

Bilingualism and translation through the lens of cognition

In brief



📄 SPA [Bilingüismo y traducción - procesos cognitivos](#)

◀ origins

The word *bilingualism* comes from the Latin form *bilinguis*, composed of *bis* ('two') and *lingua* ('languages'). It is defined as 'the ability to speak two languages' or 'the frequent use (as by a community) of two languages' (Merriam Webster's dictionary).

☰ abstract


The anthropological acceptance of translation practice both as a profession and as a form of brain functioning built on a specific cognitive architecture has been “a tortuous road up the mountain”. The trend, during many years and both in research and within the professional domain, has been to consider translators as proficient bilinguals who, for different reasons, engage in activities somehow related to meaning transfer. Neuroscience and cognitive psychology undoubtedly confirm that there are substantial differences in the way translators and bilinguals tackle their bilingualism. Bilingualism results from the interaction of different factors, such as L2 usage in the environment (Green & Abutalebi 2013); it is dynamic in nature, and there are several factors that do exert an impact on what has been defined as *The Bilingual Advantage* (e.g., Luk & Bialystok 2013). By consequence, the idea of *Translation Expertise* (e.g., Muñoz Martín 2009) as an independent, modulating factor is well worth of consideration and justifies the comparison to other forms of bilingualism. It has been extensively shown that expertise in translation transfers to other domains, and that this transfer is related to the cognitive processes triggered to perform translation tasks. Therefore, bilinguals and translators handle differently their languages and the cognitive regulation of resources due to consistent practice in their specific domain.


At the light of the most updated psychological research, the present work will provide a comprehensive overview of bilingualism as a dynamic construct, focusing on how the

cognitive architecture underlying performance in handling several languages is shaped differentially by professional expertise and bilingualism. Namely, this chapter aims at identifying the *locus* of the cognitive differences that have been detected so far between bilinguals and translators, with a special emphasis on the *tasks* that have revealed a differential triggering and use of their cognitive resources. Our final goal is to reach a thorough understanding of how a varying interaction of bilingualism with the environment is responsible for an adaptive cognitive restructuring of the processes that allow to cope with specific linguistic and translation tasks.

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Entry



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Introduction

This entry discusses bilingualism and translation from the psycholinguistic perspective. We will first clarify what is meant here by bilingualism and translation and then, we will shift the focus to the cognitive processes that come into play in both phenomena. These processes will be commented according to specific levels of analysis (i.e., phonological, lexical, semantic, syntactic). Moreover, we will consider regulatory and cognitive control processes that seem to characterize both bilingual experiences and cross-language translation tasks. Our analysis will be circumscribed by the functional perspective and the exploration of the contribution made by behavioral studies; on this occasion, our understanding of the cognitive processes underlying the two practices (bilingualism and translation) will leave aside the neuroanatomical changes that may derive from the continuous activation of these processes.

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Bilingüism: Concept, linguistic processes and cognitive control

Concept

In the field of psycholinguistics, much of the research focusing on bilingualism has attempted to observe how being able to communicate in two (or more) languages impacts general cognitive functioning (i.e., in nonverbal tasks). The first evidence that bilingualism modulates nonverbal cognitive functions was found by Peal and Lambert (1962). The authors observed that bilingual children excelled in verbal and nonverbal

intelligence tasks compared to monolingual children. Years later, after it was observed that bilingual children are also characterized by greater metalinguistic awareness (e.g., Feldman & Shen 1971; Cummins 1978), bilingualism began to be systematically studied and defined in scientific terms. The construct acquired relevance within the psycholinguistic discipline and its exploration generated a productive, varied, and often heterogeneous, line of research.

This research topic still causes debate and fascinates researchers from a multitude of disciplines (e.g., psychology, linguistics, translation, anthropology, to name a few). Moreover, over time and because of the results obtained, the construct has been fragmented into more specific "subcategories" that allow to address the different typologies of bilingualism, depending on which parameters are considered for the analysis. For example, bilingualism can be conceived depending on how people represent the languages they know in their cognitive system (e.g., compound, coordinated, subordinate bilingualism, Weinreich 1953); in terms of the competence or proficiency in each of the languages involved (e.g., balanced vs. dominant bilingualism, Peal & Lambert 1962); as a function of the use that people make of the languages they handle (e.g., additive vs. subtractive bilingualism; Lambert 1974), or the age and order of language acquisition (e.g., early vs. late bilingualism, simultaneous vs. sequential bilingualism; Genesee, Harmers, Lambert *et al.* 1978), or depending on the sociodemographic factors that determine language use (e.g., optional vs. situational bilingualism, Valdés & Figueroa 1994), or the relationship between language knowledge and the associated culture (e.g., bicultural vs. monocultural bilingualism, Hamers & Blance 2000).

The advantage implied in such a diverse definition of bilingualism is that all the nuances involved in the knowledge of a native or first language (L1) and a foreign or second language (L2) can be approached. However, instead of exploring this set of definitions, the present work will highlight different aspects that, in recent years, have come under the spotlight and seem to characterize the phenomenon of bilingualism:

1. *Bilingualism is not a categorical variable* (monolingual-bilingual), but a continuum ranging from people who know only one language (monolinguals) to people who could be considered monolinguals of two languages (ambilinguals). Between the two extremes of the continuum, we would find a great variety of individuals according to the degree of knowledge of their languages. Moreover, this continuum varies according to the dimensions included under the umbrella of the language considered (i.e., reading comprehension, listening comprehension, speaking, and writing). Thus, we could find bilinguals with an enhanced ability to understand information in the L2, but a reduced ability to express themselves in that same language.
2. *A bilingual person is not always bilingual*. Grosjean (2013) proposed that a person with knowledge of more than one language could behave as a monolingual or as a bilingual depending on the context. For example, when a bilingual engages in a conversation with

interlocutors who speak different languages, he/she is more likely to have the languages he/she knows active and consequently adopt a "bilingual mode", whereas in situations where the same person is interacting in an environment where only one language is spoken, he/she would adopt a "monolingual mode".

3. We should not refer to bilingualism but to *bilingual experiences* (e.g., Hartanto & Yang 2016). For example, there might be cases of early bilinguals who forget the L2 in their adulthood and late bilinguals who shift their dominance towards the L2; moreover, some early bilinguals will never visit the country of their L2 and will simply show a "domestic" use of the L2 (heritage speakers), while some late bilinguals will live immersed in the native context of their second language. The idea of *bilingual experiences* shows that bilingualism is determined by many factors (e.g., age of acquisition, amount and variety of linguistic immersion, language use, degree of acculturation in the L2, etc.). We still do not know the exact degree of contribution of these factors in explaining bilingualism (see, e.g., Pliatsikas, DeLuca, Moschopoulou *et al.* [2016](#); DeLuca, Rothman, Bialystok *et al.* 2020). In short, bilingualism implies using more than one language. It is a dynamic, changing concept, modulated by a multitude of factors, and its nature varies on a person-to-person basis.

Cognition: linguistic processes

Despite heterogeneity in defining bilingualism, the impact of the L2 on cognition (i.e., on the internal processing and manipulation of information proceeding from the environment) is an established phenomenon that has been validated in the field of psycholinguistics. The "cognitive hallmark" associated with multilingual proficiency can be observed at different language levels. For example, in reference to *phonological processing*, several studies have observed that the ability to discriminate phonemes (e.g., different vowels) is established very early in childhood. Rivera, Silva & Kuhl ([2005](#)) showed that 7-month-old infants can discriminate phonological contrasts of a non-native language. However, after the age of 11 months, infants display a reduced ability to discriminate phonemes that are not present in their environment. Such studies highlight the importance of exposing infants to a rich phonological environment (i.e., phonology of different languages) to promote future phonological processing abilities in bilingual contexts.

Coherently, Sebastián, Rodríguez, Diego *et al.* ([2006](#)) showed that bilinguals, despite being fluent in the L2, tend to be non-sensitive to phoneme contrasts in their L2 if they acquired them after the age of 13 (late bilinguals). Bosch & Sebastián (1997, [2001](#)) analyzed discrimination capacities between the two languages in four-month-old monolingual and bilingual infants (the latter, exposed simultaneously to Spanish and Catalan). They used a

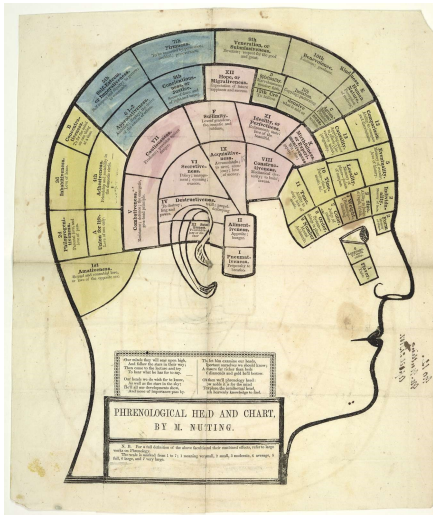


Figure 1. Phrenological head and chart *de M. Nutting* (1857). Source [Library of Congress](#).

familiarization-preference procedure based on the measurement of head movements as an index of attention to the auditory stimulus presented in two languages. The authors observed that the effect size in discrimination between the two languages was equivalent in the two groups, showing that phonetic discrimination capacities appear very early in simultaneous bilinguals, similarly to monolinguals. Therefore, early bilinguals acquire the ability to discriminate phonemes from the L1 and the L2 just as monolinguals do within their L1. This ability is not visible in late bilinguals, confirming that different bilingual experiences shape the way phonology is processed in a second language.

At the *lexical-semantic* level, it has long been assumed that bilingual processing is characterized by distributed conceptual information (Kroll & de Groot 1997), implying that some semantic features are common across languages while some others are specific to each of the bilingual's languages. For example, *coffee* would carry common features (i.e., liquid, contains caffeine, etc.) and

other properties that vary according to cultural aspects and language use in the environment (e.g., short, espresso-like, and intense for Italian or Spanish speakers; long, more diluted for American English speakers). It is postulated that the number of shared features between the two languages will influence L2 word processing, especially in early learning stages. Hence, word processing would be enhanced by a higher amount of shared features available; conversely, the processing of those L2 words that share a reduced number of features with the L1 would be more problematic, as in the case of culturally specific L2 words (e.g., *tablao*, in Spanish). Exposure to the L2 (e.g., through immersion), would boost the acquisition of new conceptual features that enrich the semantic store, creating stronger connections between the form (spelling and other structural properties of the word) and its meaning.

Additionally, knowing more than one language also seems to determine the way *syntactic processing* is carried out during comprehension. Studies based on the analysis of bilingual syntactic processing often employ ambiguous relative clauses: *Someone shot the waiter of the actress [who was on the balcony]*, structures whose disambiguation process consists in determining the agent of the relative clause (who was on the balcony? the waiter or the actress?). The way speakers resolve ambiguity

depends on their L1 (see Rayner, Carlson & Frazier 1983, for English; for Spanish, Cuetos & Mitchell 1988). Spanish speakers show a preference for a high attachment strategy, assigning the action to the agent in the "higher" position of the sentence (*the waiter was on the balcony*), whereas English speakers choose a low attachment strategy (*the actress was on the balcony*). When comparing monolingual English speakers (N = 15), early bilinguals (N = 15; age of L2 acquisition, English: before the age of 10) and late bilinguals (N = 15; age of L2 acquisition, English: after the age of 10) in terms of syntactic attachment when processing English sentences, Fernández (1999) observed that monolinguals showed a preference toward the attachment strategy of their L1 (English: low); late bilinguals showed a tendency toward a high strategy (the one preferred in their L1, Spanish) despite processing in their second language.

Moreover, early bilinguals did not show any preference (Fernández 1999), in the sense that no statistically significant differences were observed between the strategies adopted. Fernández demonstrated that syntactic processing strategies transfer from the L1 to the L2 (late bilinguals) and, through correlational analyses focused on the early bilingual group, found that the level of fluency in the L2 predicts the attachment strategy when processing ambiguous sentences. In other words, the higher the fluency in the L2, the higher the preference towards the strategy used in the L2. The author demonstrated that different bilingual experiences (i.e., early vs. late bilingualism) modulate syntactic processing in the L2.

Hence, knowing more than one language determines the way people process language at the phonological, semantic, and syntactic levels. However, in recent years, it has become increasingly clear that the "cognitive hallmark" that most characterizes the bilingual experience lies on the efficient use of regulatory and control processes. Throughout the following paragraphs, we will elaborate further on this point.

Cognition: regulation and cognitive control

Green & Abutalebi (2013) proposed that the use of two or more languages increases the cognitive demands associated with language processing, implying that bilingual individuals -compared to monolinguals- will show a more efficient use of cognitive control processes (or executive processes). Furthermore, it is assumed that these control processes are domain-independent, so that a "bilingual advantage" could be observed in language tasks as well as in other cognitively demanding activities.

The bilingual advantage has been consistently observed in tasks that require this type of processes; the most commonly used experimental tasks have been the Simon task

(Bialystok, Craik, Klein et al. 2004), the Stroop task (Bialystok, Craik & Luk 2008) and the Flanker task (Costa, Hernandez, Costa et al. 2009). As an example, in the Simon task, colored rectangles are displayed (e.g., blue and green) on the right and left side of a central space and participants are asked to press a key with the right or left hand, depending on the color presented. A condition is labeled as congruent when the location of the color (e.g., blue-right) matches the position of the response hand, whereas an incongruent condition would involve a mismatch between the location of the color and the response hand (e.g., blue color on the right and response key on the left). Using this task, Baker, Kovelman, Bialystok et al. (2003) and Bialystok (2006) observed that, despite more errors and slower reaction times were recorded in response to incongruent versus congruent trials (interference effect), bilingual children showed less interference than monolingual children. Many studies support the bilingual advantage, but the topic is being hotly debated, so caution should be exercised before drawing conclusions. In fact, other studies have failed to replicate the bilingual advantage (e.g., Paap & Greenberg 2013).

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¶ Translation: concept, linguistic processes and cognitive control

The literature clearly shows that, in order to identify the cognitive benefits associated to bilingualism, the modulating influence of different factors needs to be considered, such as the type of bilingualism, the way people manage their languages during a specific activity (Green & Abutalebi 2013), and the nature of the task itself (e.g., Morales, Gómez & Bajo 2013; Morales, Padilla, Gómez et al. 2015). Different bilingual experiences will uniquely determine the functioning of the underlying cognitive control mechanisms. This idea plays a crucial role towards a thorough understanding of translation practice, a topic that is addressed in the following section.

Concept

Where should we locate the group of professional translators along the bilingual continuum? There are important differences, all due to professional practice, that allow to set them apart from the group of untrained bilinguals. Namely, translators are bilinguals whose sustained practice in a specific domain has differentially shaped the execution of certain cognitive processes and the implementation of the mechanisms used to optimize performance, with a direct impact on observable behaviors. These characteristics clearly differentiate them from those bilinguals who have not been trained in translation.

Translating is a particularly demanding activity characterized by the activation of several linguistic processes (lexical access, semantic, syntactic processing), cognitive processes of a general nature (Yudes, Macizo & Bajo 2011a, b), high demands on working memory (Signorelli, Haarmann & Obler 2012), divided attention (Gile 1997), coordination to switch from one language to the other (Christoffels & de Groot 2004), and an efficient allocation of attentional resources between the different phases of the translation process (Gile 1997). Then, it is legit to think that the intrinsic characteristics of the task may imply a different handling of the two languages, both at the linguistic level and in relation to those control mechanisms that allow to regulate information processing in a translation task. An analysis of these two aspects is offered below.

Cognition: linguistic processes

In reference to lexical processing, it has been observed that professional translators coordinate efficiently the activation of lexical forms in the target language; Macizo & Bajo (2006, Experiment 2) asked their participants to either translate or read visually presented sentences. The words used as stimuli were either cognate or non-cognate words. Cross-language cognates are words that are similar in form and meaning (e.g., piano, in English and Spanish). This type of manipulation (cognates vs. non-cognates) is critical, as it has been used as an index of the bilingual's dual language coactivation (e.g., Kroll & Stewart 1994; Macizo & Bajo 2006). The authors reasoned that if participants accessed the lexical and semantic forms of the target language (TL) before completing the comprehension process of the source language (SL), faster reading times, i.e., facilitation, would be observed for cognates compared to control words. Their initial hypothesis was confirmed. Moreover, the facilitation effect for cognate words was only observed in the reading-for-translation condition, implying that the task modulates lexical processing and that the goal of translating a text determines language coactivation in the group of professionals. Ruiz, Paredes, Macizo et al. (2008, Experiment 1) obtained the same pattern using a similar paradigm. In this study, the frequency of critical words in TL was manipulated. In the reading-for-translation condition, words with high frequency of use in the TL were processed faster than low-frequency words, despite that the frequency of all words was equated in the SL. Again, the effect was observed in the reading-for-translation task and not in the reading-for-repetition task, confirming that the task modulates dual language coactivation.

In another study, Ibáñez, Macizo & Bajo (2010) asked bilinguals and professional translators (matched in L2 proficiency) to read sentences in Spanish or English. The language used for sentence presentation varied from trial-to-trial in unpredictable ways. This was the first critical manipulation; the goal was to observe possible inhibition of the

non-in-use language by measuring the lapse of change when switching from one language to the other as a function of the direction of the change (L1→L2 or L2→L1). The authors also manipulated cognate vs. non-cognate words, as in Macizo & Bajo (2006). A processing advantage was observed for cognate words in the case of professional translators, suggesting that they keep their two languages active during processing. Moreover, translators did not show an inhibition pattern since they did not display asymmetry in switching cost when shifting from one language to the other. In the case of bilinguals, however, a higher switching cost towards the L1 than the L2 was observed, implying that bilinguals do inhibit the language not required for the task. No facilitation in cognate processing was observed for bilinguals, suggesting that only the language in use was active. In other words, different bilingual experiences shaped different patterns of activation of the two languages, implying differences in linguistic control mechanisms: translators kept both languages active and did not experience asymmetric costs when switching from one language to the other, whereas bilinguals kept active the presentation language only; therefore, a cost in comprehension was observed for bilinguals each time they were required to language switch. These results indicate differences in the way translators and bilinguals coordinate the lexical processes involved in translation, and that these differences are due to language coactivation.

Research on syntactic processing in translation is rather scarce. One of the first (and few) studies on the topic is the one by Ruiz, Paredes, Macizo et al. (2008, Experiment 2). A group of translators carried out a reading-for-repetition task (in Spanish) and a reading-for-translation task (into English). On this occasion, the authors manipulated the interlinguistic congruence of the order of the words included in each sentence. In the congruent condition, the adjective was presented before the noun, and the subject was always placed before the verb of the relative clause, for example, *la bonita casa que yo alquilé este verano tenía un verde jardín*, creating an overlapping condition with the English structure (i.e., *the nice house that I rented this summer had a green garden*). In contrast, in incongruent trials, the word order within the syntactic structure of the sentence did not overlap with the other language (e.g., *la casa bonita que alquilé este verano tenía un jardín verde*). Results revealed that, when performing the translation task, reading times for congruent sentences were faster than for incongruent sentences. In other words, participants

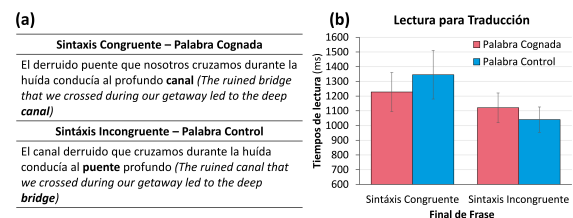


Figure 2. The results of Ruiz and Macizo (2018) showed that, when comprehending for translation, participants used to a greater extent the syntactic cues preferred in the TL (i.e., word order) compared to when they had to comprehend for repetition in the L1 (see Figure 2). Thus, the results of different studies on syntactic processing in translation show that syntactic structure, attachment strategies and syntactic cues in the TL are active during SL comprehension and modulate the response depending on the goals to be achieved during the task.

were faster in comprehending the information for posterior translation when the syntactic structures of the two languages overlapped. This facilitation effect was not observed in the reading for repetition task. In a more recent study, Ruiz & Macizo (2019) jointly manipulated lexical factors (cognate words) and syntactic factors (syntactic structure) of sentences during a translation task. Their results showed an interaction between both aspects; namely, processing was more efficient when participants processed cognate words vs. non-cognate control words but only when these words were embedded in congruent structures, and not when participants read to translate incongruent structures (see Figure 1). Taken together, these studies indicate that lexical and syntactic information is activated from the TL during SL comprehension and that both contents interact cross-linguistically.

Moreover, the activation of syntactic information from the TL during SL comprehension in translation tasks is not limited to syntactic structure (syntactic congruency). A couple of recent studies show that other syntactic aspects of the TL also affect SL comprehension; namely, attachment strategies and syntactic cues used for agent assignment. Regarding the first aspect, Togato, Paredes, Macizo et al. (2017) evaluated attachment strategies when comprehending ambiguous sentences described in previous sections (Someone shot the waiter of the actress [who was on the balcony]) for posterior translation. When professional interpreters (Spanish/English) read for repetition, no clear preference (high or low attachment strategy) was observed, confirming what was previously observed with bilingual populations (Fernández 1999). However, when reading in Spanish for posterior translation into English, interpreters adopted the attachment strategy preferred in the TL (low attachment in English), showing that TL syntactic strategies were active while comprehending the SL.

Ruiz & Macizo (2018) visually presented Spanish (L1)/English (L2) bilinguals with noun-verb-noun (NVN) structures in Spanish. After reading in Spanish (the SL), sentences disappeared from the screen and participants had to orally produce a sentence following the subject-verb-object structure in Spanish, or in the TL (English). That is, in this task, participants were asked to select the subject of a sentence (agent assignment task) to either repeat orally in the SL or to translate into the TL. Many previous studies (e.g., Bates & MacWhinney 1987, 1989; MacWhinney 2002, 2005, 2012; Togato & Macizo 2020) have confirmed that speakers of different languages tend to employ different syntactic "cues" or clues to identify the agent of a sentence. For example, native English speakers tend to use word order as a preferential cue (i.e., the first noun is usually the subject) while Spanish speakers prefer other cues, such as the animacy of nouns (e.g., an animate noun is preferred as the subject of a sentence over an inanimate noun). Ruiz and Macizo critically manipulated several cues (i.e., animacy, subject-verb agreement, and word order) within NVN fragments to observe which cue would be preferred as a function of the task performed by bilinguals (repetition vs. translation).

The results of Ruiz and Macizo (2018) showed that, when comprehending for translation, participants used to a greater extent the syntactic cues preferred in the TL (i.e., word order) compared to when they had to comprehend for repetition in the L1 (see Figure 2). Thus, the results of different studies on syntactic processing in translation show that syntactic structure, attachment strategies and syntactic cues in the TL are active during SL comprehension and modulate the response depending on the goals to be achieved during the task.

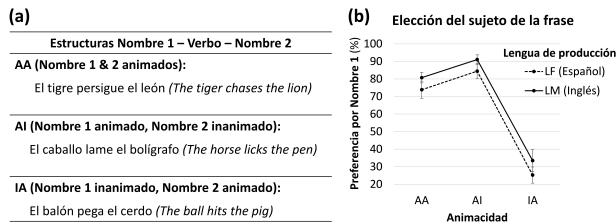


Figure 3. Description of the study by Ruiz and Macizo (2018). (a) Example of structures as a function of animacy of the two nouns. (b) Results obtained. Participants use more the cue preferred in the TL (word order, higher preference of Noun 1 as subject) when producing in the TL vs. the SL.

Following this train of thought, there are studies that show that the functional changes imposed by the translation task transcend the structural aspects of language to reach the *representational (semantic) level*. Along these lines, Yudes, Macizo, Morales *et al.* (2013) carried out a study based on error detection in texts; they compared interpreters, interpreting students, bilinguals, and monolinguals in text comprehension tasks. Their hypothesis was that, because comprehension is particularly demanding in translation tasks, interpreters would show qualitatively different comprehension strategies from those adopted by other participants. Their results confirmed the initial hypothesis, since interpreters detected more

semantic and syntactic inconsistencies in texts and demonstrated higher levels of comprehension in a post-task questionnaire, showing better performance than the rest of participants. This pattern confirms that translation practice modulates the development of processing strategies in such a way that they are more oriented towards meaning construction and less towards form preservation; moreover, this strategic restructuring occurs gradually and increases through training.

Cognition: regulation and cognitive control

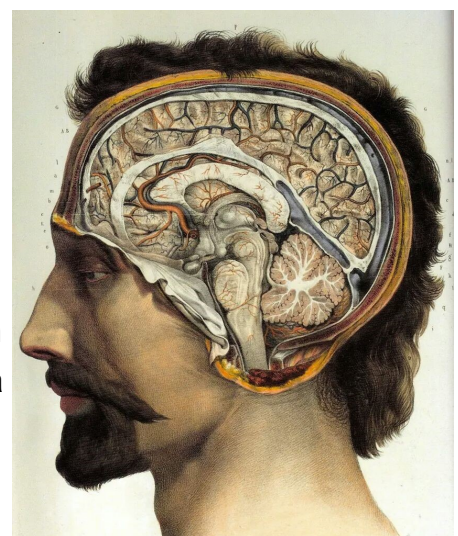
Considering what has been commented so far, it is reasonable to ask what the root cause of the translator's advantage in lexical, syntactic and semantic processing is. Working memory (WM), understood as a system needed to process/store relevant information to perform complex activities (Baddeley, Eysenck & Anderson 2020), is essential in any task (e.g., reasoning, understanding, learning); hence, its role is crucial

also in translation tasks. Moreover, the experience accumulated through sustained practice in translation is mirrored by a general improvement of the mechanisms acting within the WM system (e.g., Christoffels, de Groot & Waldorp 2003; Christoffels, de Groot & Kroll 2006).

Numerous studies have found that trained translators show higher WM span than untrained bilinguals (e.g., Bajo, Padilla & Padilla 2000; Christoffels, de Groot & Kroll 2006). Furthermore, it has been observed that WM span is related to translators' efficiency in linguistic tasks. Bajo, Padilla and Padilla (2000), for example, compared professional interpreters, students of interpreting, bilinguals, and professionals from other domains and found that interpreters had a greater ability to maintain high levels of divided attention, i.e., cognitive control, during the execution of language tasks. Specifically, participants memorized a list of words for later recall while, at the same time, during the memorization phase, an articulatory suppression task was introduced for all participants in 50% of the trials.

The articulatory suppression task is used to block the maintenance of information in WM by verbalizing speech unrelated to the main task (e.g., repeating *bla-bla-bla*). Interpreters excelled in task performance when articulatory suppression was introduced (i.e., performance within their WM system was not impaired by the dual task). Thus, in the case of interpreters, their enhanced performance in comprehension tasks (lexical and semantic access, syntactic processing) might be due to a better overall control, within the WM system (as defined by Baddeley, Allen, & Hitch 2001), of the cognitive resources on which the computation and storage required for translation, respectively, depend.

Seen from Cowan's (1999) perspective, improved performance by interpreters would be due to a more efficient regulation, by the central executive, of the activation of those relevant representations (within the long-term memory, LTM) towards the focus of attention (responsible for processing). Padilla, Bajo & Macizo (2005) replicated the absence of articulatory suppression effect in professional interpreters by comparing them to a control group matched in WM span. The authors demonstrated that the absence of the effect in professionals is not due to the WM span per se, but to their ability to process and retrieve information while articulating the message. Hence, their study demonstrated that the absence of the articulatory suppression effect is due to the ability to efficiently



allocate cognitive resources and to better coordinate the different sub-processes implemented in parallel within the WM system.

In a second experiment, Padilla, Bajo & Macizo (2005) introduced another dual-task condition, more precisely, visual tracking. No differences were found between groups using this task, a task which is similar to the first one in terms of duality, but different in terms of the modality involved (in this case, visual). These results led to think that the absence of the articulatory suppression effect in interpreters (previously observed) is not due to the general ability to keep divided attention among several tasks or processes, but to some type of ability more closely related to simultaneous comprehension and

Figure 4. Human Brain, J.M. Bourgerie (1831-1854). Source [Wikimedia](#).

production processes, such as lexical or semantic access to known contents. The authors confirmed this idea in another experiment in which the familiarity of linguistic material was manipulated; they hypothesized that, under conditions of articulatory suppression, the effect would be observed in the case of unfamiliar material (non-words). Data supported their initial reasoning: low familiarity with the materials led to the articulatory suppression effect, showing that familiarity with linguistic inputs is fundamental for the phonological loop (WM component responsible for the temporal storage of speech) in professional interpreters.

Overall, the effective coordination of linguistic subprocesses does not seem to maximize the WM span but its efficiency, through an optimization of the matching between partial processing results and the activation of linguistic information stored in long-term memory. This study paved the way to the idea that the linguistic skills at play in professional practice would manifest in a different management of basic cognitive processes. We will briefly discuss a study based on this idea (see also Babcock & Vallesi 2015; Babcock, Capizzi, Arbula et al. 2017; Morales, Padilla, Gómez et al. 2015).

Yudes, Macizo & Bajo (2011b) posited that perhaps translators and bilinguals would show enhancement in different components of executive functions. They compared professional translators and untrained bilinguals on a cognitive flexibility task (Wisconsin Card Sorting Test). The test requires participants to infer a categorization norm. The norm changes throughout the task, in a way that participants have to infer the new norm on each switching point. They are informed about the accuracy of their responses, but they receive no feedback about the norm. In other words, the task reflects participants' ability to switch between different cognitive sets and flexibly adapt

to the new norm. Yudes, Macizo & Bajo (2011b) observed improved performance for the group of interpreters; specifically, they needed fewer attempts to infer the norm and made fewer errors compared to bilinguals. Above all, they made fewer perseveration errors, i.e., they showed greater cognitive flexibility in changing the hypotheses linked to the inference of the norm.

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¶ Conclusion

It seems that sustained practice in translation will imply a very specific "cognitive hallmark" on behavior. On the one hand, bilingualism determines a particular way of processing lexical, syntactic, and semantic information compared to monolingual speakers. Moreover, bilinguals seem to use regulatory control processes very efficiently (Green & Abutalebi 2013).

On the one hand, bilingualism determines a particular way of processing lexical, syntactic, and semantic information compared to monolingual speakers. Moreover, bilinguals seem to use regulatory control processes very efficiently (Green & Abutalebi 2013). On the other hand, translators have been shown to cope differently with linguistic coactivation compared to untrained bilinguals (e.g., Ibáñez, Macizo & Bajo 2010); bilinguals inhibit the language not in use (e.g., Bialystok 2001; Ibáñez, Macizo & Bajo 2010; but see Paap, Anders-Jefferson & Mason, 2018, for different interpretations), whereas translators seem to employ inhibition mechanisms to a lesser extent and keep their languages active to perform the task (e.g., Macizo & Bajo 2006; Grosjean 2008; Ibáñez, Macizo, & Bajo 2010). This different use of coactivation may explain why the translator's advantage is especially visible in linguistic tasks (lexico-semantic and syntactic tasks); moreover, this advantage in the verbal domain seems to be related to the efficiency of execution within the WM system.

This relationship was initially explained in terms of WM capacity (Christoffels, de Groot & Waldorp 2003) but other studies (e.g., Padilla, Macizo & Bajo 2005; Babcock & Vallesi 2016; Babcock, Capizzi, Arbula et al. 2017) open the door to the idea that an effective coordination of different linguistic subprocesses by professionals fosters not simply WM span, but the efficiency with which active information in WM relates to retrieval in LTM, facilitating future linguistic mediations. Along the same lines, the presence of an advantage for translators has been found in basic cognitive processes that reflect the processing demands imposed by the task: flexibility to adapt the cognitive set to new circumstances, sustained global control (throughout the task), alertness to process the input, and better attentional orientation to be able to redirect the focus to the production phase.

Will we still think, then, that every bilingual can translate?

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Research potential

It would be interesting to explore, from the point of view of cognitive psychology, the differences between professional translators and interpreters, since the tasks they perform are very different; despite this, and unlike other fields of research (e.g., translation), research in the field of cognitive psychology tends not to differentiate between the two professional roles; in fact, the two groups have scarcely been compared in the same study. Another area of research with much potential (and less explored) is the one based on emotional language processing in translation; many studies have investigated the cognitive aspect linked to bilingualism and translation; however, fewer studies have focused on exploring the emotionality (including motivational aspects) underlying the two phenomena.

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