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Defeng Li, Victoria Lai Cheng Lei, and Yuanjian He (eds), *Researching Cognitive Processes of Translation* (New Frontiers in Translation Studies). Singapore: Springer, 2019. Pp. 201. ISBN: 978-981-13-1983-9 (Hb), 978-981-13-1984-6 (E-book)

Translation process research (TPR), as one of the three major kinds of research in descriptive translation studies (Holmes, 1972), has been regarded as "the most complex type of event yet produced in the evolution of the cosmos" (Richards, 1953, p. 250). It refers to the research on the mental process of translators or interpreters when they are rendering a text from one language into another, including taking decisions, solving problems, and making corrections. Better knowledge about what is going on in the translator's mind during translation contributes to both theory construction and translator training (Jääskeläine, 2011). It is also relevant for the development and improvement of computer-aided translation and machine translation (Hansen, 2013). The past 40 years have seen an upsurge in TPR thanks to the application of advanced techniques and methods of cognitive science to translation studies. A number of works in this area have been published, including *Translation and Cognition* (Shreve & Angelone, 2010), *Interdisciplinarity in Translation and Interpreting Process Research* (Ehrensberger-Dow, Göpferich, & O'Brien, 2015), and *Innovation and Expansion in Translation Process Research* (Lacruz & Jääskeläinen, 2018).

Despite its rapid development, TPR has also encountered some challenges, such as the building of robust theoretical models of the translation process, the analysis of massive amounts of data, the proper triangulation of different data sources, and the efficient application of advanced and sophisticated research instruments such as the functional near-infrared spectroscopy (fNIRS) and the functional magnetic resonance imaging (fMRI).

Against this backdrop, the present volume, *Researching Cognitive Processes of Translation*, is a worthy attempt to meet such challenges. It is a collection of eight original contributions from some leading scholars in TPR, covering new frameworks, approaches, and research instruments in the most recent development in TPR. It comprises two parts. The first part elaborates three interdisciplinary theoretical models for TPR, and the second part presents tools, methods, and their applications in the experiential–empirical research of translation process.

The first part consists of three chapters. In Chapter 1, Juliane House, while acknowledging the importance of the socio-cultural approach in translation

studies, opposes exaggerated emphasis on it. She appeals to renew a focus on the linguistic aspect and the cognitive aspect instead. That is to say, more attention should be given to language and text as well as what happens in translators' minds when they are translating. Based on a critical review of previous translation cognition research using introspection and retrospection, behavioral experiments, and neuro-imaging techniques, House suggests that a first step towards a new interdisciplinary approach to translation process can be realized by integrating a functional-linguistic translation theory and a neuro-functional theory of bilingualism.

Similarly, Jianyuan He also searches for a neurolinguistic theory of bilingualism for TPR. In Chapter 2, He constructs a conceptually detailed theoretical framework for treating translating or interpreting as bilingual processing, by integrating four major theories of human language and cognition: the theory of Universal Grammar, the computational theory of language processing, neurocognitive bilingualism, and the neuro-functional control theory for bilinguals. He hypothesizes memory and computation as two processing mechanisms that interact and complement each other in translation and interpreting. Specifically, since processing via memory is cognitively less costly than via computation, "memory applies as a priori and computation takes over whenever memory fails" (p. 36).

In Chapter 3, Michael Carl and Moritz Schaeffer propose a computational framework for post-editing machine translation, based on relevance theory and the noisy channel model. This framework realizes a close integration of TPR and the cognitive science paradigm. The authors believe that relevance theory is reliable for analyzing pragmatic phenomena such as communicative intentions in translation, and the noisy channel model "allows for rigorous quantification and predictive modelling of translation processes" (p. 50). Such a combination is thus proposed to explain both the unconscious priming effects and the conscious meta-cognitive processes in post-editing machine translation.

The second part consists of five chapters. In Chapter 4, Arne Lykke Jakobsen addresses the relationship between the typing or eye-movement behavior of translators and their experience of "flow", namely the feeling of smooth progress in translation, based on the data from the TPR database developed by the Center for Research and Innovation in Translation and Translation Technology at Copenhagen Business School. The keystroke data contain much information about the production process of translation, while the gaze data reveal much about how the translator works on the source text. Therefore, these two sources of data are combined to obtain a more complete and reliable picture of the translator's cognitive processing in translation. The author admits that it would be very rash to claim that the findings in one single recording have "validity for cognitive aspects of translation in general"

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(p. 104). However, such qualitative research still makes a contribution, since a number of patterns summarized here can be compared with the results of future case analyses or large-scale studies.

In Chapter 5, Fengmei Lu and Zhen Yuan first review the basic principles and instrumentations of fNIRS, and then discuss how it can be used to explore brain activity during the process of translation or interpreting. According to the authors, since fNIRS can monitor rapid changes in brain activities with portability, convenience, and low cost, it is conducive to the investigation of the complicated translation and interpreting processes, which involve various subskills such as listening, reading, speaking, writing, reasoning, problem-solving, and memory.

In Chapter 6, Fabio Alves, Karina K. Szpak, and Augusto Buchweitz present their preliminary thoughts about the feasibility of using brain-imaging technologies to investigate psychological processes in translation. They point out that, in order to facilitate communication, translators have to figure out the author's meanings and the target audience's cognitive environment, during which they "activate different layers of mind reading and inferential mechanisms" (p. viii). Therefore, the authors propose to combine the neuro-scientific data and the behavioral data obtained from fMRI and eye-tracking environments respectively to explore the inferential nature of translation processing.

In Chapter 7, Sanjun Sun discusses how to measure difficulty in post-editing machine translation based on his earlier work on measuring difficulty in human translation. Sun summarizes two assumptions in translation difficulty research: the assumption of linearity and the same ranking assumption. The measurement of such difficulty is believed not only to help avert translators' cognitive overload and underload, but also to benefit translation training.

In the last chapter, Susanne Göpferich examines the role of translation in L2 writing. Based on an extensive literature review, Göpferich argues that "translation has both advantages and disadvantages for L2 writing pedagogy" (p. 170), depending on students' translation competence and the purposes for which the translation is used. On one hand, translation favors knowledge construction when students write to learn. For example, students who are non-native speakers of English write papers in their L2 English in an economics course. On the other hand, translation may have disadvantages if students write to enhance their L2 proficiency in the course of a foreign language, because of the negative influence that the L1 transfer leaves on their L2 writing. After addressing some pedagogical strategies, the author further claims that translation competence, as a "soft skill", should be grasped by students of all disciplines in this multilingual and multicultural society, given the fact that international academic writers usually refer to literature in more than one language.

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Compared with other similar publications, one of the merits of this book is that it lays particular emphasis on the construction of coherent theoretical models. As increasingly noted, theoretical disposition and exposition is critical for the development of any research. In TPR, although the massive amounts of data obtained from different sources contribute to the exploration of the complex mental process of translators, a consistent and logical understanding is almost impossible without robust theoretical models. In this sense, "the search for a strong, commonly-accepted model (or even viable competing models) of the translation process" is a paramount concern in this field (Shreve & Angelone, 2010, p. 12). According to Shreve and Diamond (2016), in cognitive translation studies there are three levels of information processing: the highest or computational level is concerned with the main processes, tasks, and goals of translation; the middle or algorithmic/representational level looks at the underlying cognitive processes and their associated mental representations in translation; and the lowest or implemental level focuses on how these underlying processes and representations are realized in the neural system of human beings. Previous studies in TPR have paid more attention to the highest and middle levels. By contrast, this book pushes the boundaries by moving to the lowest level in the construction of theoretical frameworks, which provide a more complete theoretical panorama for TPR.

In addition, this book demonstrates various methodological innovations in TPR, in both the gathering and the interpretation of the data. First, thanks to the influence of cognitive science, cutting-edge and non-invasive research instruments such as fNIRS and fMIR are adopted in TPR, as in the cases of Chapter 5 and 6. Furthermore, Chapter 6, which is authored by scholars from the fields of translation studies and cognitive neuroscience, sets a good example for interdisciplinary cooperation. Second, many translation studies have a small sample size, which makes it difficult to generalize the findings or replicate the experiments. Chapter 7 in this book tries to find a way out of this dilemma by resorting to the TPR database, which stores Translog-II data from various sources in different languages. Such large-scale shared databases facilitate the efficient use of data in an economical way. Third, in addition to quantitative methods, this book also pays close attention to qualitative analyses. Although quantitative methods have enormous advantages in identifying commonalities, they may ignore individual differences and even data inaccuracies, which can be compensated by qualitative methods. In Chapter 4, Jakobsen demonstrates how the eye-tracking and keystroke data in one single recording can contribute to the exploration of the translator's cognitive processing, indicating that qualitative analysis is crucial in revealing patterns, and can be combined with quantitative methods for the higher accuracy of research findings and a more comprehensive picture of what is going on in the process.

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Finally, another striking characteristic of this book is that it attends closely to the applications of theoretical findings in TPR. A systematic investigation of what happens in the "little black box" of translators and interpreters not only benefits translation and interpreting training, but also facilitates language learning and teaching. Chapters 7 and 8 have presented this kind of applied study.

Despite these strengths, there are some shortcomings. First, it would be more reader-friendly if an abstract were provided at the beginning of each chapter so that readers could rapidly grasp the whole picture before reading the chapter. Second, register variation is ignored in this book. Since translation and interpreting are highly specialized activities, register is a crucial variable in the translation process. For instance, translators' processing may vary in the translating or interpreting of business, medical, and forensic discourses. Therefore, it might be more interesting and convincing to specify the genre or register of the data involved in some of the empirical studies in this book. Last, the most recent research is not included in the book because its contributions are based on some keynote presentations at the First and the Second Conferences of Cognitive Research on Translation and Interpreting (ICCRTI) in 2014 and 2015. In the past few years, some of the ideas proposed in the book have been developed, yielding new research findings. For instance, either fNIRS or TPR database has been used in some studies to explore the cognitive process of translation (e.g., Carl, Bangalore, & Schaeffer, 2016; Lin, Lei, Li, & Yuan, 2018). There are also studies which verify and even improve the theoretical framework proposed in this book (e.g., Lang, Hou, & He, 2019).

Notwithstanding these minor deficits, this volume is an engaging and thought-provoking book on TPR. Given the exponential development of TPR, it goes without saying that this field of research requires continual updates. Even so, the collection can still serve as an important reference book for researchers, teachers, and students who are interested in this area. Additionally, the comprehensive content undoubtedly lays a solid foundation for more holistic and in-depth approaches to this topic in the future.

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