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Book review
Tymoczko, M. (2021). *Neuroscience and translation*. University of Tartu Press. ISBN 9949035546

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In the past decades, researchers have established various theories and approaches to explore the nature of translation, this "most complex type of event yet produced in the evolution of the cosmos" (Richard, 1953:250). Especially since the inception of Translation Studies as an academic discipline in the 1970s, translation scholars have drawn extensively on tools, concepts, and theories from other disciplines, such as sociology, anthropology, psychology, and biology in their efforts to explore the many facets of translation and interpreting. Now, neuroscience came to the fore. As the study of the nervous system, the task of neuroscience is to understand brain processes— how we perceive, act, learn, and remember – and explain behavior in terms of brain activities (Kandel et al., 2012, pp. 3-5). For decades, neuroscientists have explored human language and have produced remarkable studies on language development and learning. Yet the findings on how the brain handles language processing are still primarily based on monolinguals. The mental process of multilingual people and many other aspects of the transfer between different languages remain largely unsettled. This inspired Maria Tymoczko to explore the neurological mechanisms involved in translating, a field that she dubs as one of the "known unknowns" in translation studies (Tymoczko, 2012) and believes will fundamentally influence the way translation is thought about and ultimately illuminate many aspects of translation, including the "black box" of the individual translator. The stated goal of her book, *Neuroscience and Translation,* is to explore the implications of the findings of neuroscience for translation studies and how they can be illuminating in understanding the cognition of translators and the processes of translation (p.154). Tymoczko stated in 2005 that employing the findings of neuroscience in translation would be one of the major trajectories in future translation studies and gave in 2012 a nuanced account of how the findings regarding perception, memory, and brain plasticity would have permanent implications for our understanding of translation. This book, the result of the author's exploration of the field over a period of more than ten years, not only represents a new fascinating contribution to the myriad disciplines that have been drawn upon in translation studies but also prepares the ground for further contributions to the systemic and groundbreaking investigation of neuroscience in translation.

The book basically follows the structure of a field report. It consists of eight chapters, with the first three chapters serving as guide to neuroscience basics in respect to language and the last chapter as conclusion. Chapters 4-7 constitutes the main body of book, each of them dedicated to illustrating one specific notion of neuroscience. Chapter 1 is the Introduction in which the author delineates the basics of neuroscience that are relevant to language and translation, outlines the scope the book, and illustrates five premises of neuroscience used in the book, which are: cognitive capacity, cognitive variation, the coordination of cognition, the unity of consciousness, and the question of mind. The author also states at the end of this chapter that this is a book more about questions than providing solutions.

Chapter 2, 'The neuroscience of language: basic principles' is an account of neuroscience in relation to human language, with a focus on how human language is acquired and evolved in the brain, how explicit and implicit memories function in language learning and information storage in the brain. Following this introduction to neuroscience of language, the author moves on in Chapter 3 to explore the neuroscience of bilingualism and multilingualism from the perspective of their relevance to translation. Such notions as memory patterns, multilingualism and lateralization, types of multilingualism, adult-onset multilingualism, and infant-onset multilingualism are explained at the level of neuroscience. The author argues that all these findings concerning human being's ability of mastering more than one language have implications for translation studies. Some of these findings include, for instance, every person has the potential for multilingualism, and the critical age for it is 7; adult multilingual learning relies more on explicit memory processes and knowledge related to their second languages. These findings at the level of neuroscience are not only referential to the pedagogy of translation, but also able to facilitate our understanding of the cognitive process of translation and shed light on the "black box" of the translator.

Only from Chapter 4 does the author start to discuss the neuroscience in relation to translation. She chooses four notions that she believes are most essential to human cognition and most relevant to translation and cross-cultural communication to elaborate on: perception, memory, plasticity, attention (in combination with decision, choice and control). Specifically, Chapter 4, 'perception' explicates the basic concepts of perception which have been widely accepted by researchers in the field of neuroscience. Basically, perception is our knowledge of the world that comes from sensory information. However, findings in neuroscience tell us that perception is not just what we see and hear, but is constructed and limited by culture, which constitutes a major challenge for translators and interpreters. Tymoczko asserts that the implication of perception is multifold both for the translator and translation studies. While we can only translate what we see, we cannot neglect the constructivist and cultural aspects of perception. Thus, how to perceive and translate a culturally-shaped text unbiasedly is a chief problem facing translators, and a key issue of translation studies that needs to be situated within the framework of the neuroscience of perception.

Chapter 5, 'memory' keeps the focus on neurological discoveries in human memory in relation to language and translation. It first presents a survey of the various types and basic features of memory, mainly short-term memory and long-term memory, the hierarchical and componential facets of memory, memory networks, and the retrieval of memories. All these features of memory impinge on translation in terms of establishing long-term memory and retrieving information stored in memory when translating and interpreting; for example, how to establish long-term memory, and how to retrieve information stored in memory. These

findings also indicate that memories are stored and organized componentially and hierarchically in the hippocampus of the brain, which is particularly enlightening for translation studies, considering the fact that language also exhibits componential and hierarchical features. Therefore, the hierarchical and componential aspects of memory constructed by culture and experience can help us understand the process of translating and the reception of translations at both conscious and unconscious levels. The author contends that a general framework for the operation of language at the biomolecular level is possible with such research.

Chapter 6 elaborates on the plasticity of the brain and its relevance to translation. Plasticity in neuroscience is defined as "the means by which the nervous system changes its response through experience" (Fields 2004: 60). In more plain terms, it refers to the ability of the brain to grow new neurons and modify itself according to new situations during adulthood and even old age. This physical flexibility of the brain suggests the possibility of alleviating the narrowing of cognitive abilities and enlarging perceptual and memory capacities throughout life. Under the umbrella of plasticity, the author also details the concepts of neurogenesis, networks, myelination, and mirror neurons in terms of their specific functions in relation with language and cross-cultural communication. The physical flexibility of the brain mainly ensures the generativity of language and culture, and eventually makes translation both possible and necessary (p.321).

Chapter 7 illustrates four essential cognitive functions of human beings – attention, decisions, choices, and control – and their implication for translation studies. It first presents a review of the interdependent relationship of these four functions, focusing on how attention filters input information, directs perception, and thus influences decisions. Then it shifts to the implication of attention for translators, mainly those aspects of the source texts that most need attention. Finally, it elaborates on areas of translation studies where neurological advances concerning attention, decision, choices and control are highly significant, mainly translation theory in terms of the decision-making process of the translator, the promotion of choice in the pedagogy and profession of translation, the ethics of translating and the reception of translations.

The eighth and last chapter offers a brief summary of a variety of ways in which neuroscience can contribute to translation studies. Basically, it can add to a universal theoretical framework that "structures the practice of translation and the human interactions that result" (p. 377). It can also shed light on and provide a source of explanations for such issues as the complexity of translation, generativity and equivalence in translation, and the behavior of the translator that are central to our understanding of the nature of translation. The author concludes this chapter and the whole book with a dozen research questions through which she hopes to offer an avenue for future integration of neuroscience in translation studies.

Overall, *Neuroscience and Translation* is first of all a courageous and pioneering book. Neuroscience is considered the last frontier of the biological sciences (Kandel et al., 2012, p., 5). Few scholars in the humanities venture into this field that has been fraught with huge challenges. With her science education in college, Tymoczko makes her foray and outlines a blueprint for linking the advances of neuroscience to studies of various aspects of translation. Secondly, as one of the few volumes to explore neuroscience tools in translation, this book presents a comprehensive review of how discoveries in neuroscience can contribute to translation theoretically and practically at both micro and macro levels, thus further expanding the scope of translation studies. The book is also organized clearly, with each chapter first showcasing certain basics of neuroscience and then

illustrating their implications for translation studies. Seeing neuroscience as a promising field that will fundamentally influence the way we see translation and eventually reshape translation studies in the future, Tymoczko invites neurologists and translation studies scholars to work together to unveil one of the chief "known unknowns" of translation studies (Tymoczko, 2012). While grounded in translation studies, the book can also serve as an introduction to the neuroscience of perception and cognition. Apart from daunting technical terms and acronyms such as fMRI, PET, EEG, and ERP (cf. Rinne et al., 2000; García, 2019), the book is relatively easy to read and able to provide pleasure and enlightenment for readers who are interested in language, translation, culture, and human brain as well.

That being said, the limitations of the book are equally notable. First, it devotes much space to reporting findings in neuroscience, which results in relatively limited discussion of translation, especially the methodology in the integration of the two disciplines. Secondly, the book overall is redundant and verbose, with many paragraphs in some chapters stressing similar points such as the implication of neuroscience for (aspects of) translation. The author, as a postcolonial translation scholar advocating for global multilingualism, is ambitious about the future of neuroscience as an ultimate tool to address the central concerns of translation and translation studies, especially the question of ethnocentrism and Eurocentrism. However, without saying much about how to approach the issues, the author has just painted a rosy picture for us. Over the past decades, neuroscience has grown up considerably and accordingly Neuroscience of Translation is sure to be a promising and fruitful academic discipline. Despite the shortage in sounder theoretical models and rigorous methodologies for Neuroscience of Translation to be an autonomous field of study, this book nonetheless opens a precious venue for the integration of the two disciplines.

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