Besides, the whole structure of translation thinking process in Fig. 2 also displays three typical features of connectionism model: distributed representation, parallel processing, and mutual complementation of neural units (ibid: 17-19).

## 1.2 Analysis of Translation Thinking Process

The two cognitive models mentioned above can be regarded as two prototypes of translation thinking. They present both similarities and differences and both reveal certain characteristics of translation thinking process. In fact, supplemented by further details of translation information processing, the two prototype models have been developed into complex models of translation process, such as Bell (1991: 81), Kiraly (1997: 156), Danks & Griffin (1997: 174), and Moser-Mercer (1997: 180-81). Although these models present certain differences in details, they all still display some basic characteristics of translation thinking process.

Firstly, translation thinking process involves serial processing. From SL input/perception to complex transfer process (the one-way sequence from long-term memory to working memory and to semantic representation), and then to TL output, the whole process presents the feature of serial processing.

Secondly, translation thinking process involves recursive thinking as well. From SL input/perception to transfer process (the two-way sequences of long-term memory,

working memory, and semantic representation), and then to TL output, the whole process is also a reversible process, which shows the interaction of bottom-up and top-down thinking processes, although the interactive process may present different cognitive costs at different stages. The recursiveness of translation thinking process has been verified by the empirical research (Buchweitz & Alves, 2006).

Thirdly, translation thinking displays both positive and negative connections in the interaction of different levels of neural units.

It should be noted that the two above-mentioned prototypes of translation thinking process in Fig. 1 and Fig. 2, growing from modeling general cognitive psychological models, inevitably present a certain deficiency. Although the two models both present a certain transfer process, they cannot highlight the speciality of bilingual transfer different from single language processing. The model in Fig. 1 does not indicate which kind of transfer it is while the model in Fig. 2 only marks a transfer between the sign and the concept. In addition, the meaning of “concept” is too general and vague to be much helpful to our understanding of the nature of translation thinking.

In the matter of the transfer thinking of translation, Gommlich (1997) once argued that there exist two different representational perspectives corresponding to SL and TL in the process of translation thinking. He thought that representational perspective “is a kind of cultural position reflected in language” (62). He said:

the fact that translators more or less automatically extrapolate representational perspective in their L1 proves that representative perspective belongs to the basic set of cultural-situational influence on language use and that it is fundamentally intertwined with basic cognitive process of text production. (65-66)

So it is clear that the representational perspective in fact refers to the cultural-situational context and the thinking model closely relevant to it. Gommlich (1997: 67) also argued that for a translator the ability to switch from one representational perspective to the other is a basic process that may be supported or hampered by various factors. So, we can see that translation is not only the transfer between languages but the transfer between two different thinking models, which are closely related to the respective cultural-situational contexts.

In addition, the complex relationship between language, culture and thinking shows that the difference in thinking modes closely related to certain cultural contexts has become the deepest and most dominating element of the linguistic disparity. Seemingly, translation transfer is a transfer between languages, and yet a deeper layer of transfer is in fact a transfer between different thinking modes underlying L1 and L2. In this light, we can conclude that unlike in the case of single language information processing, the most important characteristic of translation thinking process is bilingual interactive thinking.

Taken together, the major characteristics of translation thinking process should be (1) both serial processing and recursive processing, (2) the universal interaction of neural units, (3) bilingual interactive thinking.

## 2. Types and Qualities of Translation Thinking

Having discussed the characteristics of translation thinking process, in this section of the paper we will make a detailed study of the types and qualities of translation thinking on the basis of the research findings of cognitive linguistics and psychology of thinking. The significance of this section lies in its detailed analysis of the speciality of translation thinking different from the general single-language-thinking.

### 2.1 *Types of Transfer Thinking of Translation*

Such Chinese scholars as Huang (2004: 4), Wang (2002: 124-29), Liu (2005: 92), Zeng (2006: 184), Xu (2006: 6), and Wen (2006: 9-10), once discussed the types of translation thinking, including abstract thinking, visualized thinking, intuitional thinking, monitoring thinking, presupposing thinking, creative thinking, and so on. All these types of thinking should belong in general ones. Translation thinking in fact presents not just the general properties of thinking but its speciality different from the general ones.

The speciality of translation thinking lies in its feature as the transfer between two languages and cultures. In this sense, translation thinking should be a transfer thinking. And the general properties of translation thinking mentioned above must center around this feature. Kussmaul (1995) once discussed the creativity in translation. He argued that “creativity is not a gift of the select few but a basic feature of the human mind and that we can all be creative when we translate” (ibid: 52). In addition, Kussmaul (2000) put forward five psychological types of creative translation in the process of transfer with such cognitive linguistic ideas as figure-ground, sense-frame,<sup>3</sup> as well as prototype and category. The five psychological types include chaining categories, picking out scene elements within a frame (i.e., a scene of TT replaces a frame of ST), enlarging a scene, framing a scene (i.e., a frame of TT replaces a scene of ST), and creating a new frame. They constitute five types of transfer thinking of translation, which describe the

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<sup>3</sup> Frame was developed by the cognitive linguistics C. Fillmore in the 1970s. Later he changed its meaning from the linguistic definition [frame is “any system of linguistic choice that can be get associated with prototypical instances of scenes” (1974: 124).] to cognitive definition [frames are specific unified frameworks of knowledge, or coherent schematization of experience (cf. 1985: 223).]. Kussmaul adopted this concept of frame in the senses-and-frames semantics of Fillmore (1977) and supposed that “scenes are linguistically represented by frames” (Kussmaul, 2000: 120) and “a frame is more abstract and consists of fewer words than a description of a scene” (ibid).

translator's different strategies in matching ST with TT.

Besides, this paper develops other three types of transfer thinking: creating a new scene, scene to scene and frame to frame. So the transfer thinking of translation can be eight types altogether. Table 1 explains and exemplifies the contents of the eight types of transfer thinking.<sup>4</sup>

The types of transfer thinking of translation	The types of the match between ST and TT	Simple examples
Chaining categories	ST and TT as different categories (with different perspectives and foci) of a same scenario	《红楼梦》—— <i>The Story of the Stone</i> —— <i>A Dream of Red Mansions</i>
ST Frame into TT scene	An abstract frame of ST was transferred into a concrete scene in TT	得意忘形——have one's nose in the air 开门见山——come straight to the point
ST Scene into TT frame	A concrete scene of ST was transferred into an abstract frame in TT	reaping what he has sown——咎由自取 快马加鞭——speed up
Creating a new TT scene	A scene of ST was transferred into a new scene in TT	雨后春笋——shoot up like mushroom burn one's bridge——破釜沉舟
Creating a new TT frame	A frame of ST was transferred into a new frame in TT	kiss——握手
Enlarging the ST scene	A scene of ST was transferred into an enlarged scene with additive elements	引狼入室——set the wolf to keep the sheep
ST scene to TT scene	Equivalent match between scenes of ST and TT.	fish in the troubled water——混水摸鱼
ST frame to TT frame	Equivalent match between frames of ST and TT	熟能生巧——practice makes perfect

Table 1: Types of transfer thinking of translation and their contents

The multiplicity of transfer thinking indicates that in the process of translation the translator needs to employ different ways of thinking when he or she matches ST with TT because of certain social, cultural, linguistic and thinking differences involved. In terms of its function, the research on the types of transfer thinking, investigating in cognitive-linguistic perspective, integrates language with thinking organically and thereby effectively explains the psychological mechanism of the thinking types of language transfer involved in translation. More importantly, the research findings can well facilitate translation instruction, which will be discussed in the last part of didactics in this paper.

<sup>4</sup> Table 1 only provides simple examples of the phrasal translation between English and Chinese because of limited space here. In real translations (esp. literary translations), it is possible for the eight types of transfer thinking to be applied to different layers of linguistic structures and with different languages. Kussmaul (2000) once cited some examples of translation between English and German.

## 2.2 Qualities of Translation Thinking

While the types of thinking describe its general properties, the quality of thinking measures the degree of its development and individual differences. The study of thinking quality in fact is an important theoretical issue of psychology of thinking and thus becomes the key to improving thinking ability and intelligence. According to psychology of thinking, the qualities of thinking mainly involve profundity, flexibility, originality, criticalness, and agility (cf. Zhu & Lin, 2002: 584-94). In light of this research finding, the qualities of translation thinking can be further analyzed accordingly as follows in Table 2.

Thinking Qualities	The general contents	The contents in the translation process
Profundity	Thinking in depth, grasping the regularity and nature, and foreseeing the process	A good command of the bilingual structures and the different thinking models
Flexibility	Divergent thinking: various ways of employing knowledge and strategies	Divergent thinking of developing various translation strategies and solving translation problems flexibly
Originality	Independent and creative thinking with production of social and individual values as well as original elements	Integration of various translation strategies and knowledge into creative translation
Criticalness	Strictly estimating the thinking material and carefully examining the thinking process	Carefully analyzing different layers of ST and strictly choosing translation strategies
Agility	Speedy response to problems and situations	Fluency of thinking in the translation process, speedy decision-making of translation strategies

Table 2: The qualities of translation thinking

A clear awareness of the types and qualities of translation thinking presented in Table 2, as both theoretical and ideological preparations, is very beneficial to improving translators' thinking qualities in translation instruction. The discussion about it will be treated in the last part of this paper.

## 3. Structural Differences of Translation Thinking between Novice and Expert Translators

Empirical researches with modern computer technologies have revealed certain structural differences of translation thinking between novice and expert translators, which can be reflected not just in various ways of dealing with textual materials but in different stages of translation process. Before our discussion about these structural



differences, this section firstly offers a detailed analysis of the structural elements of translation thinking in light of the psychological research into the structure of thinking.

### 3.1 Structural Elements of Translation Thinking

According to psychology of thinking, the structural elements of thinking mainly involve its purpose, process, material, production, monitor, quality, as well as its cognitive and non-cognitive elements. Accordingly, the structural elements of translation thinking can be further explored in these aspects and on the basis of an analysis of translation process. Table 3, as the result of this exploration, presents the concrete contents of the structural elements of translation thinking.<sup>5</sup>

The structure elements of thinking	Main contents	The structural elements of translation thinking
Purpose	Comprehending and solving problems	Comprehending the ST, transferring the thinking models and linguistic signs, and producing the TT
Process	Basic process: analysis and synthesis (abstraction and generalization, comparison and categorization; systematization and reification)	Analysis and synthesis of the ST and TT (morpheme, grammatical, stylistic and semantic layers), (cultural- situational) context, and transfer strategies
Material	Perceptual material (sensation, perception, representation), and rational material (concept, judgment, inference)	World of works (linguistic representations, expressive ways, logic and images), subjective world (semantic categories, the structure of personality, image schema), objective world (sign system, cultural conception, reality)
Production	Concept, judgment, inference	Logic and images, expressive ways, and linguistic representations of the TT
Monitoring or self-adjustment	Meta-cognitive function: focusing, controlling, and adjusting	Monitoring translation process, finding problems in time and adjusting and optimizing translation strategies
Non-cognitive elements	Motive, interest, emotion, attitude, volition, personality	The motive, interest, emotion, attitude, volition, and personality of the translator in translation process

Table 3: The structural elements of translation thinking

<sup>5</sup> In Table 3, the items of “quality” and “cognitive elements” are not discussed because the “quality of thinking” has been discussed in the above section, and the “cognitive elements” is in fact much overlapped with the item of “process”.

The detailed description of the structural elements of translation thinking in Table 3 helps both instructors and learners to develop clear and effective cognition of translation thinking, and thereby greatly facilitate the improvement of their meta-cognition of translation process.

### ***3.2 Structural Differences of Translation Thinking between Novice and Expert Translators***

Exploring structural differences of translation thinking between novice and expert translators will make instructors and learners become more aware of the gap in translation competence between learners and the expert in more detailed way. It thus will help them to establish clear and detailed objectives of learning and to design more efficient learning plans and methods as well. Of the aforementioned structural elements of thinking, the thinking process is most difficult to inquiry clearly. But the new empirical research findings have revealed it to some extent. Since the mid 1980s, with the research methods of experimental psychology and such modern technologies of computer software as TAPs, Translog, and Camtasia recorder, the “black box” of the translator’s brain has won more and more attention.

A recent empirical research made by Alves and Gonçalves (2007), based on the relevance theory and connectionism theory, contributes its findings about the cognitive model of translation competence. They find that expert translators display the following cognitive characteristics (ibid):

- (1) A higher level of ability to coordinate different demands of translation tasks and to integrate procedurally, conceptually and contextually encoded information into a coherent whole;
- (2) A higher level of ability to integrate the periphery with the central parts of their cognitive systems in an attempt to create a situated perspective for their cognitive functioning;
- (3) Contextually embedded information and meta-cognition drove their problem-solving and decision-making processes;
- (4) Reliance on themselves in passing judgment on their own decision-making processes.

By contrast, novice translators display the following cognitive characteristics (ibid):

- (1) Insufficient use of contextualized cues and too strong reliance on the dictionary-based meaning of words instead of contextualized meaning;
- (2) Failing to bridge the gap between procedurally, conceptually and contextually encoded information;
- (3) Source and target languages mutually affect one another;
- (4) Being difficult to determine at which level a translation unit should be processed in order to generate strong contextual effects and a maximized

interpretive resemblance;

(5) An insufficient meta-cognition, which is connected only to the structural features of language and text production;

(6) Being rather insecure when it comes to decision-making.

These research findings demonstrate that there exist obvious gaps between novice and expert translators in the meta-cognition, thinking material, thinking process, cognitive elements, and non-cognitive elements (especially confidence) of translation thinking.

In another empirical research, by regulating (cognitive) effort and (contextual) effect relations, Alves (2007:32) found that expert translators present an ability to monitor and measure their own thinking and language performance and thereby generate certain meta-representations which can strengthen the existing contextual information. This ability is exactly the function of meta-cognition. Jakobsen (2005) once explored expert translators' thinking process of knowledge processing with empirical research (TAPS). He found that at the beginning of translating, expert translators could judge the range of knowledge with subject knowledge of ST and then build a semantic field to deal with some vague meanings of words with the subject knowledge. They could also employ various translation resources efficiently and develop multiple translation strategies (ibid: 179).

In addition, Jakobsen (2005) observed that there is a great difference in time allocation between novice and expert translators. Compared with novice translators, expert translators used less time at drafting stage and used more time at revising stage. This indicates that expert translators think much more fluently and profoundly than novice translators. Besides, expert translators used more time at both the beginning stage and the final stage in translation process, because expert translators took a comprehensive view of the translation task and thus considered it more widely and deeply while novice translators considered partly at these stages.

So far, the empirical research into translation process has made great achievements. The research subjects involve the cognitive differences between expert and novice translators, translation expertise, translation strategies (Shreve, 2006; Ericsson, 2002), the development of translation competence (Séguinot, 1991), and so on. These empirical researches present certain differences in the translation thinking and strategy between novice and expert translators. Besides, in the non-cognitive elements, expert translators also hold commendable professional ethics, such as their strong sense of responsibility for the TL readers.<sup>6</sup> All the above research findings about translation expertise can be good guidance for translation didactics.

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<sup>6</sup> We can encourage learners to read the biographies of eminent translators and learn good professional and personal ethics from them.

#### **4. To Optimize Thinking Habits and Develop Monitoring Thinking in Translation**

Based on the above research of translation thinking, it is proposed that the main objective of cultivating translation thinking ability is to optimize thinking habits (including optimized thinking procedural/process and good thinking qualities) and at the same time to develop the ability of monitoring thinking step by step.

Each learner is an individual with independent thinking. In translation instruction, all the learners in a class present both similar and diverse characteristics in translation thinking. So before instruction, under the guidance of aforementioned research findings of translation thinking, instructors should firstly investigate learners' cognitive features with some practical methods, such as questionnaire, interview, empirical research, and so on. With certain concrete problems of translation thinking in mind, the instructor has made a good preparation for his/her design of translation instruction.

More importantly, the above research findings (the basic characteristics of translation thinking process, the types of transfer thinking, the structural elements and qualities of translation thinking) can be effective guidance for developing translation thinking ability in translation instruction.

##### ***4.1 Basic Characteristics of Translation Thinking Process as Guidance for Optimizing Thinking Habits***

To optimize the habit of translation thinking is both to optimize the process of translation thinking and to develop the good qualities of translation thinking. We have discussed the basic characteristics of the translation thinking process in the first part of this paper. They involve serial processing and recursive processing (simultaneously), the interaction of neural units, and the bilingual interactive thinking.

The characteristic of serial processing and recursive processing of the translation thinking process requires instructors to guide learners to think both procedurally and divergently in translation process. For example, the instructor can teach them: (1) how to coordinate the different demands of the translation tasks at the beginning stage, that is, how to integrate subject knowledge, text types, translation brief, readers' expectation, and possible relationship between ST and TT into a whole as reference for translation decisions; (2) how to optimize translation thinking at the stages of comprehending, transferring and producing, that is to learn the mutually complementary thinking of the three stages, to be aware of prior elements that should be considered in transferring, and to avoid mutual interference of languages, and so on.

The characteristic of recursive processing of the translation thinking process indicates that instructors should guide learners to form the habit of the repeated and careful thinking about and comparison between ST and TT (in terms of linguistic, structural,

and stylistic aspects), SL culture and TL culture, ST readers and intended TT readers in translation process, and then make decisions on the basis of those thoughtful considerations. With this thinking training, learners can be fully aware of the complexity of translation thinking and thereby improve the profundity and criticalness of their thinking.

The interaction of the neural units of translation thinking indicates that translation process, as a comprehensive thinking process, requires the translator to integrate the procedurally-, conceptually- and contextually-encoded information into a coherent whole in the translation process with flexible employment of various types of translation thinking. Thinking training in this aspect can help learners to improve the originality of their thinking. In the meanwhile, instructors should try to foresee possible difficulties and problems in translation process according to learners' cognitive characteristics, and thereby guide them to build positive neural interactions and avoid negative ones. For example, the linguistic, cultural and thinking comparison between languages can help students to discern the differences clearly and thereby avoid negative transfer between the two different language structures and thinking styles.

The bilingual interactive thinking of translation also require us to lay emphasis on a comparative study of languages, cultures, and thinking styles, making the differences clear to learners. With this help, the learners will then build flexible and agile transfer thinking when translating.

#### ***4.2 Research Findings of Translation Thinking as Guidance for Developing Monitoring Thinking***

The clear self-conception of the translation thinking process and its characteristics, structure, types, and qualities can guide learners to build metacognition of translation thinking and strengthen their ability of monitoring thinking. It thus has become an important foundation of improving translation thinking ability. The eight types of transfer thinking indicate that we cannot only emphasize „equivalence“ in translation instruction. Instead, we should guide learners to be aware of those various relations of ST and TT and help them to put their theoretical awareness into translation practice with some selected translation exercises involving these types of transfer thinking. So with these translation exercises, learners' transfer ability between two languages will get improved effectively.

In addition, the structure of translation thinking and the structural differences between novice and expert translators suggest that we should help learners know clearly about both the structural elements of their translation thinking and a certain gap in translation thinking between them and expert translators. With a self-conception of their own translation thinking and expert translation thinking as well, they can try to find effective training methods and objectives of their translation thinking with the instructor's

guidance.

In respect of translation instruction, Colina (cf. 2003:5) argued that translation didactics constitutes a subarea of translation studies that employs the findings of theoretical and descriptive researches to develop teaching principles and methods. So in developing translation thinking, instructors and scholars of translation teaching should consider how to turn some relevant theoretical and descriptive research findings into effective teaching principles and methodologies of translation thinking training, which can help optimize learners' thinking process. For example, the functionalism in translation theory emphasizes translation skopos and the functions of the target text. The documentary translation and instrumental translation connect translation skopos and text functions with text types and translation strategies. These theoretical ideas have very good implications for translation thinking process. With these theoretical inspirations, instructors can guide students to think over how to think procedurally and interactively about the translation of different text types.

Each translation theory is only a generalization of a certain aspect or layer of translation and has its own special range of application. So we may integrate different layers of theoretical ideas into coherent principles or methods of translation thinking about different types of translation. It is very useful for learners to adjust their thinking process and methods to different cases of translation. And we believe that learners' thinking ability will be optimized and developed step by step with these theoretically-sensible thinking training and the selected translation exercises. Of course, at each stage of training, learners must do exercises of real translation material with real translation brief. And translation exercises can be assigned partly as team works and partly as individual works. In addition, instructors should arrange certain time for the class to discuss the translation thinking process in dealing with those exercises in order for a wisdom-pooling purpose. Of course, the discussion can also proceed with web-blog and email, which has become highly economic and effective channels of communication today.

## 5. Conclusion

With the help of cognitive psychology, cognitive linguistics, psychology of thinking, and developmental psychology of thinking, this paper developed the research findings of the basic characteristics of translation thinking process, the types of transfer thinking, as well as the structure and qualities of translation thinking. It also puts forward methodological suggestions on translation instruction under the guidance of these research findings. Of course, these research findings of translation thinking and the corresponding teaching suggestions must be applied to detailed teaching materials and teaching methods by each instructor according to the specific situation of his or her class. Instructors have the right to create effective teaching methods for their own lessons. For example, the psychological methods of thinking training (such as, pooling

the wisdom of the masses/ brainstorm/ question-inducing methods) can be applied to translation thinking training; and the think-aloud research method can be put into pedagogical use.

No matter what methods we use in translation instruction, we should follow two basic principles: (1) to help learners form a clear self-conception (metacognition) of translation thinking and constantly optimize their own thinking habit or process according to that self-conception; (2) to help learners solve real translation problems with the optimized habits of their translation thinking.

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