Multi-dimensional Consideration of Cognitive Effort in Translation and Interpreting Process Studies

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Abstract: Cognitive effort is the core element of translation and interpreting process studies, but theoretical and practical issues such as the concept, the characteristics and the measurement of cognitive effort still need to be clarified. This paper firstly analyzes the concept and the research characteristics of cognitive effort in translation and interpreting process studies. Then, based on the cost concept (internal cost, opportunity cost) and the reward concept (need for cognition, learned industriousness) of cognitive effort, it carries out multi-dimensional analysis of the characteristics of cognitive effort. Finally, it points out the enlightenment of multi-dimensional consideration of cognitive effort to translation and interpreting process studies.

Key words: translation and interpreting process; cognitive effort; internal cost; opportunity cost; need for cognition; learned industriousness

I. Introduction

Many extraordinary human skills, such as reading, mastering a musical instrument, or writing complex software, require thousands of hours of practice and continuous cognitive effort. While cognitive effort is the most challenging to understand, studying this type of effort is key to gaining insights into the translation process (Lacruz, 2017: 387). Time constraints have increasingly become one of the common features of translation and interpreting. The cross-border integration of translation and interpreting has made time constraints more prominent in translation activities such as consecutive interpreting, simultaneous interpreting, sight translation, audiovisual translation, and translation under time pressure (Zou & Liu, 2020). The commonality of the above-mentioned time-limited translation activities is that translators need to adopt faster and greater information integration, simplified translation, literal translation, chunking and other decisions, which makes the trade-off between effort and effect in the translation process more important. On the one hand, people may voluntarily put in effort even without external rewards in everyday life, but popular scientific theory holds that effort is unpleasant and people avoid it as much as possible. On the other hand, some researchers have recently begun to critically question

whether cognitive effort is always repulsive, instead arguing that challenging cognitive activities can be experienced as rewarding and valuable in certain situations. In other words, cognitive effort is both a cost and a reward, and its role in cognitive research of translation and interpreting still has huge room for exploration.

II. Cognitive effort and its research status in translation

2.1 Effort and Cognitive Effort

Effort is a purpose-based physical or mental activity, an explicit behavior that can be observed by oneself and others (de Morree & Marcora, 2010: 377). Cognitive effort is the proportion of limited-capacity central processing involved (Tyler et al., 1979: 607). There is a complex interaction between cognitive effort and task load, task performance, cognitive needs, learning motivation, cognitive competence, and other factors, which together play an important role in individuals' performance and competence development in complex tasks. This has become the focus of research in psychology, cognitive science, neuroscience, and other fields.

2.2 Research on Cognitive Effort during Translation and Interpreting

Cognitive research on translation and interpreting process began in the 1960s and 1970s and continued until the 1980s. Early researchers discussed cognitive resources (Gerver, 1969) and cognitive load (Kirchhoff, 1976) in the process of interpreting. Gutt (1991/2000) introduced the concept of cognitive processing effort into translation theory through Sperber and Wilson's Relevance Theory (1986). Gile (1995/2009) proposed a cognitive effort model for interpreting, which focuses on the cognitive effort and energy that interpreters actually allocate and coordinate in each subtask of the interpreting process and describes the cognitive limitations that interpreters may encounter during the interpreting process, which provides a cognitive explanation for the phenomenon of poor performance of interpreters (Su et al., 2021). Since the new century, with the continuous development of T&I cognitive research, the study of cognitive effort has become the focus of T&I process research.

However, the research on cognitive effort in T&I process still demonstrate the following deficiencies: 1) Definition and its understanding vague, cognitive effort is more of an adjunct to the task difficulty, cognitive load, and translator performance in T&I cognitive process. It brings challenges to the variable control and validity of related studies. 2) Discussion of subjects, conditions, limits, changes, development, and other traits of cognitive effort has been insufficient,

which affects the cognitive research on traits and commonalities of related synchronic and diachronic factors in T&I process. 3) The measurement methods are limited, often mixed with the measurement methods of factors such as task load, and triangulation is insufficiently used, which affects the research design and the explanatory power of the results. 4) There is insufficient research space. Translation is a more complex language cognitive activity. Translation research is an indispensable field in human language research and cognitive development research. Therefore, translation research needs to draw on the latest methods and achievements in language and cognition research, to enpand the frontier and enhance the sustainability of its own research, and at the same time contribute to cognitive research of human language.

III. The Cost View of Cognitive Effort

Effort needs to consume resources, and individuals tend to avoid making effort, or obtain the maximum effect with the least effort, which reflects the characteristic of "effort is a cost", and contemporary theoretical and empirical studies in cognitive neuroscience and economics have confirmed and reinforced this view. The cost view of cognitive effort can be expounded from two aspects: the internal cost and the opportunity cost.

3.1 Internal Cost

Firstly, the internal cost of cognitive effort is reflected in the limited working memory of cognitive activity performers. Working memory capacity is a recognized determinant of human learning. The earliest research in this area proposed the magic number 7, which believed that the short-term memory span was 7 ± 2, that is, between 5-9, meaning in short-term memory tasks, people can remember about seven chunks of information (Miller, 1956). Subsequent research suggested that the magic number should be 4, and the short-term memory span should be 4 ± 1, or between 3-5; in young adults, it appears in blocks of three to five, and fewer in children and the elderly (Cowan, 2001). Recent research has pointed out that the magic number 4 is also overly optimistic, and it should be 2; the size of the chunks stored in short-term memory, not the number, enhances individual memory (Gobet & Clarkson, 2004). In conclusion, human cognitive resources are limited and must be allocated wisely. Cognitive effort is expensive, and humans are described as "cognitive misers", spending only the necessary effort to make satisfying decisions, not making the best decisions, but using shortcuts whenever possible.

Secondly, the internal cost of cognitive effort is reflected in the limited representational

ability faced by the performers of cognitive activities. Individuals have a limited amount of representational information in a certain period of time (Musslick et al., 2016: 7), and face sharing, separation and distribution of representation, in multi-task cognitive activities, which will have an impact on the completion of specific cognitive tasks (Musslick & Cohen, 2021:757). The fuzzy-trace theory proposed by Brainerd & Reyna (1990) is widely used in many disciplines including linguistics. The theory holds that the relationship between precision and ambiguity is dialectically unified and contradictory, and there is no insurmountable gap between the two. In the process of extracting the meaning of information, individuals tend to use vague traces to represent information because it is more accessible and requires less cognitive effort; in contrast, precise traces are more likely to be disturbed and then forgotten. Most human cognitive activities are not accurate, but rely on vague representations (sensations, patterns, etc.). In addition, Good-enough Representation of language understanding also found that for a given task, the syntactic and semantic representations created by the language understanding system are only "good enough", not the speakers' accurate and detailed representations of utterances (Ferreira et al., 2002; Ferreira & Patson, 2007).

3.2 Opportunity Cost

Choosing one effort task often means losing the opportunity to complete other tasks, so cognitive effort is manifested as an opportunity cost (Kurzban et al., 2013: 665; Yi Wei et al., 2019: 1442). The opportunity cost of cognitive effort is mainly explained from the perspective of benefit and cost trade-off, which can be traced back to the "Least Effort Principle", that is, people perform the least labor-intensive behavior, complete a specific task, with the least amount of effort. necessary efforts to quantify (Zipf, 1949; Case, 2005). Since the "Least Effort Principle" was put forward, it has been studied, combined with language understanding and information processing. The researchers pointed out that the "Least Effort Principle" is a key concept to understand the true nature of language behavior (Martinet, 1960). Heuristics are not simply hobbled versions of optimal strategies; there are no optimal strategies in many real-world environments in the first place (Gigerenzer et al., 1999: 22). The search for the best solution for maximum benefit, reflected in translation, is that translators and interpreters pay the least effort to achieve the maximum effect (Levy, 1967: 1179).

The study found that both reading and listening comprehension processes involved in

translation comprehension exhibit the effect of “least effort”. On the one hand, eye-tracking technology-based reading research shows that readers' eyes are not reading word by word from left to right, it’s just an illusion created by our brains. In fact, we only fix about 60% of the time we read (Rayner et al., 2011: 514), and the brain infers and obtains the entire information based on partial information and impressions, with the help of syntactic and semantic rules. The “Transposed Letter Effect” also verifies this. Randomizing letter positions in the middle of a word has little effect on the understanding of the text by skilled readers, as long as the first and last letters of the word are positioned correctly (Rawlinson, 1976). On the other hand, the study found that in the listening process, the listener's comprehension of the spoken sentence does not always stem from a comprehensive analysis of the words and syntax of the utterance; instead, listeners may instead conduct a superficial analysis, sampling some words and using presumed plausibility to arrive at an understanding of the sentence meaning (Ayasse et al., 2021: 1).

IV. The Reward View of Cognitive Effort

Effort is closely related to motivation and value. Effort can increase the result of effort and the value of effort itself, which can even play the role of a reinforcer to motivate effort, which reflects the characteristic of “Effort is a reward”. The reward view of cognitive effort can be expounded from two aspects: Need for Cognition and Learned Industriousness.

4.1 Need for Cognition

Need for Cognition is defined as “a need to understand and make reasonable the experiential world” (Cohen et al., 1955: 291), “the tendency of individuals to engage in and enjoy thinking” (Cacioppo & Petty, 1982: 116). The latter has also developed Need for Cognition Scale, which can divide subjects into those with high Need for Cognition and those with low Need for Cognition, according to the scale scores, to study the individual differences in Need for Cognition and their effect and role in cognitive activities. The study found that cognitive needs affect the effort of individuals in information processing. Compared with people with low Need for Cognition, people with high Need for Cognition put more effort into cognitive activities, perform better in information recall, and complete cognitive tasks better (Xu & Zhou, 2010: 686). The reasons for individual differences in Need for Cognition are still unclear, but studies have found that individuals’ learning experiences, tolerance for setbacks, and culturally related factors may have an impact on individuals’ Need for Cognition (Cacioppo et al., 1996: 215; Inzlicht et al., 2018:

342). Need for Cognition has individual differences, and different individuals have different views and perceptions of effort and its rewards. In conclusion, Need for Cognition highlight the static individual differences in cognitive effort from the perspective of reward.

4.2 Learned Industriousness

If Need for Cognition highlights the static individual differences in cognitive effort from the perspective of reward, then Learned Industriousness shows more dynamic changes and development of cognitive effort from the perspective of reward. According to Learned Industriousness, "rewarded effort that contributes to durable individual differences in industriousness" (Eisenberger, 1992: 248). On the one hand, after individuals form a high-value experience of effort through conditional learning, they will tend to choose high-effort behaviors (Xu & Zhang, 1996: 188), and then increase the value of high-effort tasks (Yi et al., 2019: 1444; Clay et al., 2022). Cognitive load, on the other hand, is related to the amount of information that working memory can hold at one time (Sweller, 1988: 265); since working memory has a limited capacity, teaching methods should avoid overloading working memory with additional activities that do not directly contribute to learning, and avoid overloading, as both hinder the learning progress (Zhong & Sheng, 2017: 8). In conclusion, moderate cognitive load and cognitive effort contribute to Learned Industriousness, which shows the dynamic development of cognitive effort from the perspective of reward.

V. Implications for T&I Research

5.1 Cognitive Effort as a Cost

Firstly, we should be fully aware of the "dodging" of cognitive efforts. Behavioral research shows that the willingness of human beings to choose high effort will decrease with the increase of effort, which is expressed as "Effort Discounting"; when the incentive is low or the difficulty is too high, the individual's effort will not follow. As the difficulty of the task increases, the two can be separated (Kahneman, 1973; Brehm & Self, 1989; Richter, 2016). In T&I activities, cognitive effort is the "optimization" after weighing effort and effect; the phenomenon of Effort Discounting can help us optimize the research design of the T&I process and can also become a new research point. In short, we should pay full attention to the interaction between cognitive effort and other variables in T&I process research, and at the same time improve the reliability and validity of the research, we should pay attention to the multi-dimensional interpretation of the research process

and results.

Secondly, on the basis of controlling variables, we should improve the reliability and validity of the research through triangulation. Task difficulty is considered an operational definition of effort (Wang, Zheng, & Meng, 2017). Generally speaking, the more difficult the task is, the more effort the individual has to put in; however, the effort is the active processing of the individual, and the difficulty is the attribute of the task itself (Cao et al., 2022: 877). In the translation activity, the subjects will reflect anxiety, stress, fatigue and other feelings while reporting their efforts, and these accompanying feelings are not conducive to the subjects' normal cognitive effort, which may be the trigger of Effort Discounting, which deserves sufficient attention and consideration from the researchers, in research design and process. Misuse of measures of cognitive effort and cognitive load should be avoided (Gile, 2021); in addition to subjective measures of the Need for Cognition Scale (NFC, Need for Cognition Scale), objective measures of Effort Expenditure for Rewards Task, Cognitive Effort Discounting Paradigm, Motivation for Cognition State Scale, etc. (Treadway et al., 2009; Westbrook et al., 2013; Westbrook & Braver, 2015; Blaise et al., 2021) can be used in research.

5.2 Cognitive Effort as a Reward

Firstly, we need to pay attention to individual differences in cognitive effort and take this into account in the research design and the interpretation of the findings. Effort is an active process that requires the participation of will. Based on this, in T&I process research, we need to pay attention to the group and individual differences in the cognitive effort of the translators and interpreters. According to individual differences in Need for Cognition and influencing factors, such as personal learning experience, tolerance for setbacks, cultural-related factors, etc., we can pay attention to the cognitive efforts of professional translators and student translators under different cognitive loads, or we can pay attention to the development of student translators' cognitive efforts at different stages. Translators and interpreters at different levels are different in competence, the input-output ratio between the input effort and the output effect is high among high-level translators, and the opposite for low-level translators. As research has found, learners increase this allocation of attentional resources when valuable information is encountered and perform better on tasks (Ariel & Castel, 2014: 344). It can also be said that whether cognitive effort can be used more efficiently is also part of a translator's competence.

Secondly, we need to pay attention to the changes and development of individual cognitive efforts, and to study their synergistic changes and development with cognitive and translation competence. Cognitive training in the past has not achieved a ubiquitous effect in improving cognitive skills. Relevant cognitive training such as Learned Industriousness may be a breakthrough for improving learning effect. By designing cognitive training tasks that can show the "optimized" cognitive load, mobilize cognitive efforts that conform to the general rules of skill acquisition and individualized development, maximize the added value of cognitive efforts, we can then expect to improve individual learning ability and learning effect through sustainable cognitive efforts. In this process, multiple or repeated measurements of cognitive effort in long-term tasks should be performed. This can effectively track the changes and development of cognitive effort and help further explore the role of cognitive effort in reflecting the complex interactive relationship between cognitive load and task performance.

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