

# An Investigation on Translation Strategies Based on Think-aloud Protocols

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**Abstract**—The main concern of this paper is to explore the translation strategies employed by Chinese participants when they fulfill both E-C and C-E translation tasks. The major findings are as follows: Eighteen strategies of Kiraly's strategies (1997) have been more or less employed by the participants. In addition, six other strategies are identified in this study. Among the twenty-four strategies, the participants employ "Monitor for TL accuracy"; "Self-correction" more in E-C translation tasks than in C-E translation tasks. On the other hand, they employ "Accept interim solution"; "Identify problem"; "SL-TL dictionary search"; "Make intuitive acceptability judgment"; and "Rephrase ST Segment" more frequent in C-E translation tasks than in E-C translation tasks. The number of the strategies employed by the participants increases by the development of their bilingual proficiency and the experiences gained in translation training.

**Index Terms**—translation strategies, cognitive, think-aloud protocols, C-E, E-C

## I. INTRODUCTION

There is no doubt that translation does play an extremely significant role in social reality. Some scholars start to carry out their research on every aspect of translation studies from various theoretical perspectives. Considerable experimental researches had been done in the area of cognitive translation processes all those years. They intended to understand what translators actually do compared to what they are assumed to be doing and tried to access the black box of what goes on during translating. They have focused on various aspects of the process-oriented translation studies and opened new areas in translation teaching field.

With those beliefs in mind, the author of the present research wants to investigate the translation strategies based on think-aloud protocols of twenty translation majors in China. Adopting Kiraly's psychological model (1997) of translation process as the theoretical foundation, mental processes of translation majors in China are explored. The study will contribute to the translator training and translation teaching.

## II. LITERATURE REVIEW

### A. Research Review of Translation Strategies Abroad

Wolfgang Lörcher (1991) defined a translation strategy as (the definition provided by Færch and Kasper, 1983) 'a potentially conscious procedure for the solution of a problem which an individual is faced with when translating a text segment from one language into another.' Löscher (1986, 1991) had conducted a large-scale TAP study to ask 48 German learners of English produce a spoken translation of a written text while thinking aloud. A sequence of core elements constituted each strategy was reported. A series of strategies formed the translation process, which can also be combined in different ways. Despite individual differences, there are regularities that point at the possibility of establishing taxonomies of translation strategies. No translation-specific strategies were found.

Hans Peter Krings (1986) had carried out the experiment to study eight German learners of French as a foreign language translated a text either into or out of French. Krings focused attention on the translation problems and translation strategies based on TAPs. A series of 'problem indicators' were reported. And then, he classified the translation strategies as strategies of comprehension, equivalent retrieval, equivalent monitoring, decision-making and reduction.

Gerloff (1986) described 'text-processing strategies' as '...any metalinguistic or metacognitive comments made or specific problem-solving behaviors affected, during the decoding and rendering of the translation text'. She classified the translation strategies as problem identification, linguistic analysis, storage and retrieval, general search and selection, text inferencing and reasoning, text contextualization and task monitoring.

In 1991, Séguiot studied student translator at different levels of proficiency to translate two similar texts. They translated two advertisements from French into English. Séguiot reported that native speakers of English translating

into their mother tongue show more efficient monitoring and revising strategies, and work more at the textual level, whereas non-native speakers seem to rely more on learned principles and lexical-level processes.

Based on Lörcher's definition, Riitta Jääskeläinen (1993) classified the translation strategies into global strategies (applying to the whole task, namely style, readership etc.) and local strategies (applying to specific items, namely lexical searches). She reported that global strategies are much more frequently used by professionals and semi-professionals (translator trainees) than by non-professionals.

As far as lexical search strategies were concerned, Mondhal and Jensen (1996) distinguish production from evaluation strategies. Production strategies were divided into achievement strategies and reduction strategies (also studied by Chesterman, 1998). Spontaneous association and reformulation formed achievement strategies. Avoidance and unmarked rendering of marked items formed reduction strategies. Evaluation strategies reflected on the adequacy and acceptability of translation equivalents.

Séguinot (1996) studied two professional translators working together at the same task. Four types of translation strategies are identified in such a professional translation. Those strategies included interpersonal strategies (brainstorming, correction, phatic function), search strategies (dictionaries, world knowledge, words) inferring strategies (rereading ST and TT, consult) and monitoring strategies (reread ST and TT, consult, compare units).

In addition, Donald Charles Kiraly (1997) reported studies on the strategies in the process of translating. The problem and strategy indicators are found and more strategies are differentiated. He had investigated the mental aspects of the translation process. The translation strategies drawn from Kiraly's research will be used in the present experiment.

Seen from what we have covered so far, a number of TAP studies, especially early ones, have tried to recognize and classify the translation strategies. And the researchers have concluded that the performance of professionals differs from that of non professionals with regards to the strategies use. Let us now turn to consider what the Chinese researchers had done about translation strategies by means of TAPs.

### *B. Research Review of Translation Strategies in China*

To the knowledge of the author of present paper, not many Chinese scholars carried out the researches on the translation strategies. In the year of 2000, Hansong Cai stressed the great importance of research into translating process and briefly discussed the origin and classification of verbal protocols. Then it dealt with the specific procedure in the application. He attempted an investigation into the thinking process of three subjects in the given task of translating English sentences of cause-effect relations into Chinese. To broaden the research scope, Hansong Cai and Jiayao Guo conducted the psycholinguistic case study on the translating process of three subjects in the given task of translating English sentences of double negation into Chinese.

In 2002, Jinquan Wang carried out the research of translating English sentences with attributive clause into Chinese. Jun Wen explained the concept of "translation competence", introduced "linguistic/text competence", "strategic-competence" and "self-monitoring competence" by adopting concrete examples in 2004. In the same year, Min Han found that domestic and foreign theorists of translation studies applied the learning strategies from three aspects. Dechao Li (2004) reviewed the development of TAPs translation research over the past years, he pointed out its operational pitfalls and methodological limitations despite its marginal success in some areas. His research concluded by offering some suggestions for the future development of TAPs translation research.

Chen Gao (2007) studied the translation strategies of the translators when dealing with CSIs. The small-scale investigation involved an experiment to elicit TAPs from six participants, two competent professional translators, and four advanced language students. Their TAPs were coded and analyzed both qualitatively and quantitatively, with regards to their translation strategies of CSIs, namely the problem-solving strategies and the manipulation strategies. Junxia Dai (2009) made a review on the tapping translation process by applying the theory and method in psychology. Qiulan Zhai (2009) reported the translation strategies of the 32 student translators when dealing with CSIs.

Dandan Tao (2010) adopted TAPs methods to explore the subjects' use of translation strategies and their relation to the translation performances in TEM8. It is found that the two strategies, namely "back translate" and "recontextualize", are not used in CE or EC translation, and that "rephrase" is more frequently applied in CE than in EC. Besides, strategies used by participants of higher scores out number those of lower scores. Gaoyan Liang (2010) carried out an experiment to find out translating behaviors and translating strategies between experienced translators and inexperienced translators.

After such a brief scanning, a conclusion can be drawn: at the very beginning, the researchers focused their attention not on translation strategies but on metacognitive strategies and cognitive strategies in SLA. Then, most researches were conducted from empirical perspective. In spite of some think-aloud protocols experiments, the present researcher tried to conduct this research as a contribution to the translation strategies.

### III. RESEARCH DESIGN

The current research will take Donald Charles Kiraly's model as the theoretical foundation, which is based on the introspective data collected from the experiment of think-aloud-protocols. Kiraly's strategy indicators will be applied to analyze the data from think-aloud protocols although it is still a challenge to discover how the mental mechanisms function in the translating process.

### A. Aim of the Research

Therefore, this research explores into translation process empirically both with qualitative and quantitative analysis. After data collecting, the qualitative analysis, that is, the mental translation strategies used by the participants will be recorded, described, and analyzed, will be done as well as a quantitative analysis using the software Statistical Package for the Social Sciences (SPSS15.0). Then, the use of translation strategies in the translation process can be explored further.

### B. Research Questions

More specifically, the present study will answer the following questions:

- Which prevailing translation strategies can be identified in the translation process of Chinese students?
- Which strategies have pronounced tendency in the E-C and C-E translation process?
- What is the difference in the translation strategy use in terms of different students?

### C. Research Method

Think-aloud means a special case of introspecting. Regarding translation process as a problem-solving process, some researchers have made the suggestion that it should be possible to study it by means of TAPs. The theoretical framework for TAP experiments comes from *Protocol Analysis--verbal reports as data* by Ericsson and Simon (1993), who work with a model of human cognition as information processing. So far, TAPs have focused on translation strategies (Lürscher 1986 and 1991; Gerloff 1986; Jääskeläinen 1993; Krings 1986; Seguinot 1991 and 1996), automaticity of processing (Jääskeläinen and Tirkkonen-Condit 1991; Jääskeläinen 1993 and 1997, Ivanova 1998) and affective factors (Kusmaul 1991; Laukkanen 1996; Jääskeläinen 1997; Tirkkonen-Condit 1997).

### D. Participants

With the aim of presenting the actual process of translation, the translation major students will be selected for the present protocols. This study collected TAPs data from two groups of participants. First of all, ten fourth-year translation majors, who have agreed to act as test subjects. The first five are called higher-score group; the last five are named low-score group. Then, ten second-year translation majors are chosen from total number of thirty-one according to their English proficiency: the first five are called higher-score group; the last five are named low-score group. All of them have Chinese as their mother tongue and have also received a period of time of translating training in university.

### E. Testing Materials

Strategic-translating involved problem-solving. It is necessary to use the texts containing translation problems for the solutions of which the subjects must consider the problems solvable and ensure that they can make an effort to solve them by employing strategies. With those ideas in mind, four pieces of translating texts were chosen. Two English texts need to be translated into Chinese. Two Chinese texts need to be translated into English. Text One and Text Three may be much easier for the students while Text Two and Text four are very difficult for them. In addition, ten English majors were randomly selected for the pilot think-aloud translating task of all these texts. Thus, the enough time restriction was found: one hour for each text.

### F. Instruments

#### 1. Aiding devices of think-aloud protocol

The participants of each group were taken, in turn, to language lab with audio-recording device on each desk. Each of the subjects translated aloud and an audio-record device was employed to record the words either in English or Chinese uttered by the subjects. Furthermore, two cameramen carried their video cameras to give a shot of the whole experiment process, which facilitate a more detailed analysis for these various processing activities. Eventually, their cooperation proved to be a success in data collecting and think-aloud protocols coding.

#### 2. Observation notes

Two video devices were at the same time applied while the participants doing the translation. One was panoramic camera in order to obtain the translating process of the whole lab. The other was used for close-up shot so as to observe some details and special features of certain subject. Five assistants of the researcher paid close attention to each subject and took observation notes carefully and clear some doubts with the participants after the translating tasks. Then, the researcher also made observation notes of the videotapes. Ultimately, a discussion concerning these notes was held between the assistants and the researcher, which could result in the in-depth study upon the translation behaviors. Thus, it is feasible to investigate the subjects' translation strategies.

#### 3. Rating scale

The rating scale of translation product is adopted from *Practice Tests and Lectures for English Majors (Grade Eight)* edited by Zhu Yanhua, which is supposed to show the quality of the translation in detail. The translation product of the participants was rated in light of five grades.

#### 4. Post-translating questionnaire and interview

There are two types of post-translating questionnaires, one (A) for English-Chinese translation; the other (B) for Chinese-English translation, each of them consists of two parts. The questionnaire is conducted after the translation task,

which first deal with the information on subjects' background, impression on the task, comment on their work and time-consuming, and retrospection of the translation process.

### G. Procedures

#### 1. Think-aloud training

The researcher talked in Chinese with each group of participants respectively, making a brief self-introduction, explaining the think-aloud method, reassuring the subjects that the translation would be rated by some researchers who would have no access to their names, the results of the research would be used for research purposes only. The participants are instructed to verbalize all the thoughts that occurred to them while translating. After the instruction, the researcher then explained tape-recording and videotaping to assure the subjects that they are the helper of the research, but not a disturbance. The researcher showed the subject how to think aloud by reading a passage from a Chinese material. After the demonstration, the researcher thanked the subjects for their cooperation and promised to deliver each of them an elegant souvenir at the end of the experiment.

#### 2. Data collection

Each of the subjects translated aloud and an audio-record device was employed to record the words either in English or Chinese uttered by the subjects. Then the questionnaires (a & b) and the interview were followed. The data collected from the experiment fall into two main categories, namely the translation products and the think-aloud protocols. Each of the translation products was rated by two teachers, and the final score was the average of the two scores given by the experienced teachers. The intersubjective validity of the score is 0.8964. Then, the scores were kept for the consequent data analysis. The researcher transcribed the exact words of the think-aloud protocol, marked the time span of the pauses and coded them according to twenty translation strategy indicators proposed by Donald Charles Kiraly (1997). Some different strategies are identified during the whole analysis process.

The quantitative analysis of the data in this research was implemented by SPSS (15.0). It was employed to find the co-relationship between the scores of different grades, groups, together with the relationship between the strategy use and the texts with different difficulties, as well as the different translation tasks. Software of Word 2007 and Excel 2007 were applied to calculate some minor problems in data analysis.

## IV. DATA ANALYSIS AND DISCUSSION

### A. The Reliability and Validity of the Data

The present study is based on think-aloud protocol, so the reliability and validity of this method should be conformed first. The information gotten from the twenty participants showed that the think-aloud method did not interfere them very much. Most of them finished the translation tasks within the limited time (one hour for each text). As for the noticeable pause, all these subjects kept silent less than 20% of the whole translating time, and the average percentage of their pause is 9.5% of their translating task (just for one text). This meant each subject's thought elicited was sufficient for the think-aloud protocol and available for analysis, and on average, more than 90% of the subjects' thought could be captured and analyzed for the study.

### B. Data Analysis and Discussion

#### 1. On the score of translation products

When it comes to the ultimate score of all the E-C and C-E translation products produced by participants, the researcher classified them into four groups: High<sub>high</sub> (H<sub>h</sub>) referred to the first group with the highest score; High<sub>low</sub> (H<sub>l</sub>) and Low<sub>high</sub> (L<sub>h</sub>) referred to the second and third groups with medium score; Low<sub>low</sub> (L<sub>l</sub>) referred to the last group with the lowest score. This result was consistent with the original groups: high-score (4A1-4A5) and low-score (4B1-4B5) groups of Grade Four together with the high-score (2A1-2A5) and low-score (2B1-2B5) groups of Grade Two. ( $r=0.913$ ,  $P=0.000$ ).

a. Taking the testing materials (E-C; C-E), the degree of difficulty (Easy; Difficult), the grades of participants (Grade Four; Grade Two) and original groups (high-score and low-score groups) as independent variables and the scores of the translation product as dependent variable, an Univariate ANOVA suggested that there existed a significant interaction only between the testing materials, the grades of participants and the scores of the translation product. (See Table 1) Therefore, it could be argued that the translation scores varied with the change of the testing materials (E-C; C-E) and also with the growth of university grades (Grade Four; Grade Two).

TABLE 1  
UNIVARIATE ANOVA OF TRANSLATION SCORES

Source	Hypothesis df	Error df	Mean Square	F	Sig.
materials+grade	1.000	15.000	669.338	8.310	.011*

F(1,15)=8.310, \* p=0.011<0.05

b. Based on the above data, Independent Sample Test was conducted on the differences between second-year students and fourth-year students on the four testing materials (T1; T2; T3; T4). The results suggested, concerning the testing materials of T1 and T2, there was reliably significance on the two grades of participants and fourth-year students were

significantly better than the second-year students. (See Table 2a) As to the testing materials of T3 and T4, there was no significant difference. Though the fourth-year students were better than the second-year students, there existed no significance in statistical sense.

TABLE 2A  
INDEPENDENT SAMPLES TEST OF THE PARTICIPANTS FROM TWO GRADES

	<i>t</i>	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
T1	-2.951	18	.009*	-21.7000	7.3525
T2	-2.878	18	.010*	-18.3000	6.3579
T3	-1.492	18	.153	-10.9000	7.3064
T4	-1.636	18	.119	-10.6000	6.4799

*t* (18) = -2.951 \* *p* = 0.009 < 0.05; *t* (18) = -2.878, \**p* = 0.010 < 0.05

Notes: T1---Easy E-C Translation T2--- Difficult E-C Translation T3--- Easy C-E Translation T4---- Difficult C-E Translation

c. Not taking the difficulty degree of the testing materials into account, but only the texts of these materials (E-C, C-E), the results suggested that there was reliably significance on the two grades of participants and the fourth-year students were significantly better than the second-year students (See Table 2b)

TABLE 2B  
INDEPENDENT SAMPLES TEST ON THE PARTICIPANTS FROM TWO GRADES

	<i>t</i>	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
T1 & T2	-4.220	38	.000*	-20.0000	4.7389
T3 & T4	-2.222	38	.032*	-10.7500	4.8373

*t* (38) = -4.220 \* *p* = 0.000 < 0.05; *t* (38) = -2.222, \**p* = 0.032 < 0.05

Notes: T1 & T2--- E-C Translation T3 & T4---- C-E Translation

All in all, concerning whether the testing materials or the difficulty degree, the participants' translation score was becoming better and better with the growth of university grades. There was positive correlation with the translation competence and the training periods of those student translators. With the development of their English proficiency, the cognitive potentials of both native and foreign languages, and experiences gained both from books and outside world, their translation competence was also improved. The participants did better in E-C translation materials better than that of C-E. That is to say, they had no trouble in the receiving of SL (English as their foreign language) and the producing of TL (Chinese as their native language). Such E-C translation tasks were comparatively much easier to them. On the other hand, the researcher found that it turned to be painstaking for them to fulfill the C-E translation tasks. To investigate it deeply from the thinking model perspective, the participants had no trouble in the receiving of SL (Chinese as their native language), but had great difficulty in the producing of TL (English as their foreign language). As far as the semantic generation was concerned, it was easy to understand the meaning of the ST. Meanwhile, as to the TT production, they were not so experienced in dealing with the sentence structure and textual construction in English. As a consequence, the C-E translation tasks appeared to be more difficult for them. The implication in translation teaching was that more attention should be paid to the textual teaching of English and the improvement of English proficiency of the translation majors.

2. On the application of translation strategies

Translation strategies in translating process were the major concern of the present study. The application and distribution of translation strategies proposed by Kiraly and other strategies proposed by the researcher were totally investigated here and below.

a. Taking the two types of testing materials E-C (T1;T2) and C-E (T3;T4) into account, Chi-Square Tests on each strategy (S1-S26) employed by participants from different grades were conducted respectively. The results suggested that there was reliably significance on the participants in employing the following eight strategies. (See table 3a) At the same time, no significance was shown on the participants in employing the other strategies when they dealt with E-C and C-E testing materials. Moreover, there did not show any appearance in the application of S3 and S5. It could be concluded that the Chinese participants in this study did not employ such strategies as "Back Translate" and "Break off translation and start over".

TABLE 3A  
CHI-SQUARE TESTS OF STRATEGY APPLICATION

Strategy	Value	df	Asymp. Sig. (2-sided)
S8	6.149	1	.013*
S11	3.869	1	.049*
S12	4.540	1	.033*
S14	4.748	1	.029*
S17	13.780	1	.000*
S22	6.091	1	.014*
S24	12.014	1	.001*
S25	4.305	1	.038*

\* *p* < 0.05

As to the application of S8, the participant employed this strategy “SL-TL dictionary search” 257 times of the total number 436 (59%) in E-C translation tasks; while 265 times of the total number 394 (67%) in C-E translation tasks. It could be seen that they were more likely to resort to dictionary search in C-E translation in order to make sure of the TL production. While the automatic production of native language played an important role in E-C translation. As for the application of S11, the participant employed this strategy “Monitor for TL accuracy” 44 times of the total number 436 (10%) in E-C translation tasks; while 25 times of the total number 394 (6%) in C-E translation tasks. It seemed that they wanted to monitor the production of the native language, but not that of foreign language, for they were more confident in the manipulation of native language. As to the application of S14, the participant employed this strategy “Recontextualize” 19 times of the total number 436 (4%) in E-C translation tasks; while 7 times of the total number 394 (2%) in C-E translation tasks. The difference was not so distinct that many efforts should be made to strengthen the textual teaching of translation. As for the application of S17, the participant employed this strategy “Rephrase ST Segment” 3 times of the total number 436 (0.6%) in E-C translation tasks; while 18 times of the total number 394 (4.6%) in C-E translation tasks. The participants had much trouble in rephrase the segment of source language as English; while they took it easy to rephrase the segment of SL as Chinese, their native language, because they could put native language at their disposal. As to the application of S22, the participant employed this strategy “Postpone attempt” 26 times of the total number 436 (6%) in E-C translation tasks; while 10 times of the total number 394 (2.5%) in C-E translation tasks. As for the application of S24, the participant employed this strategy “Read ST segment” 32 times of the total number 436 (7.3%) in E-C translation tasks; while 9 times of the total number 394 (2.3%) in C-E translation tasks. The participants read English so many times so as to get a better understanding of the SL; while they just took interim solution during the C-E translation tasks. This undoubtedly reflects the students’ had more need to comprehend the source text as foreign language than the source language as Chinese, since they held more spacious cognitions in their native language. As to the application of S25, the participant employed this strategy “Self-correction” 45 times of the total number 436 (10.3%) in E-C translation tasks; while 25 times of the total number 394 (6.3%) in C-E translation tasks. In this respect, the participants were good at the self-correction of their TT in Chinese; while not so certain in the monitoring of TT in English.

As to the application of S1, the participants employed this strategy “Accept interim solution” 327 times of the total number 436 (75%) in E-C translation tasks; while 302 times of the total number 394 (77%) in C-E translation tasks. Seen from this, the participants frequently accept interim solution, which was a solid proof for the theory that translating process is a mental process which should consult to the psychology field in order to study it further and deeper. As for the application of S7, the participant employed this strategy “Identify problem” 395 times of the total number 436 (91%) in E-C translation tasks; while 352 times of the total number 394 (89%) in C-E translation tasks. Judge from these, to classify the translation problem was very important for the participants both in E-C and C-E translation. Is it of a pragmatic (situation and style, speech act and illocution, culture, text type conventions) or a semantic (denotative and connotative meaning) nature? One and the same word, phrase, utterance or passage may present different types of problems. They often confronted such situation and identified various problems during translating. As to the application of S10, the participant employed this strategy “Make intuitive acceptability judgment” 229 times of the total number 436 (53%) in E-C translation tasks; while 220 times of the total number 394 (56%) in C-E translation tasks. These data still told us that translation, in some sense, was a kind of mental processing, which made the participants to make some decision. As for the application of S18, the participant employed this strategy “Uncertainty regarding acceptability” 70 times of the total number 436 (16%) in E-C translation tasks; while 50 times of the total number 394 (13%) in C-E translation tasks. It was showed that little monitoring was done to the whole translation process both in E-C and C-E translation tasks.

b. Taking the difficulty degree of testing materials (T1; T3) and C-E (T2; T4) into account, Chi-Square Tests on each strategy (S1-S26) employed by participants from the two grades were conducted respectively. The results suggested that there was reliably significance on the participants while employ the following eight strategies while they dealt with the easy and difficult translation tasks. (See table 3b) At the same time, no significance was shown on the participants while employ the other strategies.

TABLE 3B  
CHI-SQUARE TESTS OF STRATEGY APPLICATION

Strategy	Value	df	Asymp. Sig. (2-sided)
S1	9.545	1	.002*
S7	19.321	1	.000*
S12	7.518	1	.006*
S13	5.145	1	.023*
S17	3.996	1	.046*
S19	9.302	1	.002*
S22	5.697	1	.017*
S25	4.920	1	.027*

\* p < 0.05

As to the application of S1, the participant employed this strategy “Accept interim solution” 297 times of the total number 417 (71%) in easy translation tasks; while 332 times of the total number 413 (80%) in difficult translation tasks.

Because the difficult translation tasks were beyond their control, they just accepted interim solution to solve the translation problems. However, in dealing with the easy ones, they could apply the other strategies. As for the application of S7, the participant employed this strategy “Identify problem” 394 times of the total number 417 (94%) in easy translation tasks; while 353 times of the total number 413 (85%) in difficult translation tasks. It seemed that they could identify more problems in easy task than in difficult one. That was just because the easy task did not bring much psychological burden to the subjects while the difficult one did. When it comes to S19, the participant employed this strategy “Uncontrolled interim unit production” 285 times of the total number 417 (68%) in easy translation tasks; while 321 times of the total number 413 (78%) in difficult translation tasks. That was the same case with S1. As to the application of S25, the participant employed this strategy “Self-correction” 44 times of the total number 417 (11%) in easy translation tasks; while 26 times of the total number 413 (6 %) in difficult translation tasks. Judging from these data, the participants were afraid of the difficult tasks, thus, they just put them away as long as finishing them. Meanwhile, more care were taken to the easy tasks, therefore, the self-correction frequently appeared.

Chosen from the other strategies, three of them should be especially mentioned here: S6, S8, and S10. As for the application of S6, the participant employed this strategy “Employ mnemonic aid” 62 times of the total number 417 (15%) in easy translation tasks; while 43 times of the total number 413 (10%) in difficult translation tasks. Because the easy tasks could stimulate the long-term memory of the participants, they often use the mnemonic aid to help them produce the TT. Whereas, they felt worried about difficult ones, less mnemonic aid was applied by them. As to the application of S8, the participant employed this strategy “SL-TL dictionary search” 272 times of the total number 417 (65%) in easy translation tasks; while 250 times of the total number 413 (61%) in difficult translation tasks. Dictionary-dependence was an interesting finding in the present study. Whether E-C translation or C-E translation and whether the easy task or the difficult one, this strategy was employed everywhere. The participants depended on dictionary search to a great degree. The teachers should try to teach the students how to consult dictionary in a correct way and appreciate time. As to the application of S10, the participant employed this strategy “Make intuitive acceptability judgment” 230 times of the total number 417 (55%) in easy translation tasks; while 219 times of the total number 413 (53%) in difficult translation tasks. Since translation process is a kind of decision-making process, the participants often make intuitive judgment to produce the TT.

3. On questionnaire A and questionnaire B

The descriptive statistics of Questionnaire A & B were obtained so as to explore the frequency of strategy use both in E-C and C-E translation process. The questionnaire was composed of two parts: the first part was their self-estimated frequency of strategy use when they fulfilled E-C translation tasks (Questionnaire A) and C-E translation tasks (Questionnaire B), which will be discussed in table 4; the second part reflected their self-estimated time-consuming and proportion of thought uttered, as well as their feeling towards the influence of the think-aloud method.

TABLE 4  
THE DESCRIPTIVE STATISTICS OF QUESTIONNAIRE A & B

Questionnaires A	
High Frequency	S13 > S7 > S2 > S8 > S6 >
Medium Frequency	S1 > S11 = S14 > S10 = S16 > S17 > S19 > S20 > S18 > S15 >
Low Frequency	S9 > S5 > S4 > S12 > S3
Questionnaires B	
High Frequency	S7 > S2 = S17 > S6 = S8 >
Medium Frequency	S14 > S19 > S1 = S13 > S10 = S11 > S16 > S18 > S20 > S12 >
Low Frequency	S15 > S9 > S4 > S5 > S3

As to Questionnaires A, the strategies employed in high frequency were: S6 (Employ mnemonic aid), S7 (Identify problem), S8 (SL-TL dictionary search), S13 (Proposed dictionary solution) and S2 (Attempt syntactic reconstruction) while those of low frequency were: S9 (Make extra linguistic judgment), S12 (TL - SL dictionary search), and S3 (Back translate), S5 (Break off translation and start over), S4 (Break off attempt). As to Questionnaires B, the strategies employed in high frequency were: S6 (Employ mnemonic aid), S7 (Identify problem), S8 (SL-TL dictionary search), S17 (Rephrase ST segment) and S2 (Attempt syntactic reconstruction) while those of low frequency were: S4 (Break off attempt), S5 (Break off translation and start over), S3 (Back translate), S9 (Make extra linguistic judgment) and S15 (Reduce meaning). The high frequency of S6, S7, and S8 was consistent with the data from TAPs. S17 was employed more frequent in C-E than E-C translation. Yet, their self-estimation of the use of S2 was not consistent with the data from TAPs. In effect, the participants seldom applied this strategy. On the other hand, the low frequency of S4, S9, S12 and S15 was consistent with the data from TAPs. Apart from these strategies, there was no appearance of S3 and S5. In a word, the participants were self-estimated that they always depended on the mnemonic aid and dictionary search as long as they met with translation problems. Since they had the larger cognitive space in their native language, they often rephrased Chinese segment to obtain the good comprehension of the source text. They realized that the extra linguistic judgment was hardly used in translation process. Thus, more attention should be paid to the extra linguistic training in translation teaching.

V. CONCLUSIONS

Now that the qualitative and quantitative analyses of the TAPs data have been finished, the aim of this study has largely been achieved. The translation strategies, as well as their levels and the phases of translation process were analyzed qualitatively and quantitatively. Some findings are presented here also as answers to the research questions put forward at the very beginning of the research design. Findings below are based on the analysis of the think-aloud protocols and the answers to post-translating questionnaires of the twenty Chinese college level translation majors under the present study:

There were not any appearance in the application of Kiraly's third strategy "Back Translate" and the fifth one "Break off translation and start over" in the translation process of Chinese participants. And all the other eighteen strategies proposed by Kiraly have been more or less employed by the participants in this study. In addition, six other strategies were identified in this study, they were as follows: Interim Selection; Postpone Attempt; Tentative Solution; Self-correction; Read ST Segment and Read the Whole ST. Among the twenty-four strategies, Accept Interim Solution; Identify Problem; Employ Mnemonic Aid; SL-TL Dictionary Search and Uncontrolled Interim Unit Production were applied frequently.

There was reliably difference on the participants in employing these eight strategies (S8, S11, S12, S14, S17, S22, S24, and S25), but no significance was shown on the participants in employing the other strategies when they fulfilled E-C and C-E translation tasks. There was reliably significance on the participants while employ the following eight strategies (S1, S7, S12, S13, S17, S19, S22, S25) while they dealt with the easy and difficult translation tasks. And no significance was shown on the participants while they employed the other strategies. The participant employed the strategy of "Monitor for TL accuracy"; "Self-correction" more in E-C translation tasks than in C-E translation tasks. On the other hand, the participant employed the strategy "Accept interim solution"; "Identify problem"; "SL-TL dictionary search"; "Make intuitive acceptability judgment"; and "Rephrase ST Segment" more frequent in C-E translation tasks than in E-C translation tasks. "Employ mnemonic aid"; "Identify problem"; "SL-TL dictionary search"; "Make intuitive acceptability judgment" and "Self-correction" more frequent in easy translation tasks than in difficult translation tasks. On the other hand, the strategy of "Accept interim solution" and "Uncontrolled interim unit production" was employed more frequent in the difficult translation tasks than in the easy translation tasks.

There existed a significant interaction only between the scores of the translation product and the testing materials as well as the grades of participants. Therefore, it could be argued that the translation scores varied with the change of the testing materials (E-C; C-E) and also with the growth of university grades (Grade Four; Grade Two). Concerning the testing materials of T1 and T2, there was reliably significance on the two grades of participants and fourth-year students were significantly better than the second-year students. As to the testing materials of T3 and T4, there was no significant difference. Though the fourth-year students were better than the second-year students, there existed no significance in statistical sense. The entire participants felt more painstaking in C-E translating process than in E-C translating process. They did fairly well in E-C translation than in C-E translation. The number of the strategies employed by participants increased by the development of the participants' bilingual proficiency and the experiences gained in translation training.

Judging from the participants' self-estimation, they thought that S6 (Employ mnemonic aid), S7 (Identify problem) and S8 (SL-TL dictionary search) were frequently employed in E-C and C-E translation. S17 (Rephrase ST segment) was employed more frequent in C-E than E-C translation. Yet, their self-estimation of the use of S2 (Attempt syntactic reconstruction) was not consistent with the data revealed in TAPs. In effect, the participants seldom applied this strategy. On the other hand, they thought that S3 (Back translate), S5 (Break off translation and start over), S4 (Break off attempt), S9 (Make extralinguistic judgment), S12 (TL - SL dictionary search) and S15 (Reduce meaning) were seldom employed in E-C and C-E translation. In fact, there was no appearance of S3 and S5 in the present experiment.

In summary, the present study demonstrates the significant role TAPs play in discovering the nature of translation process, to shed light on the methodology in translation, and to contribute to the translator training. Such a study, a good attempt to study TAPs and its application to C-E and E-C translation practice, remains open to criticism and still needs further research, just because of its confinements, such as the strictly demanded experiment condition as well as the limited time and resource.

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