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The Handbook of Translation and Cognition showcases new research directions in translation and interpreting studies while emphasizing their enrichment from and interface with cognitive science. We are profoundly grateful to the invited contributors for their diligence and hard work, without which this handbook would not exist. These scholars have helped us to put together a much-needed collection of essential topics that present engaging discussions. The value of their expertise to readers resonates in a quote by an anonymous peer reviewer of the handbook project:

The caliber of the contributors involved has every chance of becoming the first—and remaining the main—reference work of this kind.

We would also like to thank the anonymous peer reviewers who were commissioned by Wiley-Blackwell to assess our proposal for The Handbook of Translation and Cognition. Their suggestions on how to improve the handbook were extremely beneficial as we put together the project. We hope that readers will agree with the anonymous peer reviewers that the handbook serves as

a groundbreaking proposal that bridges the gap between the field of translation and interpreting and cognitive science

and

a unique attempt to explore underpinnings of the interdisciplinary connections between translation studies and cognitive linguistics.

A special thank-you goes to Prof. Erik Angelone, Prof. Birgitta Englund Dimitrova, Prof. Yves Gambier, and Prof. Daniel Gile for having endorsed The Handbook of Translation and Cognition. Their assessments are both humbling and encouraging, and we hope that readers will agree with their words that grace this handbook’s back cover.

We would like to offer our gratitude to the publisher, John Wiley & Sons, whose support was beyond professional and efficient in the development of The Handbook of Translation and Cognition. Those who deserve special thanks for their excellent and

Acknowledgments
prompt correspondence include Mark Calley, Assistant Editor for Linguistics; Tanya McMullin, Associate Editor for Social Sciences; Aravind Kannankara, Copy Editor; Vimali Joseph, Production Editor and Manish Luthra, Project Editor. It has been our pleasure to work with John Wiley & Sons on this publication.

We are very grateful to our two editorial assistants for their excellent work during the preparation of the manuscript: Andrea Hadland and Samantha Graham. We thankfully acknowledge that financial support to hire these two editorial assistants was received from a grant partly funded by Wilfrid Laurier University operating funds and partly by a Social Sciences and Humanities Research Council of Canada Institutional Grant.

Finally, we are extremely appreciative of the scholars—both internal and external to The Handbook of Translation and Cognition—who served as anonymous peer reviewers of the individual contributions. It is without a doubt that their knowledge and expertise have strengthened the content of this handbook and its implications for future research. As such, we would like to extend sincere thanks to the following researchers:

Erik Angelone
Carolina Barcellos
Rafael Barranco
Allison Beeby
Bergljot Behrens
Ursula Boser
Clemens Brunner
Augusto Buchweitz
Michael Carl
Cinzia Citarella
Oliver Ćulo
Igor da Silva
Silvana Maria de Jesus
Maureen Ehrensberger-Dow
Birgitta Englund Dimitrova
Claudia Förster Hegrenæs
Antin Fougner Rydning
Daniel Gile
Maria González Davies
Sandra L. Halverson
Gyde Hansen
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Haidee Kruger
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Paul Kussmaul
Anna Kuznik
Elisabeth Lavault
Kirsten Malmkjær
Celia Martín de León
Gary Massey
Heliana Mello
Ricardo Muñoz Martín
Elide Oliver
Mariana Orozco
Nataša Pavlović
Marisa Presas
Hanna Risku
Ana Rojo
Marcia Schmaltz
Moritz J. Schaeffer
Sanjun Sun
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Part I  Introduction
1 Translation and Cognition

An Overview

ALINE FERREIRA AND JOHN W. SCHWIETER

1.1 Introduction

Translation has been carried out for millennia, but understanding the particularities of the complicated process of transforming a piece of information from one language into another increasingly intrigues researchers around the world. Perhaps this is one of the many reasons why researchers have become so motivated to conduct studies explaining the processes of translation and interpreting. The integration of cognitive science into translation and interpreting studies (TIS) has formed an interdisciplinary-rich field that is the foundation and impetus of The Handbook of Translation and Cognition. In a comprehensive and critical review, the Handbook builds on existing theories and research designs by bringing together contributions from international experts affiliated with institutions and research centers in 18 countries.

As noted by Ferreira, Schwieter, and Gile (2015), “the continued diversity and ever-deepening exploration of various aspects of translation and interpreting are naturally associated with interdisciplinarity and [...] the input of cognitive science has been considerable” (p. 7). We exploit this observation in this introductory chapter by foreshadowing prominent themes at the forefront of research in translation and cognition. In the following sections, we briefly present and comment on each of the chapters in the Handbook in the order that they appear within the main parts of the book, namely: theoretical advances; methodological innovations; translator and workplace characteristics; competence, training, and interpreting; and moving forward.

1.2 Theoretical Advances

In Part II, “Theoretical Advances,” nine chapters present an overview of translation process research (TPR) and discuss the contributions from and interfaces with cognitive science. In Chapter 2, “Translation Process Research” by Arnt Lykke Jakobsen, the author
provides a review of the behavioral-cognitive experimental paradigm that has been popularly used by researchers around the world. Jakobsen explains the correlation between the events in the mind and the body when humans translate. He presents the historical context of TPR and its development since the first methodologies such as think-aloud protocols. The chapter paints a colorful picture of current TPR and illuminates how translation itself is changing as a result of multimedia forms and machine translation.

Chapter 3, “Models of the Translation Process” by Michael Carl and Moritz Schaeffer, reviews translation models since the late 1940s. Models of translation processes have been developed for machine and human translation and in both TS (translation studies) and in computational linguistics. The idea of linguistic stratification was the basis for translation models, mostly established on the belief that the syntax of natural languages could be formalized. The authors explain rule-based and example-based machine translation, focusing on the decoding process of the source text (ST), followed by the analysis, transfer, and regeneration of sentences in the target text (TT). In the 1980s, as humans continued to gain access to personal computers and more translations were conducted in electronic format, the foundations of statistical machine translations (SMTs) were formulated. Also around the same time, more attention was given to translation functions in the target culture, and less to the linguistic aspects of the STs. The authors move to review models based on empirical data (Gutt, 1991/2000; PACTE, 2003; Risku, Windhager, & Apfelthaler, 2013) and discuss Schaeffer and Carl’s (2013) recursive translation process model. The chapter demonstrates that both TS and TPR have generated models and hypotheses that have been concerned with both translation process and product, by investigating typical phenomena in the product, the representation of translation in the translator’s mind, and how translations are carried out. Although experiments have been conducted across different languages and tasks, there is still a need to formalize, operationalize, and test the variables that have been identified as relevant in TPR.

Based on the notion that written, auditory, and audiovisual translations are built on two cognitive processes—production and reception—Chapter 4 by Kruger and Kruger, “Cognition and Reception,” discusses the importance of a more solid, empirical approach to translation effects. The asymmetrical focus on producers and receivers in cognitive studies is discussed, and it is clear that the importance of analyzing how the translated texts are reconstituted every time the product is read, viewed, and received has been neglected in the literature. An overview of Chesterman’s (1997) explanation of translation effects on the reader is presented (i.e., change of mental state, change in actions, and effects in the target culture or intercultural relationships). Kruger and Kruger first explain the relevance of the analysis of cognitive processing in the reception of translation. A target orientation has been accepted by scholars (Chesterman, 1997; Nida & Taber, 2003/1969); however, how receivers (both original and receivers of translations) respond to those texts is scarcely investigated. As such, Kruger and Kruger present a critical review of the links between cognitive-linguistic and sociocultural or ideological approaches to translation, followed by an explanation of the connections between the micro-level of cognitive processing and the macro-level of texts, cultures, and ideologies. A brief discussion on the theory of mind (Annoni, Lee-Jahnke, & Sturm, 2012) is offered to examine the translator’s ability to assess the target audience’s knowledge and needs, which is related to a person’s mental state. Next, Kruger and Kruger present the
theoretical models of translation reception, followed by a discussion on usability studies, accessibility, and translation evaluation. They also offer an overview of empirical research on cognitive processing in terms of reception for written and audiovisual translation from different perspectives, such as reading behavior, cognitive effort, comprehension, and attitudes. The chapter concludes with a discussion on the complexity characteristic of cognitive processing in translation spanning several modalities.

In Chapter 5, “Directionality in Translation,” Ferreira and Schwieter bring to light the importance of translating into a non-mother language (inverse translation, IT) and how research in this area has not been adequately recognized even though its practice may be more common than translation into the mother language (direct translation, DT). Traditional assumptions regarding the superiority of DT relative to IT have been made without empirical support, even though IT is a necessity as it may be difficult to have access to translators who are native speakers of the target language. The authors analyze the few empirical studies that have compared DT and IT and their often misleading discussions of the translator’s ability to perform IT. They also review data from questionnaires carried out in Europe, where IT seems to be a common practice accepted by both clients and translators. The idea of the perfect translator, or a balanced bilingual, is briefly discussed. From a Chomskyan perspective, the perfect informant would be an authority on the language and would be able to make grammatical judgments. The chapter considers issues relating to a translator’s identity and ideologies and notes that in terms of social and cultural approaches, little interest has been shown in answering these important questions. Both IT practice and teaching have been criticized by scholars without having the empirical data to support their claims. The field has now reached a point where studies must be developed to not only describe IT’s specificities but also the development of IT competence. Future work should try to uncover the array of variables that play a role in the translation process, including translators’ own abilities and experiences.

Celia Martín de León, in Chapter 6, “Mental Representations,” discusses two perspectives of mental representations: The first defines a mental representation as an image-like or a language-like construct, and the second explains cognition through mental representations. The chapter begins by discussing the nature of mental representations and how their components have been tested in multiple frameworks and by different philosophers over the last century. It then turns to symbolic representations in cognitive science from a relevance theory perspective and to the imagery debate and its role in TS. Focusing on social and cultural dimensions, Martín de León applies experience-based mental representations to TS, assuming that mental representations may be differently organized by different groups (source culture and target culture) and that translators would be able to identify such differences. Experiential mental representations are also used to describe the translators in a user-centered approach, as well as to describe how TTs are mapped. Next, she explains embodied representations and mental simulations in cognitive science, including image schemas, followed by a review of how they form part of TS. According to these approaches, cognition relies on mental representations, although alternative perspectives are also discussed. The chapter concludes with a commentary on how the mind and world are coupled in dynamic ways and that mental representations are “more like internal simulations of external actions and situations than like internal static structures.”
Chapter 7, “Aspects of a Cognitive Model of Translation,” is contributed by Gregory M. Shreve and Isabel Lacruz. The chapter explains how translation and cognition has developed in sync during the last two decades and how there is every reason to believe that it will continue to rapidly increase. The fusion of translation and cognition allows research to build a solid empirical framework that supports the creation of a robust cognitive model of translation. The chapter presents a review of translation competence as understood by Wilss (1976) and discusses the cognitive resources required during translation as interpreted in expertise studies. The authors also discuss the idea that being able to solve transfer problems is a required starting point for a cognitive translation model. Under this assumption, the process of solving transfer problems, based on several knowledges, is presented. Because reading, writing, and transfer are essential components of translation processes, the authors provide an overview of models from various perspectives. They point out that there is not a wide range of theoretical apparatus to explain the transfer process of a comprehensive psycholinguistic model of reading, text comprehension, and writing. Perhaps the most significant contribution of the model is that it provides an explanation of the transfer processes that occur between ST reading and TT writing. The chapter transitions to explain that translation is a complex crosslanguage activity that involves sequences of activation and inhibition. This discussion integrates language switching models from the bilingual literature into translation activities and explains a cognitive model of translation that situates activities such as reading, writing, and transfer within the scope of general and specialized models of cognition and bilingualism. The integration of models from various disciplines can lead to more robust models of translation processes.

In Chapter 8, “Bilingualism in Cognitive Translation and Interpreting Studies,” Schwieter and Ferreira outline issues related to the interface between cognitive bilingualism and TIS. A discussion on the differences and similarities between translation and interpreting from psycholinguistic perspectives is first contextualized, followed by a review on language recoding as articulated in Christoffels’ (2004) meaning-based strategy and transcoding strategy. The authors underscore the differences between translation and interpreting—both of which are complex tasks, yet involve different strategies and decision-making processes. The chapter then turns to a discussion on literal translation and cognitive effort (Schaeffer & Carl, 2014; Tirkkonen-Condit, 2005) and then to an examination of the role of working memory (WM) in interpreting tasks. Key studies are reviewed that measure the relationship between WM and multilingualism while focusing on the multilingual lexicon and multilingualism in general. The cognitive consequences of bilingualism are presented in a brief review of important studies that have analyzed different groups of bilinguals in order to access executive control, among other aspects. Even though there are still mixed and rather controversial findings to be clarified, it has generally been shown that bilinguals have cognitive advantages compared to their monolingual counterparts. Schwieter and Ferreira’s chapter demonstrates the essential integration into TIS of studying multilingualism from psycholinguistic perspectives.

In Chapter 9, “Recognizing Social Aspects of Translation,” Sonia Vandepitte presents an overview of the development of sociological approaches to TS. As a subfield of TS,
sociological perspectives and methodologies are rather recent and traditionally have been treated separately from cognitive approaches to TS. The chapter presents a discussion on interlingual *tertium comparationis* applied to translation that compares the meaning of an ST in its respective language to the ST in the target language. It also focuses on how a transition from a linguistic approach to a more social approach could replace the focus on the shift from languages (ST and TT) to audiences. Throughout the chapter, the author presents aspects of cognitive research that help shed light on social characteristics of translation work. She discusses the construction of the meaning as described in previous work and moves to a reflection on how translation solutions are carried out. Through her commentary on the principle of relevance (Gutt, 1991/2000), Vandepitte explains translation as interlingual interpretive language use. She then reviews the notion of prototypes as explained by Halverson (2007) and the idea that translation is a mental activity based on both prototypes and schemas (Langacker, 2008). The chapter concludes by discussing reception and cognitive characteristics of the audience and advocates for future work that integrates social aspects into cognitive approaches.

Boguslawa Whyatt, in Chapter 10, “Intralingual Translation,” presents a discussion on the process of reformulating, rewording, or paraphrasing—also known as intralingual translation. The author explains that there are obstacles to effective communication within the same language, even though they may be less pronounced than the obstacles involved between different languages. The chapter presents a review on the semiotic approach to intralingual translation, followed by a discussion of language and meaning and how words are used as material mediators (Barthes, 1967) for communicative purposes. It also discusses how intralingual translation might be a less obvious type of linguistic mediation compared to interlingual translation and then offers a commentary on how glosses found in religious manuscripts were used as aids in their interpretative process. The author looks at the effects of time in intralingual translation and leads a dialogue on the reinterpretation of canonical texts that are adapted for new generations, in its written form, and also for stage or screen. She also presents some insights from studies on reading and how intralingual translation may remove linguistic obscurity. She also articulates the objectives of the ParaTrans Project, which promises to contribute to TPR in its understanding of how translation and paraphrasing share similar stages of processing information from texts. Whyatt’s chapter argues that cognitive-oriented approaches to translation should not underestimate the contributions that intralingual translation has to offer to TS.

1.3 Methodological Innovations

In Part III, the Handbook turns to methodological innovations of translation and cognition. Chapter 11, “Multimethod Approaches” by Sandra L. Halverson, explains how cognitive translation studies (CTS) has developed hand in hand with research methodologies eliciting new types of data. She identifies important reasons for employing a mixed-methods approach as informed by Bryman (2008) and explains the role of
theory in mixed-methods research projects as they are applied to quantitative and qualitative studies. Moving to a discussion on the constructs that have been used especially within the TRP paradigm, Halverson presents an overview of some of the studies that have analyzed cognitive effort during translation. The author also comments on literal translation as a default rendering procedure following her previous work (Halverson, 2015). This overview is followed by a discussion on an additional set of constructs within CTS, including the concept of “functional fixedness.” Its relevance is related to the idea of translation as a problem-solving activity. She also presents a review on the notion of automaticity as discussed by Schaeffer and Carl (2013), in which it is assumed that the smaller the number of potential translations, the more likely the translation decision will be “automatic.” The chapter illuminates the fact that the traditional dichotomy of product vs. process has become outdated in light of new data types that are available and analyzed in cognitively-oriented work. It also argues that research questions cannot be answered on the basis of only process- or product-oriented data (e.g., corpus or gaze data).

In Chapter 12, “Verbal Reports,” Riitta Jääskeläinen offers a review of a popular methodology that is strongly associated with fundamental ontological and epistemological convictions. Jääskeläinen starts the chapter by discussing Ericsson and Simon’s (1984/1993) theory of verbalization. As a result of practice, cognitive processing tends to become automated but still unavailable for verbalization. The chapter presents the limitations of verbalization and points out that few studies have focused specifically on methodology—something she argues is long overdue. In terms of TPR designs, she draws attention to the fact that researchers have commonly neglected a theoretical reflection that might be related to the fact that TPR is a young discipline. Questions related to the validity and reliability of verbal protocols are discussed in order to offer a critical view of the methodologies employed thus far in TPR. These questions, however, remain unanswered and require specific testing. The chapter also argues that future research should explore the possible incompatibility of verbal reports with the evolutionary view of consciousness.

Silvia Hansen-Schirra, in Chapter 13, “EEG and Universal Language Processing in Translation,” presents an overview of EEG methods and event-related potentials that have recently been used in research in translation and interpreting. She starts with an overview of translation universals as they are related to cognitive processes during translation (e.g., explicitation, cohesive features, and simplification) and continues on to a review of the concept of grammatical metaphor (Halliday, 1985; Halliday/Matthiessen, 1999) as used to model translation. In translation, TTs are made more explicit as the translator’s own understanding and interpretation are transferred, when the easiest alternative for formulation of the TT is used (Steiner, 2001; Tirkkonen-Condit, 2005), leading to explicitation and simplification. The chapter next reviews Toury’s (1995/2012) two laws of translational behavior: growing standardization and the law of interference. Other references are incorporated to understand normalization, including Baker’s (1996) universal feature of normalization and the use of parallel corpora (Hansen, 2003; Teich, 2003). A mixture of normalization and shining-through phenomena, as proposed by Hansen-Schirra (2011), is then discussed. Other studies that discuss normalization
and shining-through (Hansen-Schirra & Steiner, 2012; Tirkonen-Condit, 2004) are also presented. The chapter then transitions to discuss several models of the translation process and key studies that have employed EEG technology. In psycholinguistics, priming, inhibition, and monitoring, among other tasks, have been investigated using cognates, non-cognate word recognition tasks, and word translation tasks, among others. Quantitatively, as we move forward to new methods and approaches to investigate translation, it seems that it is possible to operationalize and measure certain processes. Triangulation appears to be a productive way of analyzing translation processes, in contexts in which ecological validity complements experimental control.

Chapter 14, “Eye Tracking in Translation Process Research” by Kristian T. Hvelplund, explains how eye tracking has become a well-established method in TPR. He starts the chapter by presenting central methodological issues currently being debated in the field. There are several challenges involved in the research designs discussed, from the choice of equipment to the selection of participants. Hvelplund presents a nonexhaustive list of studies that have explored the main questions on TPR by using eye-tracking data, including studies on interpreting, sight translation, reading in translation, cognitive effort in translation, time pressure and text difficulty, directionality, expertise, competence, translation styles, metaphor translations, and post-editing translation. In terms of future research, the chapter points out that technology could redefine research practices in terms of developing in situ “ecological” data collection. Hvelplund also takes into account the importance of triangulation and the production of a translation. With eye-tracking technology, research questions that were previously tested using other methods could be revisited to obtain qualitative, fine-grained analyses and potentially a better comprehension of translation processes.

Chapter 15 by Patricia Rodríguez-Inéz, “Corpus-Based Insights into Cognition,” presents a review on the most common corpus linguistics method used in TPR. The chapter begins under the assumption that corpora cannot provide direct insights into cognition, leading researchers to combine corpus and experimental data and analyze both process and product. Rodríguez-Inéz presents an overview of corpus methods and techniques and turns to a discussion on the few studies of translation competence and corpora along with an overview of studies that have focused on translation units. From this conversation, the chapter moves to discuss style in translation followed by a brief review of translation universals, post-editing and genre, and translator training. Finally, the chapter critically looks at the corpus-based research that has contributed to studies of cognitive aspects of translation and argues that the combination of data from other methods should be included in corpus-based studies to offer a more comprehensive view of the processes involved in translation.

Hanna Risku, in Chapter 16, “Ethnographies of Translation and Situated Cognition,” presents a review on situatedness and translators’ interaction with the environment and how cognitive translation processes benefit from a situated approach to cognition. This new approach highlights novel data collection methods, including an ethnographic approach to TPR. Risku begins the chapter with foundational definitions of knowledge from its theoretical and epistemological origins and moves to a discussion on the relevance of ethnography for TS. The chapter then focuses on the methodological challenges
that an ethnographic approach faces (e.g., ethnographic research focuses on a deep, close analysis of selected cases, capturing as many factors in one single case). Practical challenges for this type of research, such as finding relevant and willing translation settings, are also discussed in the chapter. Qualitative data analysis methods including grounded theory (Glaser & Strauss, 1967) are discussed along with a discussion on data reporting in ethnographic research. The chapter concludes with a critical review of the contributions of ethnographic research, emphasizing that quantitative and qualitative approaches in translation and cognition should be intertwined.

### 1.4 Translator and Workplace Characteristics

Part IV of the Handbook focuses on characteristics of translators and the workplace. Chapter 17 by Sharon O’Brien, “Machine Translation and Cognition,” starts with a review on human interaction with machine translation (MT) in its three basic forms: evaluation, revision, and use. Evaluation relies on human perception, from a cognitive point of view, and can be approached from different perspectives, such as error classification and annotation, adequacy, fluency, and ranking. O’Brien points out some of the problems associated with human evaluation and calls attention to the relationship between limited processing capacity and quality of evaluations. She then moves to a discussion on automatic evaluation metrics (AEMs); although they have overcome several of the weaknesses in human evaluation, they still present some challenges. A review on post-editing MT as a complex cognitive task is put forth. The author also reviews Risku’s (2012) discussion of the three cognitive frameworks used in TPR, including the information processing model, followed by a review of the information processing view of post-editing. O’Brien then explains the dynamic connectionist system, its use in cognitive science, and how it might help us to understand the complexities in post-editing. She extends this discussion to include how information integration takes place during translation as hypothesized in Smith and Thelen’s (2003) dynamic field model. In all, the chapter makes a clear argument for the fact that MT evaluation presents several limitations that might not be solved with AEMs. Future research must recognize that post-editing is a complex cognitive process and that as technology develops, complexity will also increase, making it all but necessary to make methodological alterations.

In Chapter 18, “An Ergonomic Perspective of Translation,” Maureen Ehrensberger-Dow discusses an under-researched subfield of TS, namely, the role of ergonomics in translation. Ergonomics is concerned with the interaction between humans and the application of theories, principles, and methods to optimize human well-being and overall system performance. Ehrensberger-Dow opens the chapter by presenting an overview of ergonomics, its three main domains, and its application in TS. She first explains the physical ergonomics of translation and moves to the cognitive ergonomics of translation, and later explains some aspects related to the organizational factors that affect a translator’s situated activity. She explains how translators interact with the tools they use, such as in computer-aided translation, for which research has shown both positive and negative effects on the translator’s work. The chapter explains how a translator’s decision making might be affected by ergonomics, and she uses the translator’s