Introduction.
Probing the process: Towards more integrative research methods

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1. The scientific method: The search for control and rigor in translation research

Translation is not an exact scientific endeavor. Yet, we scholars strive to make it so. In our quest for greater precision, we engage in placing phenomena into neatly cut categories. After all, quantification is an exercise in high abstraction. We long for translation solutions that can be clearly classified as correct or creative, right or wrong; we strive for research methods that will yield exactly the same results, whether focusing on the product or on the process, whether analyzing them quantitatively or qualitatively. After so many years closing in on our quarry, something we know for certain is that translating—or language use, for that matter—is a fuzzy phenomenon that escapes easy definitions and categorizations. This is precisely why disciplines that deal with human language and behavior have been classified as "soft"—as opposed to the "hard" or natural sciences—on the basis of the difficulty to establish strictly measurable criteria for the investigated phenomena (Fanelli & Glänzel, 2013).

The scientific method relies first on observations, then on testable hypotheses by using airtight methods and, in the case of experimental designs, control groups. In translation and interpreting studies (TIS henceforth), researchers normally spare no effort to achieve thoroughness, but rigor may become challenging in studies where the analysis of data relies on the researcher's introspections and where the range of translation solutions is so wide and varied that it escapes easy classifications, leaving the door ajar to arbitrariness. Control also poses formidable problems in the experimental research of translation. Whereas chemical substances or even physical processes are relatively easy to group and tackle, humans rarely come in neat cohorts that conform one hundred percent to the design of the study. TIS researchers may try to reach greater control from the start by focusing, for instance, on students or professionals, and then narrowing the groups down according to criteria such as their L1, L2 and translation skills, or their training stage or years or experience, but the list of confounders feels endless: personality traits, current mood, past experiences, health issues and even substance intake can impact performance.

The "hard" sciences are not problem-free either. The range of phenomena under study may be more regular and manageable, but not everything can be

easily controlled for. There is still a fair share of unchallenged assumptions as to the expected unfolding of processes under study, and there may also be unexpected phenomena that are not easy to account for. In biology, for instance, the reaction of cells may be conditioned by the behavior of the host (e.g., alcohol and cigarette smoke can induce cell death). Biologists make assumptions about the expected behavior of cells under certain conditions, very much like TIS researchers do about translators' expected performance. The distinction between hard and soft sciences is not thus based on the presence or absence of rigor and control, but on the degrees achieved in both realms. In TIS, the difficulties to attain rigor and control beg the question of what strategies and procedures can be used to implement more stringent methods to allow researchers to maximize systematicity and minimize conjectures and fuzziness.

2. Can more integrative methods be a solution?

The dichotomy of hard vs soft sciences is often equated with that of quantitative vs qualitative research. Quantitative methods are associated with greater rigor and control. Qualitative methods allow for greater flexibility and in-depth observation, but they often result in laxer control and a looser interpretation of evidence. In TIS, earlier qualitative studies based solely on researcher's introspection were soon followed by a surge of quantitative work that advanced towards a more scientific research methodology (Rojo López, 2013). Quantitative research reached its peak in the 1990s with the boom of experimental designs on translators' cognitive processes within Cognitive Translation & Interpreting Studies (CTIS). The limitations of quantitative methods for the study of translation would soon become evident, and they were criticized, among other reasons, for the scarce ecological validity of their settings—particularly, in the study of professional translation—and the wanting reports on the quality and nature of data. As a result, researchers have started to look for more integrative methods to obtain safer insights with more accurate data.

A popular strategy has been the combination of qualitative and quantitative data on the premise that together they can provide a deeper understanding of problems and allow for greater systematicity than either approach on its own. This integration of qualitative and quantitative methods is now widely recognized in the social sciences as a research method of its own, known as *mixed methods research* (Creswell & Plano Clark, 2007). Mixed methods research typically combines qualitative and quantitative methods using data collection tools associated with both types of data. TIS research has veered into mixed methods approaches as a way to achieve a deeper understanding of research problems and a more accurate approximation to the examined populations. In mixed methods research in TIS, greater objectivity can be added to qualitative studies focused on the analysis of translation phenomena and errors by using statistics to quantify well-defined types of those phenomena and errors. Similarly, the arbitrariness of having data analyzed only by researcher's introspection can be minimized adding analyses by more researchers—ideally a minimum of three—and quantifying the level of agreement of their assessment. Conversely, qualitative analyses can provide greater insight into the phenomena computed in quantitative studies by shedding light on their nature. Furthermore, the control of confounding variables in experiments with quantitative data collection tools (e.g., eye-trackers, keyloggers, etc.) can be maximized with questionnaires or interviews that will allow researchers to collect relevant information to rule out the effects of unexpected intervening variables (e.g., mental or health problems, or working habit that may interfere with the results).

Mixed methods may also be applied to compare sets of data of one and the same variable, a practice commonly referred to as *triangulation*. In quantitative TIS, triangulation has recently gained ground over the use of a single data collection tool. Translation research has frequently combined eye-tracking and keylogging (e.g., Dragsted & Carl, 2013; Hvelplund, 2014; Kruger, 2016; Chen, 2021); research on interpreting stress has combined heart rate with skin conductance (e.g., Korpal, 2016) and with voice analysis (e.g., Rojo López et al., 2021); heart rate has also been combined with cortisol analysis to research sexual arousal in audio description (e.g., Rojo López et al., 2021). The comparison of different sets of results provides researchers with a better understanding of the factors involved and enhances the quality of data and hence the validity of inferences.

The search for more integrative research has not only shaped methodological issues; theoretical frameworks have also evolved towards more unifying models that attempt to bring different approaches together. Textual and pedagogical approaches have incorporated process-oriented perspectives (e.g., Massey, 2017); the reception of translated texts has been included into literary and audiovisual translation theories (e.g., Gambier 2018); and cognitive approaches have grown to integrate ergonomics, social and emotional aspects into an embodied, embedded, extended and affective model of cognition (e.g., Muñoz 2010; Muñoz & González, 2021). Process and product, mental and textual aspects, social and cognitive issues are gradually converging to provide a more holistic view of translation and interpreting as multi-faceted phenomena that can be best investigated with integrative models and methods.

3. Integrative approaches to theory and methodology in translation and interpreting research

The present volume offers seven papers to illustrate different integrative theoretical and methodological approaches to TIS research. The volume opens with two interdisciplinary proposals (by Muñoz & Apfelthaler and Risku & Rogl) that address the cognitive study of the translation process by integrating notions and approaches from disciplines such as writing studies and sociology. These are followed by three studies that implement mixed methods by combining quantitative and qualitative methods of analysis (by Martín de León & Cardona, Angelone & Marín, and Deckert & Augustyn). The issue closes with two papers (by Mellinger, and Tomczak & Whyatt) that integrate the use of different data-collection tools in a single study.

In "A task segment framework to study keylogged translation processes", Ricardo Muñoz and Matthias Apfelthaler lay out a cutting-edge framework that integrates notions from cognitive science, writing and cognitive translation studies, and shifts the focus from text to task as the basic phenomenon in translation process research. After carefully reviewing keylogging research, the authors describe a *Task Segment Framework* (TSF), an analytical model specifically designed for translation tasks that can also be applied to other typing tasks. Based on the notion of fluency, and on the alternation of typing periods and intentional pauses, the second part of the paper presents a principled and realistic approach to chunking the task flow based on individual pause length thresholds and observed subtasks. The framework breaks down the writing-process research construct of *inter-keystroke intervals* (IKIs, here the time span between releasing one key and pressing the next one) into four categories: *pauses* (intentional, task-chunking time spans that point to planning and other cognitive processes); *respites* (unintentional but cognitively relevant, task-related disfluencies that do not stop the typing flow, a key concept for the analysis of translation fluency); *delays* (unintentional, mechanical disfluencies

that do not stop the typing flow) and *lags* (IKIs under 200 ms that should not be computed in keylogged translation processes, in view of current measurement limitations but also to avoid excessive noise while setting a motivated baseline). The four categories can be distinguished through two additional thresholds separating willful from unintentional IKIs—an upper threshold between pauses and respites; and a lower threshold to separate respites from delays—that is, potentially relevant from mainly mechanical IKIs. *Task segments,* flanked by pauses, are excerpts of the keylogged task flow, with or without text. Events (keystrokes and mouse actions) are interpreted as part of more complex behaviors up to translation/typing subtasks within the text—such as *add* or *delete*—or outside the target text, such as *search* and other *human-computer interactions*. Task segments thus work as analytical units where observed behavior can be linked to hypothesized cognitive processes through transparent means in keylogged translation processes. This is a new and fundamental framework to operationalize translation fluency that stands upon a well-structured set of assumptions and coherent constructs, so it holds the promise of fostering some breakthroughs in the next decade.

In "Praxis and process meet halfway: The convergence of sociological and cognitive approaches in translation studies"*,* Hanna Risku and Regina Rogl propose an interesting theoretical debate on how to integrate cognitive and sociological approaches, often distant areas in translation research. After an exhaustive discussion of the main sociological frameworks applied to translation, the authors compare them with the distributed cognition framework developed in the cognitive sciences and present a discussion of possible interdisciplinary avenues of convergence. In the second part of the paper, they offer an interpretation of two empirical studies on work processes in translation project management from a sociological and cognitive perspective—more specifically, from Action Network Theories and distributed cognition. Both empirical studies were carried out through participant observation in a translation agency in Austria in 2002, 2007 and 2014. By analyzing long-term developments in the management of translation projects from these two perspectives, the paper manages to illustrate the plausible theoretical and methodological convergence between them, as well as the compatibility of the explanations they provide.

A different kind of integrative approach is the one that simultaneously looks into process and product data. In the paper "Spoiled for choice? Uncertainty facing options in translation"*,* Celia Martín and José Cardona integrate process and product data by combining key-logging and Choice Network Analysis (CNA) (Campbell, 2000), a qualitative method to identify and quantify the choices made by translation trainees working on the same source text. Whereas the keylogger helps identify 10 potential hesitation indicator types in key-logged processes (multiple options, marks, retypes, median pauses within words, changes, broken words, median pauses before punctuation mark, median pauses before space bar, searches, typing in the search engine), CNA compares and classifies translators' choices in order to obtain a model of the alternatives available for them. Results point to a lack of association between the options potentially available to translators and the degree of uncertainty that can be detected in their processes, since no correlation was found between the quantified hesitation indicators and the number of options for each segment: participants did not always hesitate between all available options, their decisions did not always determine further ones in a linear way, and indecision sometimes remained after the end of the process.

Another good example of process/product integration is Erik Angelone and Álvaro Marín's "Reconceptualizing breaks in translation: Breaking down or breaking through". The paper presents a small-scale, exploratory study based on screen recording to analyze the impact of cognitive suspension on translation

performance in students and professionals in a German-English translation task. In the screen recordings, the authors identify five forms of cognitive suspension behaviors (deliberate, patterned, volitional breaks that are strategically utilized by translators in a patterned fashion when performance is waning) that differ from what have been regarded as problem indicators in the TPR literature (cf. Angelone, 2018). Product analysis is performed by computing number of errors, number of generated characters, and number of typos within areas of interest that precede and follow cognitive suspension. Results show that the documented cognitive suspension types are effective for both student and professional translators to mitigate errors and enhance productivity.

A different type of mixed model is presented by Mikołaj Deckert & Rafał Augustyn in the paper "From film reception to translation production: Suboptimal visual-verbal coding". This contribution integrates a qualitative and a quantitative approach to investigate decision-making in audiovisual translation. More specifically, the paper focuses on visual verbal coding (VCC, i.e., *on-screen text*). In the first part of the paper, they qualitatively analyze scenes containing VCCs with different degrees of suboptimal ostensiveness and plot relevance, with an emphasis on the implications for translators' decisions. They then present an empirical study designed to collect respondents' reactions and reflections concerning selected scenes. After watching the scenes, 70 translation students filled in a questionnaire to see if they had noticed the examples of VVC and whether they considered they should be subtitled. Based on their results, the authors offer a general recommendation for the subtitling of VCCs that is highly applicable to the professional praxis: VVCs should (only) be subtitled if (a) they are relatively well visible in a given scene (esp. when the camera somehow highlights those VVCs, or when they appear multiple times on the screen); (b) they are directly relevant to the plot of the film (i.e., they contribute significantly to its interpretation); and (c) the technical aspects of a given scene allow for subtitling the VVC.

The volume closes with two contributions that triangulate different data in the quest for improved validity and reliability. The paper "Cognitive behavior during consecutive interpreting: Describing the notetaking process", by Christopher Mellinger, examines the integration of audio and visual data in consecutive interpreting studies, in a methodological discussion of the LiveScribe 3 Smartpen, a single data-collection tool capable of simultaneously recording the notes taken by consecutive interpreters while registering their voices. After a thorough discussion of the previous literature on notetaking and consecutive interpreting, Mellinger describes six indicators of cognitive behavior which can be analyzed from a process- and/or product-oriented perspective with synchronized audio and visual files such as the ones registered by the LiveScribe 3 Smartpen (symbols and alingual notes; ear-pen span; hesitations; omissions; and stray pen or scratch marks), and how they can be analyzed in community interpreting research. The paper exposes how this combination of data sets enabled by digital pens provides a temporal dimension which grants deeper insight into the interpreter's progression and informs of specific behaviors as they occur.

Equally significant is the contribution by Ewa Tomczak and Bogusława Whyatt. Triangulation is achieved in the paper "Directionality and lexical selection in professional translators: Evidence from verbal fluency and translation tasks" both through the integration of different data-collection tools, and by combining process and product perspectives. This closing paper investigates how directionality affects experienced bidirectional translators in the process and outcome of lexical selection. Tomczak & Whyatt present an experimental study to analyze whether lexical selection is more cognitively demanding when translating into the translator's L2 than when working into their L1. The participants translated two texts into their L1 (Polish) and two

texts of comparable complexity into their L2 (English). They also performed verbal fluency tasks in their L1 and L2—more specifically, three letter-fluency tasks (to produce words beginning with a certain letter) and three category fluency tasks (to produce words belonging to a certain category). Their task performance was recorded by a key-logging program (Translog II), an eye-tracker (EyeLink 1000 Plus) and a screen-capture program (Morae). The target texts were later rated by experienced proofreaders in terms of corrections to vocabulary. Their results prove that lexical selection is more demanding and less successful in reverse translation, confirming the L2 cognitive disadvantage (i.e., a more effortful L2 processing) described in existing literature (Whyatt, 2019).

4. Concluding remarks

Scholars' goals to maximize rigor and control in TIS research collide with the multi-faceted nature of translation and interpreting and with their endeavor to increase the explanatory power of designs. Control and rigor are easier to achieve in simple designs with few variables, but the complexity of translation as a form of communication frequently challenges simplification and requires interdisciplinary explanations. From literary translation through the audio description of images for a visually impaired audience to interpreting, translation encompasses a whole range of activities defined, among others, by different communication, cognitive and social aspects. Accounting for the range of factors involved in a phenomenon as complex as translation requires the integration of different disciplines and methods.

Methodology in TIS has gained momentum in recent years. There has been a surge of publications in the field aiming to provide guidelines for rigorous and controlled designs (e.g., Rojo López, 2013; Saldhana & O'Brien, 2013; Mellinger & Hanson, 2017; Rojo López & Korpal, 2021). Voices have been raised for and against quantitative and qualitative analysis, and both positions have found a middle ground in mixed methods designs. But while scholars have put the spotlight on the methods of analysis, there are still fine-grained issues of data collection and explanation that deserve further attention. We still need to establish the best standards of use for the different data collection tools in our field and to build theories that integrate as many aspects as possible. Integration requires the ability to assess the issue from different perspectives and to reframe it in a novel light. When faced with two opposing methods or models, we may choose one at the expense of the other, or we may attempt to integrate them into one that contains elements of both but is somehow superior to each. This volume illustrates some of the current efforts made by TIS scholars to reconcile methodological rigor and in-depth explanations through the integration of models and methods into more interdisciplinary frameworks (Muñoz & Apfelthaler; Risku & Rogl), mixed models that combine quantitative and qualitative analyses (Martín & Cardona; Angelone & Marín; Deckert & Augustyn), and the triangulation of different type of data and data-collection tools (Mellinger; Tomczak and Whyatt).

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