The Borrowers: Researching the Cognitive Aspects of Translation

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The paper considers the interdisciplinary interaction of research on the cognitive aspects of translation. Examples of influence from linguistics, psychology, neuroscience, cognitive science, reading and writing research and language technology are given, with examples from specific sub-disciplines within each one. The breadth of borrowing by researchers in cognitive translatology is made apparent, but the minimal influence of cognitive translatology on the respective disciplines themselves is also highlighted. Suggestions for future developments are made, including ways in which the domain of cognitive translatology might exert greater influence on other disciplines.

Keywords:

Translation process research, cognition, cognitive translatology, interdisciplinarity, reciprocity

1. *Introduction*

Translation process research has been ongoing for approximately thirty years now, but the field has grown significantly in the last decade or so, as evidenced by the number of recent publications dedicated to the topic (see, for example, the volumes by Hansen 1999; Alves 2003; Göpferich 2008; Göpferich et al. 2008; Mees et al. 2010; Shreve and Angelone 2010; O'Brien 2011a). The impetus for this growth, in my opinion, is due to a thirst for a greater understanding of translation as an expert task. The growth in research has also come about due to the development and increased accessibility of tools and methods for measuring specific cognitive aspects of the translation task, in particular screen recording, keystroke logging and eye-tracking technologies.

This development has not happened in a vacuum. The objectives of this paper are to give a broad sketch of the disciplines and sub-disciplines from which research in cognitive translatology has borrowed, to examine the direction of influence and to reflect on the extent to which progress has been made in this research field and on how we might push the frontiers further. The term *cognitive translatology* is taken from Muñoz Martín (2010a) to cover research on the cognitive aspects of translation. Section 2 discusses the domains and sub-domains from which research in cognitive translatology has borrowed substantially in the last decade or so, mentioning specific examples for each one. Section 3 then reflects on the progress made, the direction of the influence and makes some suggestions on how the field might develop in the future.

2. *Borrowing from specific disciplines and sub-disciplines*

A broad sweep of the published research on cognitive translatology rapidly reveals that research has been influenced and inspired by a variety of disciplines, some of

which are closely related to translation studies, others of which are more distant. Influence from disciplines such as linguistics, psychology, neuroscience, cognitive science, reading and writing research and language technology is clearly apparent. Within each of these disciplines, specific sub-disciplines have exercised particular influence. In what follows, the disciplines and sub-disciplines will be mentioned, along with the paradigms within those disciplines that have been drawn on by researchers, with examples given for each. The examples given here have been selected because they are good examples of interdisciplinary influences within translation process research.

The classification of disciplines and sub-disciplines is immediately problematic, of course. The main intention of the paper is to illustrate the extent and nature of borrowing, rather than to create a rigorous typology of disciplines and sub-disciplines. Some flexibility with regards to the categorisation is therefore required.

2.1 *Linguistics*

Unsurprisingly, the very broad domain of linguistics is heavily drawn on by researchers of cognitive translatology. While cognitive translatology has as its main focus the process of translation, debate has also taken place on the importance of a parallel analysis of the translated product. The argument is that by looking only at the process or the product during a research project, one is looking at only one side of a coin. Hence, the sub-discipline of corpus linguistics has been drawn on to aid research in cognitive translatology. Corpora of translated texts allow the researcher to systematically describe the translated product, and, if so constructed, at different points in the translation process (e.g., prior to and following the (self-) revision stage). Alves et al. (2010), for example, expound the benefits of annotated corpora in identifying translation units associated with increased levels of cognitive effort during

the translation process and Alves and Vale (2011) have developed a tool with which translation process data can be added to corpus data. While examples of research combining corpus linguistics with cognitive research are still few, there is no doubt much to be learned by combining the strengths of both approaches.

In cognitive translatology research, an important element in the research design is the nature of the source text selected for translation. Texts are selected for their appropriateness for the participants in a research project; for their level of specialism or, perhaps more commonly, for their level of generality; for their display of specific linguistic features (e.g., metaphor); or for their level of (perceived) difficulty. The selection of texts for a research project and the profiling of those texts are, however, often problematic because selection procedures have not been adequately operationalised. For example, it is tempting to use the rather old and inappropriate measures of readability indices (e.g., the Flesch Reading Ease, Flesch-Kincaid or Gunning Fog Index) as a measure of a source text's translation difficulty, but these measures have not shown themselves to correlate well with translation difficulty (O'Brien 2010). New and more reliable measures for text profiling are needed. For example, Alves, Pagano and da Silva (2010) employ Taboada and Mann's (2006) concept of Rhetorical Structure Theory as a method for profiling texts for research in cognitive translatology. This proposal has not yet seen much uptake in cognitive translatology research, but has scope for further investigation and testing.

Psycholinguistics, in particular the sub-discipline of bilingualism research, although removed in methodology from cognitive translatology, has also exerted some influence. In this case, however, it seems it is more a case of bilingualism researchers being enticed into the field of translation research than the opposite. Two recent examples of bilingualism research that also consider translation are Rydning and

Lachaud (2010) and Lachaud (2011). In the former, the researchers examine the effect of context on polysemy during comprehension and production, comparing the performance of translators with bilinguals. Lachaud (2011) examines the process of transcoding deceptive, true and non-cognates in the bilingual brain and makes the first, albeit small, steps towards considering how transcoding might be used to help 'prompt' translators during the translation process.

2.2 Psychology

As research into the process of translation largely focuses on human translators and influences on their cognitive processes, strategies and behaviour, it is logical that the discipline of psychology has exerted some influence. Psychology is, of course, a very broad domain and the influences have come from two sub-domains in particular: expertise studies and, to a lesser extent, psychometrics.

Translation is regularly conceptualised as an 'expert task' requiring specific competences, all of which have to be strategically managed to reach a successful outcome (see, for example, PACTE 2003 and Göpferich 2009). The acquisition of such competences have been of special interest to translation process researchers, as have comparisons of 'experts' versus 'novices', such as student translators and bilinguals with no specific translator training (e.g., Jääskeläinen and Tirkkonen-Condit 1991; Jakobsen 2005). This research agenda has become even more important in recent years with the increase in crowd-sourcing and volunteer translation.

Significant research has been carried out in general on the nature of expertise (e.g., Smith and Ericsson 1991; Dreyfus and Dreyfus 2005), its acquisition, and on the profiling of experts, and it is to this body of knowledge that translation process researchers have turned in order to understand translation as an expert task. As with

text profiling, mentioned above, a particular challenge continues to be the profiling of participants in research projects along the cline of 'expertise'. As a response, for example, Muñoz Martín (2010a) proposes the Wechsler Adult Intelligence Scale and TOEFL (Teaching of English as a Foreign Language) sub-tests as being useful for filtering out 'irregular' participants and for ranking 'regular' participants. In another article (2010b), the same author discusses the concept of expertise in general and how it can contribute to the field of cognitive translatology. Jääskeläinen (2010) tackles the concept of 'professional translator', a concept used frequently in cognitive translatology, and asks the difficult question "Are all professionals experts?", giving consideration to the definition of an expert and arguing for the reinterpretation of research evidence in process studies on the basis of these definitions.

A related topic, but one that has received little attention to date, is the relationship between personality and the translation process. Does personality type have any effect on the translation process, on strategies used (e.g., risk-averse versus risk-taking strategies), and even on the product (e.g., level of creativity in a translation)? There are many intriguing questions that could be posed, but that have not yet been investigated. Interestingly, the domain of psychometrics is the focus of some attention now in cognitive translatology. An example of early-stage research on this topic is Hubscher-Davidson's (2009) preliminary study of psychometric profiling and potential correlations with translation quality.

Of interest to researchers in cognitive translatology is what happens in the brain during the process of translation. The preferred method for gaining indirect information about what translators do during the translation process has been verbal protocols (Ericsson and Simon 1993), delivered either concurrently with the translation task or retrospectively, with screen recording and keystroke logging

frequently used as recall aids. The use of verbal protocols as a means of gaining access to brain activity is strongly connected to research into expertise, which was mentioned previously. Much consideration has been given to the use of verbal reports as a method for understanding cognitive processing, both outside and within the domain of translation studies, and the advantages and disadvantages of this method are well recognised (see, for example, Lörscher 1988; Krings 1986). In particular, the automatisation of expertise, that is when there is no verbalisable awareness of strategies or processes, has been recognised as a drawback, as has the fact that the production of concurrent protocols slows a task down by approximately 30% (Krings 2001) and shortens translation units (Jakobsen 2003).

2.3 Neuroscience

The limitations of verbal reports as well as the increasing ease of access to technologies such as eye tracking (the recording of eye gaze data on an area of interest, e.g., a computer monitor and text, during a task), EEG (electroencephalography, i.e., the recording of electrical activity on the scalp) and fMRI (functional Magnetic Resonance Imaging, i.e., the measurement of changes in blood flow in the brain as a result of brain activity) have resulted in new ground being broken in cognitive translatology. Eye tracking will be discussed in Section 2.4, but here two translation-related studies that have discussed or actually used fMRI scanners in a bid to understand what might occur in the brain during translation and interpreting can be mentioned. Chang (2009) uses both an fMRI scanner and an eye tracker to investigate cognitive load in directionality (translating from L1 to L2 and vice versa). This was an early-stage study which recorded fMRI measures while participants silently translated. Moser-Mercer (2010) draws on the domain of neuroscience in her discussion of the plasticity of the brain, the role of long-term and

short-term memory and of deliberate practice in the acquisition of interpreting expertise.

2.4 Cognitive science

In studying cognition in translation, it is not surprising that cognitive science has been influential, with the volume by Danks and Shreve paving the way in 1997. Metacognition, or cognition about cognition, has been of particular interest in the study of translation strategies and competences. Angelone (2010) and Angelone and Shreve (2011) are two recent studies which draw on the field of cognition to increase understanding about how translators manage uncertainty and solve problems during the process of translation, and what effect their ability to do so has on the quality of the translated product.

Long-term memory (LTM), short-term memory (STM), memory capacity and the role they play in product quality have been of particular interest in the field of interpreting for a long period (see, for example, Gambier et al. 1994). Baddeley and Hitch's (1974) model of working memory has been particularly influential. Translation process research has also been interested in these concepts, especially when considering the impact of automatisation on the usefulness of verbal protocols, where STM is said to play a role. Some work has also been done on comparing sight translation and interpreting for demands on working memory capacity (e.g., Agrifoglio 2004).

A third area of influence from the domain of cognitive science is the study of eye–mind coordination, with Just and Carpenter's (1980) eye-mind hypothesis being drawn on heavily as a paradigm for eye-tracking analyses of translation processes. The eye-mind hypothesis states that there is no appreciable lag in time between what the eye fixates on and what is processed in the brain; it is therefore useful for the

analysis of attention (on source text, target text, terminology or other resources) during the translation process. Eye tracking, along with screen recording and keystroke logging, has also opened up the possibility of measuring cognitive load in the translation task, with number and duration of pauses, number of revisions, number and duration of fixations and changes in pupil dilations all being used as measures of cognitive load, sometimes accompanied by verbal protocols for triangulation purposes. Cognitive load in translation has, for example, been measured by O'Brien (2006; 2008), specifically in the context of translation memory (TM) tools, with comparisons being made between different TM match types, ranging from exact matches (suggesting that no revisions are required) to fuzzy and machine-translation generated matches (suggesting that some revision is required).

Although also linked to the domain of sociology, situated, embodied cognition can be mentioned here as a paradigm of cognitive science which has influenced cognitive translatology, given its focus on human cognition and how it is used to interpret and take account of what is going on around us. Situated, embodied cognition is not only interested in what goes on in the human brain, but broadens the scope to examine the whole human being, their history and environment (Risku 2010). This holistic approach allows researchers in cognitive translatology to examine not only what translators do during the translation process, but also how environmental and social factors influence their decision-making as experts in their fields. Risku (2010) argues in favour of the use of the situated, embodied cognition framework to help develop research in cognitive translatology and in technical communication.

2.5 Writing and reading

Much research has been conducted in the domain of monolingual information processing, notably around the tasks of writing, reading and revising. Cognitive

translatology has looked to research in these sub-domains to help understand those components of the translation process that involve reading and writing.

The eye-mind hypothesis, mentioned earlier, has been employed to a significant extent in reading studies, which have made extensive use of eye tracking as a research methodology. The uptake of eye tracking in cognitive translatology has enabled the study of reading (of both source and target text) during the translation process. Moreover, monolingual studies of the readability of texts have inspired translation researchers to test readability indicators for their relevance to translation research (e.g., Jensen 2009 and O'Brien 2010), and to even use readability as a measure of quality for automatically translated text (Doherty et al. 2010).

Surprisingly, although one of the most important components of translation is writing, research into monolingual writing and revision processes has had a lower influence on cognitive translatology than one might expect. The two fields have much in common with their interests in metacognition, strategy, expertise, pause analysis and writer's profiles (cf. Van Waes and Schellens 2003, for example) as well as in keystroke logging, screen recording and eye tracking as methods. Nonetheless, there is some evidence now of influence of one domain on the other. For example, the writing process researchers Schrijver et al. (2011) recently investigated the concept of 'transediting', i.e., the manipulation of the source text content and structure within the target text in order to adhere to target text genre specifications in a study on patient information leaflets. Also, there is evidence of collaboration between translation process researchers and researchers into writing processes in the field of journalism (Ehrensberger-Dow and Perrin 2010).

2.6 Language technology

The increasing technologisation of the translation profession and, along with it, the translation process, has been noted elsewhere (e.g., Austermühl 2001; Bowker 2002; Quah 2006). The impact tools have on the translated product and process, and on the working lives of translators, has been a particular area of focus in recent years. Additionally, the increasing use of automatic or machine translation has necessitated that translation scholars turn their attention to that specialised field.

A focus on the cognitive load of processing different types of matches from translation memory tools has already been alluded to above. More generally, translation process research has started to ask questions about the usability and suitability of these tools for the translation process. One small study looked at the 'concordance feature' in a translation memory interface using eye tracking as an instrument of measurement (O'Brien et al. 2010). Drawing on the domain of human-computer interaction, another study investigated the topic of machine translation in the translator's workplace and noted how translators often see machine translation as a black box, which removes them from the task of translation and diminishes its collaborative nature (Karamanis et al. 2011). A third study looked more generally at translators' interaction with technology in the workplace, using the method of contextual inquiry commonly used in studies of human-computer interaction (Désilets et al. 2008).

Machine translation, by its nature, draws on computational linguistics. Translation process research would seem far removed from this domain, but recent attempts again seek to draw connections by investigating correlations between the far-removed computational, automatic algorithms for the measurement of machine translation quality (see, for example, Papineni et al. 2002; Callison-Burch et al. 2008; Lavie and

Przybocki 2009), on the one hand, and the cognitive effort of the post-editing process on the other (O'Brien 2011b).

3 Progress and direction

The review in Section 2 demonstrates the breadth of influence from other domains on research in cognitive translatology. Commencing with an interest in memory capacity and moving to studies of expertise, cognition, text and translator profiling, to translator and technology interaction, the domain has evolved and grown significantly in recent years. Moreover, the tools and methods employed have increased in range and complexity.

Strikingly, the direction of influence seems to be largely one-way, that is, translation scholars appear to borrow liberally from domains such as linguistics, cognitive science, neuroscience and so on, but the range of influence from translation studies on those domains and sub-domains appears to be very limited at the present time. Choi and Pak (2006) characterise interdisciplinarity as 'working between' two or more disciplines, but they also characterise it as having a level of 'reciprocity'. There is ample evidence that researchers in cognitive translatology are 'working between' disciplines, but, as yet, there is little evidence of reciprocity.

There is little doubt that the domain of cognitive translatology has matured over the last few years, but it is arguably still in its infancy. There are many ways in which further development could take place by borrowing even more from more established disciplines. For example, techniques used in the domain of forensic linguistics to measure author attribution and homogeneity between texts in corpora (see, for example, Vogel and Lynch 2008) could feasibly be employed in translation process research to establish similarities across source texts used in experiments. The use of Rhetorical Structure Theory, or something similar (see, for example, the Código

research project[1]), could be investigated in more detail. Researchers could draw more substantially from the field of expertise studies by, for example, seeking to test Dreyfus and Dreyfus' (2005) proposed 5-stage model of expertise (ranging from Novice, to Advanced Beginner, Competence, Proficiency and finally to Expertise) on translators. More research could be done on the field of psychometrics and we could further utilise ethnographic and HCI (human-computer interaction) methods to understand more about translation and technology. These are but a handful of suggestions.

Consolidation in the research domain of cognitive translatology is likely to lead eventually to influences on other domains. Consolidation can be achieved by building on the already interdisciplinary nature of the domain, by collaborating more with researchers within the domain, by sharing tools, expertise, data (see, for example, Göpferich 2010) and by inviting researchers from other domains to collaborate. Gradually, we will move towards reciprocal interdisciplinarity (Göpferich 2011), in which TS is not only a borrower but also a lender. Such a development would offer a number of potential benefits, enabling us to provide different perspectives on complex problems, to increase creativity and avoid a situation where individual disciplines become tired and predictable (Nissani 1997).

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Note

[1] http://www.cogtrans.net/codigoEN.htm (last accessed 01/15/2012)