Reflections on Translation Empirical Studies
by Peirce's Abduction Theory

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ABSTRACT[1]

This paper originates from empirical studies of translation process, from the epistemological perspective, we can relate the translation process to how subjective spirit can attach to the external world. To unfold the translation process ontologically and epistemologically, we integrate the logical abduction inference with semantic theory "influence the best explanation". After a large amount of TAPs data collections and theoretical discussions in translation process empirical studies (including our research), we conclude that a translator dynamically employ both of the subjective translation units and objective translation units during the translation process by combing subjectivity and objectivity physically, mentally and philosophically; As the translating conduction went on --- the proceeding of deverbalization translation strategies and mental lexical access strategies is on, the translators flexibly and frequently appeal to abduction hypothesis and abduction reasoning. We end this paper with a reflection on the experimental design of the translation process empirical study: the Survivor-ship bias points out the judge's bias to high-proficiency participants; and the limitation of inductive reasoning and analogical reasoning lead to the relevant rigor -skepticism. We call for a closer interdisciplinary and a diversity research on philosophy, logic and empirical studies on translation process.

Keywords: Abduction, Translation process, Think-aloud, Epistemology, Artificial Intelligence, Survivor-ship Bias, Semantic Influence the Best Explanation.

1. INTRODUCTION

Translation process research not only rely on cognitive science, but also have an interdisciplinary tendency---at present, translation process has been discussed from the perspectives of linguistics, psychology, philology, philosophy, ecology, etc. All of these studies are trying to uncover the translation process mystery, and we have achieved some success. Pan WG has labeled the empirical study of translation process as the "translation process turn" in their work regarding translation history [1], and since then it has found a place in interdisciplinary research [2]. Following our empirical study of the translation process (The empirical study of translation

strategies and translation units in the translation process [3]; A Case Study of English Negative Expressions on Chinese-English Translation Process [4]), this paper reflects on this issue from the philosophical and logical reasoning perspectives.

2. EMPIRICAL STUDIES OF THE TRANSLATION PROCESS

Among the empirical studies of translation process domestically and internationally for more than 20 years, TAPs[2](think aloud protocols) have been the subject of this area with its efficiency and authenticity. Krings' first study in 1986 focused on what happened in the translator's mind. Jääskeläinen and Lörscher were the main forces of empirical research on translation strategies and translation units: Lörscher conducted a large-scale translation strategy study via TAPs in 1986 [5] and 1991 [6] respectively. In China, Zheng BH and Tan HM paid attention to the study of translation units in the process of English-Chinese translation [7]: The dual indicators of subjective translation units and objective translation units reflect the translation performance of translators at different levels. Zheng BH and Liu BT studied the process of Chinese translation of English causal sentences [8]. Translators of different levels compared the use of meta-cognitive strategies and cognitive strategies.

3. TRANSLATION ONTOLOGY AND EPISTEMOLOGY

The essence of translation is an epistemological issue, that is, the problem of the relationship between thinking and being. As Engels has put it, "To all philosophy, especially modern philosophy, the most important and fundamental question is the relationship between thinking and being." [9] Hegel also pointed out that modern philosophy is striving for reconciliation between thought and being [9].

Classical western philosophy is regarded as a dogmatic ontological philosophy, which regards the unity of thought and being as the premise. While, modern western philosophy holds that the relationship between thought and being is the original prerequisite for philosophy: without epistemology, ontology is just invalid, and as a result, "the epistemological turn" of modern philosophy appears. Descartes solved this problem by using clarity of self as the principle by which he established the

basis of knowledge (the idea of truth). "So I think it is possible to establish a general rule," he said, "that what we think very clearly is true." [10] "Descartes thought certainty to be the unity of thought and being."[11]

In modern ages, two tendencies have been proposed: one is the experiment of observing the phenomenon of natural view (Empiricism), and the other is the data and rational analysis of observational materials and experimental results (Rationalism). On epistemology, Kant emphasizes empiricism and rationalism. While agreeing that all knowledge must be derived from experience, he also believes that experience alone is not enough for scientific knowledge. Their universal necessity can only be a priori. But how do we apriori experience objects? and how can "a priori synthetic judgment" be possible are also the fundamental problems of Kant's epistemology, After Hume's deconstruction of the principle of causal induction, Kant, inspired by the Heliocentric theory, reversed the relationship between knowledge and object, and made the object conform to knowledge. Though knowledge is empirical in its content, a priori is in its formation. This "Copernican revolution" proved the universality of scientific knowledge: The human intellect has a kind of innate ability of synthesizing and unifying perceptual materials, and it can form a kind of innate comprehensive judgment spontaneously by its twelve categories integrating and combining miscellaneous materials, thus building up the edifice of human scientific knowledge.

4. ABDUCTION THEORY[2]

Current situation on Abduction Research
In 1987, at the International Conference on Logic, Methodology and Philosophy of Science held in Moscow, abduction reasoning was listed as a key issue in the world. With the improvement of the status of abduction reasoning in the fields of logic, philosophy of science and artificial intelligence, its importance become more and more prominent.The reason lies in the advantage of the theory of abduction compared with deductive and inductive reasoning: in the process of abduction, not only the process and the result coexist, but also the choice and construction of the parallel mode make the abduction reasoning become an important reasoning process to produce new knowledge and detect new theories.The rise of the study of abduction has also been promoted by the times. First, philosophers of science have realized the vital role of abduction in the discovery and evaluation of scientific theories. Second, with the development of cognitive science, the research in the field of artificial intelligence has been gradually deepened, and the cognitive ability reflected in the process of medical diagnosis and psychological research has become a key step. At present, the deepening of interdisciplinary research and discussion in the field of mind and intelligence promotes the development of this research.

Guessing instinct-oriented abduction
In his early years, Peirce took abduction as an evidence-seeking process, while in his later works, he tends to hold that the most

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[2] In this paper we hold the argument that abduction contains both inference and instinct parts. To balance the two parts, here we choose the word "abduction theory" instead of traditionally and frequently used "abduction reasoning" or "abduction inference".

important usage of abduction is to make hypotheses[12]. In his work, the illustration of abduction is as follows(CP5. 189):

An amazing fact c is observed

If a is true, then people tend to take the occurrence of c for granted.

Thus, it is reasonable to suspect that a is true.

This is the great beginning of abduction theory but we can see an interesting critique of this assertion in the work of Achinstein.

I will get 1,000,000 dollars*(c),* on condition that this paper has been published*(a).*

This hypothesis can give a reasonable explanation why i am striving for the publication of this paper*(c),*but it is not reliable enough to ensure that i will be a millionaire. [13]
When he illustrates this abduction theory, Peirce points out that a hypothesis will be tenable, if conditions are satisfied (it is interpretive, verifiable, and economical)(CP7. 220). Although abduction theory can probably come to weird hypotheses like Achinstein's counter example we mentioned above, most conditions cannot be satisfied. In fact, there are two processes in this theory: the forming process of hypothesis and the selecting process of hypothesis. The former is the forming process for new idea generation, and the latter is selection for best explanation. But in Peirce's illustration, there is only an hypothesis forming process and it is the absence of the selecting process which causes Achinstein's counter example.
N.R.Hanson improve Peirce's abduction as follows:

Replace the particular hypothesis a with a hypothesis set K;
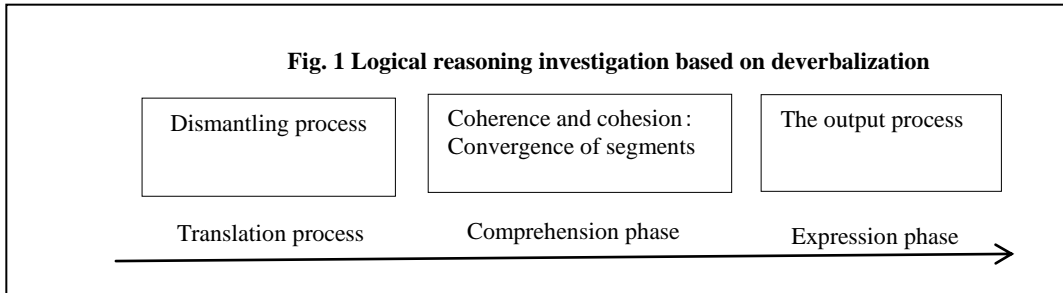
An amazing fact c is observed;

It's reasonable to think that a hypothesis set K explains c[14]

Peirce's abduction theory is precisely based on background information to establish the rationality of the hypothesis, namely both the hypothesis set and the background logically imply the amazing which is observed. As for the inclusion of hypotheses in the premises, Peirce put "a cannot be derived until all factors included in a are contained in the premises" (CP5.189). Completely new points cannot be derived from abduction.(CP5. 190) Peirce explains it in two ways, one is that although the hypothesis factors are not new, abduction makes a difference in the way they are used and combined, so the abduction shows new suggestion before we even think about it (CP5.181). Peirce proposed that the new hypothesis of abduction does not lie in its factors, but in the manner in which they are related to each other. The creativity lies in the way the object associated with the available elements of his or her different experiences[18]. The other explanation holds that those new elements in conclusion must appear in some other ways. What initially comes into mind must be a perceptual judgment, naturally we are sure to get it, however, this association of this perception with other elements should be a logical reasoning. Like any other reasoning, it is probably wrong.(CP5. 192) Here Peirce ensured that new elements can be found in perceptual judgments.(CP4. 539) In his point of

view, perceptual judgments are treated as in-sight and instinct, "an insight, as I call it, will be referred to as the same as the operation of perceptual judgment, which is also a general quality of instinct" (CP5. 173) . And insight or instinct is an important feature of Peirce's abduction theory. "Just like a flash of light, it is an act of insight, even if it may be an extremely fallible insight " (CP5.181). According to Pierce's argument, new elements must be in perceptual judgments, which are equal to insight or instinct and are important features of abduction.Therefore, new elements must be created in the abduction process, thus something new can be attached in it.

In Peirce's abduction theory, the basis for making assumptions about "surprising facts" is "guessing instinct." When resorting

Empirical research on translation units：macro-abduction analysis.

In the translation process, countless rounds of abduction reasoning are carried out in a dynamic loop. Take Zheng BH and Tan HM's empirical research [7] conclusions as examples: According to the same task, the percentage of professional translators focusing on units above the sentence is greater than that of beginner, while the percentage of beginners paying to attention to units below the sentence is greater than professional translators. When conducting abduction reasoning, beginners tend to turn their attention to individual words and expressions as the premise of reasoning and guessing. Professional

Fig. 1 Logical reasoning investigation based on deverbalization

| Dismantling process | Coherence and cohesion：Convergence of segments | The output process |

Translation process   Comprehension phase   Expression phase

to instinct, the human brain achieves the effect of correctly guessing things through its induction relationship with the structure of the universe. This is "the most surprising one among all the miracles of the universe." (CP:8:238)**³** [15].

5. ANALYSIS OF TRANSLATION EMPIRICAL STUDIES BY ABDUCTION THEORY

Here are some advantages of abduction theory: being started from the guessing instinct, it is the subjective role of the translator that we are focusing on during the translation process

translators follow the methodology of functional interpretation, reverse direction and order, and grasp the parts as a whole.

As long as they get the passage, the participants tend to look through the whole text first. In this process, both the text and sentence are highlights, which are called subjective translation unit. However, during the specific conduction, special attention is paid to detailed sentences, words or phrases which are called objective translation units. In the former process, abduction guessing is attached on the basis of cultural background and context. And as the reading goes on, abduction inference works together with different kinds of abduction guessing, which finally realize an original semantic field. In the latter process, additional abduction guessing and inference on some points like

Fig. 2 Experiential description investigation based on deverbalization

Scene representation

Abduction guessing Hypothesis generation

Abduction inference Hypothesis verification
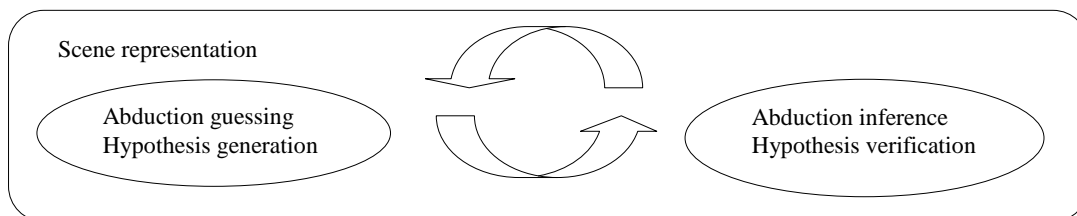
analysis. Then based on economy of research, we are trying every means to find the influence that best-explains. Abduction reasoning seeks to incorporate the deduction and induction inferences into the reasoning process. Namely, by abduction we form the premise of hypothesis, and by deduction we obtain the meaning of the sentence. We finally verify the correctness of the translated sentences by induction. The improvement of translation ability is a dynamic process in which the translator integrates what has most recently acquired into the original balanced system to attach a new recognition of the system.

linguistics, terms and grammatical points is proceeding.

Empirical research on translation strategies: micro-abduction analysis

Peirce paralyzed abduction with deduction and induction in the early stage, and in the later stage, he laid emphasis on instinct in the process of abduction. In the translation process empirical study analysis, we divided this dynamic process into hypothesis generation process (guessing instinct plays a major role) and hypothesis evaluation process (based on hypothesis generation, rigorous reasoning confirms or falsifies hypotheses[11]). Take Wang SH and Xu M's "An Empirical Study on Translation strategies in Translation Process" [12] as an example: Deverbalization translation strategies：this means that instead of being influenced by the expressions of the source text, the participant tries to be immersed in the psychological scene

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³ Here we follow the traditional reference marking rules: to mark its volume number and paragraph number.e.g. CP：7：192 means Charles Peirce the 7th volume, 192nd paragraph.

carried by the source language, and reappear the scene in the target language. In the analysis of translation process, both the logic inference and scene representation are focused on. The former cares about dismantling sentences and making good use of these segments, which contribute to the translated version. The latter focuses on creativity and convergendifferent segments responding to a certain psychological scene, and the most important one is the balance of the two. Participants in high proficiency group can shake off the source text by attaching the generation of hypothesis based on abduction guessing and comprehension of the source text.

In the scene representation, the translator uses fragmented textual information to construct prerequisite materials for imposing himself on plots and emotions; at the same time, the generation of abduction conjecture hypotheses and the verification of abduction reasoning hypotheses are repeated.

Puzzle solved phase: to deal with this puzzle, participants raised some hypotheses corresponding to the abduction guessing instinct and the scene presentation. All of these hypotheses are tested by "Inference to the best explanation" in abduction theory, and verified or falsified by the "harmony" made by these factors. Any disagreement will lead to another puzzle spot, hypotheses making and testing sequence, another turn of this loop conduction. Thus, all the abduction guessing and testing process are reciprocating and recycling, the conclusions made by them are probable arguments which call for more points to test.

Translation systematical integration phase:
After the empirical study, all the experiences from both experiential and theoretical perspectives are collected and integrated in the existing system, and they will be further be justified or falsified by the late-coming practice and studies. In this way, another round of abduction process proceeds.

Fig. 3 Translation process description based on abduction
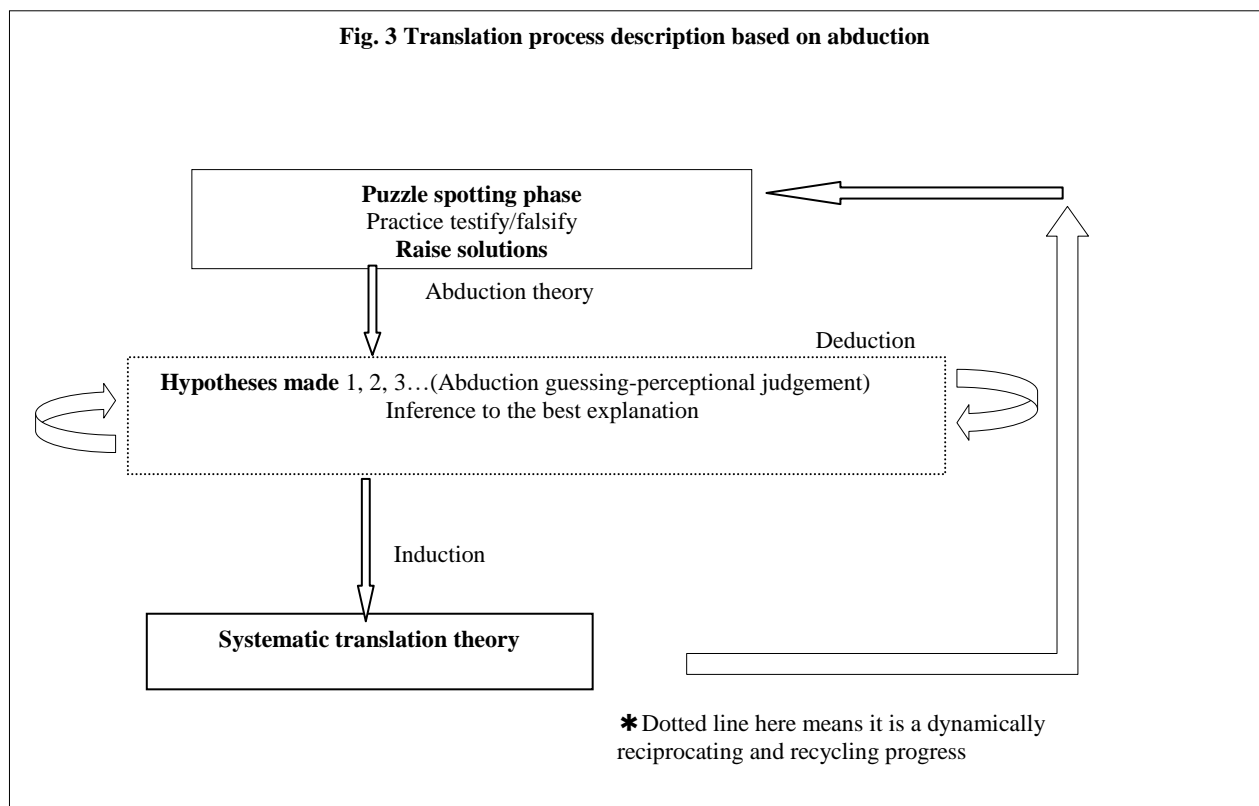
Mental lexical access strategies: the lexical translation reflects participants' proficiency attribute to corresponding diction and coordinating diction. Instead of paying attention to abduction guessing, the former tend to turn to dictionaries for help. While the latter share the abduction guessing hypothesis generation and hypothesis verification loop based on scene representation and shake off the source text.

In general, all the translation progress can be illustrated as follows:

Puzzle spotted phase: as long as they get the task, the participants are proceeding a "flu" of conduction, which can go smoothly without any interruptions. However, a sudden stop caused by spotting a certain puzzle, and emphasis is laid here to put the puzzle forward.

6. THE RIGOROUSNESS OF TRANSLATION PROGRESS EMPIRICAL STUDY

As a social science, translation studies characterize as diversified and uncertain. The empirical studies, as scientific-oriented research, focus on rigorousness and preciseness. As a result, a combination should take both rationalism and empiricism into consideration. Truth cares about the certainty of the subjective world, which can be detected only in an idealized state. Thus, now we reflect on the rigorousness of the translation process in response to the certainty of the truth.

Survivor-ship bias
Survivor-ship bias refers to the differentiation between the whole and those selected representatives which is collected by

certain standards [13]. Survivor-ship bias is not a new problem, but is the most overlooked aspect in statistical analysis, and it leads to wrong conclusions.

In translation empirical studies, the benefits (high proficiency participants) of survivor-ship bias tend to be praised, and their faults may be easily forgiven. This kind of psychological tendency can not be avoided despite the subjectivity seriously emphasized in TAPs experiment. Here the certainty of the truth has been covered, and we should take certain actions to minimize the effect of survivor-ship bias and try to be equal. All points about high and low proficiency participants should be considered and carefully studied, low proficiency participants get advantages and vice verse. While most of previous research haven't notice it, which should be cared by the later coming empirical study researchers.

The limitation of induction
On the basis of experiential points, induction reasoning normalizes the approximate similarity and the precedence-relationship-combination, and attributes them to a causal relationship. However, David Hume puts that the certainty given by induction is confined to several periods in which we make sense of the world; but how it can be expanded to the future and other issues, is seriously suspect and needs to be discussed.[18]

The dynamic operation of the abduction theory in translation process is an overthrow and reconstruction of instantaneous induction. The translator's performance in translation process should also be summarized from multiple perspectives and the more appropriate conclusion of reconstruction should be constantly overturned. The uncertainty of translation also requires that we respect different translations, for no claim of factuality is in translation.

The limitation of analogical reasoning
Analogical reasoning refers to the transfer of certain solutions for some situations or areas to other ones.(Gentner,1988)[16] Quinn has described analogical reasoning as extrapolation and questioned whether it is reasonable to project theories of other areas to our subjects.[19] Some of the theories(Ramsey theorem in Mathematics and Entropy in thermodynamics, for example) are even opposite due to different situations so how to judge the difference is just the key. Translation process research, is largely influenced by theories from other areas, whose reliability is seriously suspect.

7. CONCLUSIONS AND FUTURE WORKS

The translation process turn has advanced translation process empirical studies to a new era. This paper has shown a rigorous analysis and a suspicion of empirical studies on translation process derived from logic and philosophical perspectives. We hope it will contribute to translation process development. Some of the aspects that still have to be dealt with are more philosophical rigorousness reflection and closer-related interdisciplinary research on translation modals between translation process and abduction or other kinds of inference.

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