Working memory and high-level text comprehension processes

Ana I. Pérez Muñoz and M. Teresa Bajo

The construction of a coherent text mental representation demands multiple comprehension processes such as the activation and maintenance of the most important ideas of the text, the retrieval of related information from long-term memory, the generation of information that has not been explicitly mentioned (e.g., inference making), the detection of possible inconsistencies (i.e., comprehension monitoring), as well as the suppression of no longer relevant information (i.e., updating information). Although it is well known that working memory is essential for language comprehension, it is less clear how individual differences in working memory might explain high-level comprehension processes such as inference making, monitoring and updating information. In the present chapter, we review some of the literature showing how these cognitive processes are supported by working memory during online comprehension in the first and second language. Overall, working memory is especially necessary when text comprehension requires updating of the situation model, by inhibiting no longer relevant competing information in the native language. In contrast, a more complex pattern results from text comprehension in a second language.

Keywords: text comprehension; inference making; comprehension monitoring; updating information; bilingualism

Imagine that you have decided to spend a Sunday afternoon reading for pleasure. From the bookshelf at home you take the book of poems "*Revolting Rhymes*" by Roald Dahl. On opening the cover, the story of "*Little Red Riding Hood and the Wolf*" draws your attention and you begin to read:

As soon as Wolf began to feel
that he would like a decent meal,
he went and knocked on Grandma's door.

At this point, you would probably expect that the wolf enters the grandmother's house and devours her before putting on her clothes to fool Little Red Riding Hood and eat her next. This is a good prediction, and it is indeed what it happens. However, if you also predict that Little Red Riding Hood is going to be disturbed by the wolf (as we generally known from the classic story), you will be surprised by reading the following stanza:

The small girl smiles. One eyelid flickers.
She whips a pistol from her knickers.
She aims it at the creature's head
and bang, bang, bang, she shoots him dead.

This example illustrates that when we are trying to understand linguistic information, a constant process of hypothesis generation based on our prior knowledge on the topic is carried out to predict what is going to happen in that specific context. In turn, when new information contradicts any of these hypotheses, we must be flexible to accommodate the new ideas and reject no longer valid expectations. These abilities requires the involvement of working memory, as it is the capacity to actively represent, maintain and manipulate information in mind, as well as to retrieve knowledge from long-term memory. In fact, most influential working memory models assign it functions of storage/activation and executive control (Baddeley, 2000; Cowan, 1999). Accordingly, working memory is essential for comprehension in general (i.e., any situation requiring understanding information) and text comprehension in particular (i.e., understanding information from a passage, compared to lexical or sentence comprehension). The present chapter will deal with the relationship between these complex cognitive processes underlining text comprehension and individual differences in working memory.

1. Working memory and reading comprehension

By the 1980s, several studies demonstrated that working memory was at the base of individual differences in reading performance (e.g., Kintsch & van Dijk, 1978; Perfetti & Goldman, 1976). For example, Daneman and Carpenter (1980) developed the *reading span task* to assess both storage and information processing, and they found a positive correlation between this task and measures of fact retrieval and pronominal reference, suggesting that working memory underlies reading comprehension. Since then, extensive research has corroborated the influence of working memory in distinct comprehension abilities such as word-problem solving (e.g., Fuchs, Fuchs, Compton, Hamlett, & Wang, 2015); the resolution of apparent inconsistencies in garden-path sentences (e.g., Farmer, Fine, Misyak, & Christiansen, 2017); as well as general achievement in reading comprehension (e.g., Schroeder, 2014). Generally speaking, these results demonstrate that low working memory readers (assessed by distinct span measures) show difficulties when comprehending a text, whereas high working memory readers manifest better general reading performance. Furthermore, some meta-analyses have also established the importance of working memory in second language (L2) reading comprehension. For instance, Linck, Osthus, Koeth, and Bunting (2014) found a positive correlation between several working memory span tasks and general L2 processing, with larger effect sizes for tasks requiring executive function (vs. storage) and the verbal (vs. visuospatial) domain of working memory. Likewise, Shin (2020) analysed a total of 25 bilingual studies using the reading span task, and found a similar positive relationship between working memory and L2 reading. Thus, the recruitment of working memory during L2 comprehension seems to be as important (if not more) as the one carry out during native (L1) reading.

Prior findings can be easily explained by conceiving working memory as a limited resource capacity. In 1992, Just and Carpenter already theorised that language comprehension is constrained by working memory capacity, understanding capacity as the "maximum amount of activation available" in the system to perform both storage and information processing at any linguistic level (e.g., semantic and/or pragmatic). In this way, if the total amount of activation is lower than the one necessary to carry out a specific comprehension process, then the activation supporting a previous task demanding maintenance and/or computation will be reduced, causing the forgetting of prior information and/or a problem processing new information. For instance, if inconsistent information is presented during the comprehension of a text, readers with less activation available might experience difficulties to detect that inconsistency due to difficulties maintaining previous parts of the text in working memory. Because reading comprehension demands to be constantly activating, maintaining, processing and deactivating information (sometimes in a simultaneous fashion), the cognitive resources available in working memory during online reading strongly predict comprehension's ability. Therefore, individual differences in working memory capacity give rise to individual differences in comprehension.

An influential approach in the field of individual differences and reading comprehension has been the Structure-Building model (Gernsbacher, 1990, 1997). This model proposes that when readers find information that is associated with their current representation they *enhance* its activation and include this information in their situation model. On the contrary, when readers detect information that is incompatible with their memory representation they attempt to *suppress* the no longer relevant information. Nevertheless, if readers have not sufficient memory (i.e., working memory) capacity to suppress the irrelevant information, they may form new substructures constructed out of the main mental representation, which reduces the accessibility of information in memory (e.g., Gernsbacher & Faust, 1991). Accordingly, high-capacity working memory readers are more effective not only activating, storing and processing information, but also inhibiting larger or more complex pieces of information than low-capacity working memory readers who have reduced capacity to retain and process extra demands of information, and to achieve semantic integration of complex information. Moreover, prior knowledge may also modulate this relationship by allowing readers to retrieve appropriate information from long-term memory that it is subsequently integrated with current information, improving language comprehension (Was & Woltz, 2007).

Taking into account the extensive literature demonstrating a relationship between working memory and reading comprehension, the aim of the present chapter is to understand whether the same is true for highly complex processes underlying text comprehension. To unravel this matter, we first explain what we refer by high-level text comprehension processes (section 2), then discuss the current empirical evidence supporting their connection to working memory in the native language (section 3) and the second language (section 4), and finish the chapter with some general conclusions (section 5).

2. High-level text comprehension processes

Different from lexical or sentence processing, successful text comprehension entails the construction of a coherent, integrated and accurate mental representation of the state of affairs described by the text, which has been commonly called situation model (Kintsch & van Dijk, 1978). That is, readers need to go beyond the surface characteristics of a text to generate inferences by bringing background knowledge from long-term memory. Moreover, the situation model must be constantly updated as the text unfolds, as each new word, sentence or paragraph forces the modification of the current model to allow an integrated and coherent mental representation (e.g., McNamara & Magliano, 2009). Therefore, text comprehension demands high-level cognitive processes that are relevant in the construction of a situation model.

A crucial process for language comprehension is *inference making*, which is the ability to generate information that has not been explicitly mentioned in the text (Cain & Oakhill, 1999). Inferences have been classified in many different ways such as online vs. offline inferences, or local vs. global (see e.g., Pérez, Paolieri, Macizo & Bajo, 2014). An important distinction has been done between text-based inferences, which require the integration of different pieces of information from the text, and knowledge-based inferences, which entail the combination of text information and reader's prior knowledge (Kintsch, 1998). In addition, as it was illustrated in the example of Little Red Riding Hood, an important type of knowledge-based inference is *prediction*. Predictive inferences help to anticipate upcoming events or future outcomes in a story, and tend to be automatically generated when a) text information is highly constrained making the activation of information from long-term memory quick and easy, and/or b) they are necessary to provide text coherence (McKoon & Ratcliff, 1980). The study of the relation between working memory and inference making during reading is crucial, as inferential processing is inherent to language comprehension. Furthermore, the generation of predictions ensures that readers engage in reading for understanding (proactive comprehension) during text comprehension, which provides an ideal situation to explore the involvement of working memory.

A second high-level language process is *comprehension monitoring*. This is a metacognitive ability considered an important executive function for efficient reading because it allows allocating cognitive resources to make sense of incoming information (Wagoner, 1983). It is commonly assessed by tasks requiring the detection of inconsistencies or information that conflict with readers' prior knowledge. According to Baker (1985; see also Baker, Zeliger-Kandasamy, & DeWyngaert, 2014), comprehension monitoring encompasses an initial phase known as evaluation, which refers to the mere fact of being able to detect contradictory information in the text, and a subsequent phase named regulation, which is related to the repair processes that are carried out to solve the conflict after contradictory information has been encountered. Taking this distinction into account, the term "comprehension monitoring" will refer hereafter to the evaluation phase (see discussion of "updating information" for a deeper explanation of the regulation phase). Evaluation is conceived as a more routine, passive, and nonstrategic process that depends on the activation of new information and its integration with previous parts of the text and/or background knowledge (Kendeou, 2014). Therefore, the evaluation phase of comprehension monitoring seems to be a less cognitively demanding process, and it is not clear whether working memory capacity is involved here.

Finally, *updating information* covers a broad range of processes going from the activation of new representations to the manipulation of the contents of working memory by replacing irrelevant information with new (or more appropriate) one (Miyake et al., 2000). As it occurs with comprehension monitoring, updating during reading can be measured by tasks entailing conflict detection. However, in order to construct a coherent situation model when incorporating new inconsistent information, readers are forced to discard the information that it is no longer relevant or outdated [see the Structure-Building model (Gernsbacher, 1990, 1997) in section 1, for a deeper understanding on the rationale]. This particularly demanding type of updating is termed revision (Rapp & Kendeou, 2007). Because this is clearly an essential repair process, the term "updating information" will deal hereafter with the previously mentioned regulation phase of comprehension monitoring (Baker, 1985). Importantly, there is an apparent and direct link between updating and working memory capacity. However, differently from comprehension monitoring, the relation between updating and reading comprehension has traditionally involved working memory updating tasks with list of words, and studies that have used comprehension tasks requiring updating information in relation to working memory are scarce. Thus, whether readers require working memory to update a situation model during text comprehension remains a fundamental question.

3. Working memory and high-level comprehension in the native language

Previous literature has clearly demonstrated a positive relationship between working memory and inference making during reading comprehension in both children (e.g., Potocki, Sanchez, Ecalle, & Magnan, 2017) and adults (e.g., Bohn-Gettler & Kendeou, 2014). Moreover, when comprehending linguistic information, the ability to predict subsequent information is reduced in readers with lower executive resources (e.g., working memory) such as children or older adults, compared to young adults (see Ryskin, Levy, & Fedorenko, 2020, for a review). Thus, working memory seems to constrain the mechanisms underlying our ability to generate expectations during language comprehension. On the other hand, a considerable amount of scientific research has reported a relationship between working memory and comprehension monitoring in children (e.g., van der Schoot, Reijntjes, & van Lieshout, 2012), where low span children manifest poor comprehension due to difficulties with detecting both external and internal inconsistencies. However, although some studies have shown that low working memory young adults may fail to apply comprehension monitoring under certain circumstances (e.g., Linderholm, Cong, & Zhao, 2008), the relation between comprehension monitoring and working memory in young adults has been less conclusive (see e.g., De Beni, Borella, & Carretti, 2007). This suggests this population might not recruit working memory (or to a lesser extent) when detecting conflicting information during text comprehension. Furthermore, regarding updating of linguistic information, reading performance has been clearly associated with the ability to update working memory information in both children (e.g., García-Madruga, Vila, Gómez-Veiga, Duque, & Elosúa, 2014, but see Muijselaar & de Jong, 2015, for opposite results) and adults (e.g., Palladino, Cornoldi, De Beni, & Pazzaglia, 2001). A typical measure in this context is the *updating word span task*, where readers are required to recall the last three-to-four/five smallest objects from a list of words (e.g., from the list "*meeting, sense, woodpecker, passion, law, cow, happiness, amount, caterpillar, lamb, feast, and frog*", the three smallest words to be remembered are "*woodpecker*", "*caterpillar*" and "*frog*"). This task assesses updating information as it entails maintaining words in working memory to compare their physical size and select the smallest items, and then discarding any previously activated word that no longer meets the "smallest" criteria (i.e., inhibiting no longer relevant information). Studies using the updating word span task have demonstrated that poor comprehenders are also poor at updating the contents of working memory (García-Madruga et al., 2014; Palladino et al., 2001). These difficulties of poor comprehenders have been interpreted as due to problems inhibiting the no-longer relevant text information, which in turn, interferes with the activation of relevant information in working memory (Butterfuss & Kendeou, 2018). Nonetheless, notice that most of these studies have investigated the connection between updating and comprehension by measuring lexical or sentence level updating instead of assessing readers' ability to update information during text comprehension. Then, it is not clear whether working memory affects general comprehension when the text forces updating at the situation model level.

In a study specifically designed to study high-level comprehension processes during text comprehension, we created the *situation model revision task* (Pérez, Cain, Castellanos, & Bajo, 2015), which critically assess inferential processing, comprehension monitoring and updating during online comprehension. In this task, short narratives are presented to participants one by one. The first three sentences of each narrative are used as a context that induces the generation of a predictive inference (e.g., "guitar", see Table 1). Subsequently, participants encounter one of three possible conditions: a) neutral, which do not refer to the prediction primed by the context ("*The concert was taking place at the prestigious national concert hall*"); b) non-update, where the sentence is consistent with the initial prediction ("*His instrument was made of maple wood, with a beautiful curved body*"); and c) update, where the information is inconsistent with the initial prediction and supports the generation of a new prediction ("*His instrument was made of maple wood with a matching bow*"). Because the latter condition prompts readers to detect the inconsistency, reading times in this condition compared to the other two conditions are taken as an index of comprehension monitoring. Finally, the last sentence of the narrative brings a disambiguating word ("*The public was delighted to hear Dan playing the violin*"), which creates three new conditions depending on the previous sentence: a) uncertain, when coming from the neutral condition ("*concert hall*" → "*violin*"); b) unexpected, when coming from the non-update condition ("*curved body*" related to the idea of guitar → "*violin*"); and c) expected, when coming from the update condition ("*matching bow*" → "*violin*"). Event-related potentials recorded in the disambiguating word are taken as indexes of updating information. Importantly, in this paradigm, both comprehension monitoring and updating information occur at the inferential level which makes the task more cognitively demanding. Finally, general comprehension is assessed by means of a "Yes/No" comprehension sentence placed at the end ("*In the recital, Dan played his favourite works*", response: "*Yes*").

[Insert Table 1 about here]

In the original study (Pérez et al., 2015), young English adults were first assessed in working memory (measured by the reading span task and an updating word span task), and then divided into a high or low span group to be tested in the situation model revision task. Our results revealed different effects. First, we observed all readers took longer in the update condition ("*matching bow*" after predicting "guitar") compared to the neutral ("*concert hall*") and the non-update ("*curved body*") conditions, with no difference between the last two. These findings signalled that readers were able to generate the initial prediction and then evaluated the information that was inferentially inconsistent with their prior interpretation (inferential comprehension monitoring). The reading times of the two working memory groups did not differ at this sentence, so we concluded that comprehension monitoring was not dependent on working memory capacity. In contrast, the electrophysiological results of the disambiguating word ("*violin*") manifested working memory differences. Concretely, high span readers showed a more efficient reduced activation (i.e., parietal P300 and N400) in the expected condition compared to both the uncertain and unexpected conditions, than readers with low span capacity.

These results were interpreted as a better ability of high working memory readers to update an initial incorrect interpretation and to integrate new semantic information into their situation model. On the contrary, low working memory readers had difficulties updating their situation model probably because they fail to inhibit the initial (now outdated) prediction. In sum, our first study assessing young adults' L1 text comprehension, indicated that whereas comprehension monitoring did not require working memory, updating information at the inferential level involved working memory to be efficiently implemented.

Interestingly, in a review, Butterfuss and Kendeou (2018) theorized that updating during text comprehension might be influenced by both domain-general and domain-specific factors. On the one hand, they state that effective updating during reading entails domain-general working memory processes related to storage and information processing. We believe this is in line with our previous results, as we showed that updating a situation model requires the activation and maintenance of incoming information (storage) such as the generation of the initial prediction or the alternative interpretation, as well as the detection of a possible conflict and the replacement of no longer relevant information with the new interpretation (processing). On the other hand, Butterfuss and Kendeou (2018) also hypothesized the involvement of domain-specific factors such as the verbal (instead of the visuospatial) domain of working memory to implement inhibitory control over irrelevant linguistic information. However, once again, this hypothesis was based on studies using an updating word (vs. number) span task similar to the one described above (e.g., Pelegrina, Capodieci, Carretti, & Cornoldi, 2015) or a proactive interference task in which participants were presented with a list of words (vs. faces) and, after performing a distracting task, they were asked to recall one of the words in response to a category cue (e.g., type of fruit; Pimperton & Nation, 2010), rather than tasks measuring updating at the text level.

In a different study, we explored working memory domain specificity of updating during text comprehension by means of eye movements (Pérez, Joseph, Bajo & Nation, 2016). Similar to Pérez et al.'s (2015) research, we tested young English adults in a *mismatch detection task*, where short narratives were presented (e.g., "*It was already* 25th *of December and Sophie was back home. As a special treat, her father was making her traditional Christmas dinner. The turkey was cooking, and it needed another hour in the* ____ *before it was done*"), containing either an expected ("*oven*") or unexpected ("*grill*") concept. Subsequently, just below each narrative, readers encountered a comprehension sentence that could be either congruent or incongruent depending on the previous concept (e.g., "*The turkey needed to be* <u>*roasted/barbecued*</u> *for one more hour*"). Eye movements were recorded in the text and sentence target words. In addition, accuracy to the comprehension sentence assessed general reading comprehension. Moreover, this time working memory was measured in both the verbal domain (composite score of the listening recall and backward digits recall tasks) and visuospatial domain (odd one out and spatial recall tasks), to understand whether the differences previously observed in high compared to low span readers in the updating information process were specifically related to the verbal domain. Consistent with previous findings, readers manifested longer fixation durations (i.e., go-past time and total time) in the unexpected compared to the expected concept in the text, indicating successful comprehension monitoring. However, once more, this effect did not interact with either the verbal or visuospatial domain, signaling comprehension monitoring was not supported by working memory capacity. On the contrary, once readers encountered the unexpected concept, lower compared to higher verbal span readers spent more time rereading previous information (longer go-past time) after encountering a comprehension sentence that brought congruent information ("*grill*" → "*barbecued*"), suggesting that lower verbal working memory readers experienced difficulties performing online updating. This relationship was not found with the visuospatial domain, indicating that the ability to inhibit no longer relevant information during text comprehension specifically recruits verbal working memory.

Finally, in a recent study we explored whether the relation between updating at the situation model level and individual differences in working memory is essentially mediated by inhibitory mechanisms (Pérez, Schmidt, Kourtzi, & Tsimpli, 2020). To this aim, we evaluated young English adults in a (multimodal) mismatch detection task, together with a working memory (backward digit span) task and an inhibitory control (flanker) task. Similar to previous findings, our results indicated that both comprehension monitoring and updating information where successfully implemented during the construction of the situation model. However, updating (but not comprehension monitoring) was specifically explained by individual differences in inhibitory control, where higher resistance to distractor interference (higher inhibitory skill) was translated into a better ability to suppress no longer relevant pictorial information and a more efficient ability to update the situation model across modalities. The general measure of (verbal) working memory did not explain any effect after inhibitory control was included in the statistical model, confirming updating of the situation model is essentially supported by inhibitory control mechanisms.

Overall, studies on high-level text comprehension processes during the native language suggest comprehension monitoring is not explained by individual differences in working memory even if it occurs at the inferential level. In contrast, working memory is consistently related to updating information: Low span readers experience problems updating the situation model because they fail to discard an initial erroneous prediction, whereas high span readers are faster and more efficient updating information that becomes outdated during online comprehension. This relationship seems to be specifically supported by the verbal (vs. visuospatial) domain of working memory, and it is mainly based on inhibitory mechanisms of cognitive control.

4. Working memory and high-level comprehension in the second language

In line with studies on native language processing, individual differences in working memory also underlie inferential comprehension in L2. For example, Alptekin and Erçetin (2011) evaluated young Turkish adults, which were highly proficient in English, their L2. They were assessed in both literal and inferential L2 comprehension skills (a short autobiographical story), as well as in L2 working memory (reading span task). They observed that whereas all readers performed similarly in L2 comprehension when literal information was required, high compared to low span readers were significantly better in L2 inferential comprehension. In addition, several studies have demonstrated the connection between working memory and the ability to use prior knowledge to facilitate L2 reading (Joh & Plakans, 2017; Shin, Dronjic, & Park, 2019). Shin et al. (2019) evaluated young Korean-English bilingual adults in L2 text comprehension (different passages from TOEFL Practice Test), L2 working memory (reading span task), and L2 background knowledge (vocabulary size test and C-test). Higher working memory span readers reached a better understanding of the text in their second language than lower span readers when they had prior knowledge than when they did not. This suggests L2 readers need to have some knowledge on the specific topic to be able to efficiently use their working memory, which is connected with the idea that working memory is essential to generate knowledge-based inferences (e.g., predictions), especially during L2 reading. In fact, similar to what it has been suggested for children and older adults (Ryskin et al., 2020), L2 comprehenders have a reduced ability to predict incoming information compared to native comprehension, which has been interpreted as due to limited availability of working memory resources (e.g., Hopp, 2013).

Interestingly, in recent years, the topic of prediction has been gaining relevance in the bilingual literature (e.g., Foucart, Martin, Moreno, & Costa, 2014; Kaan, Kirkham, & Wijnen, 2016; Martin et al., 2013; Zirnstein, van Hell, & Kroll, 2018). Similar to the mismatch detection task where narrative texts biasing a prediction are presented with either an expected or unexpected concept, these studies use highly-constrained sentences biasing a lexical prediction (e.g., "*It was raining so he grabbed his…*"), followed by either an expected word ("*umbrella*") or an unexpected but still plausible concept ("*coat*"). The typical effect is a N400 in the unexpected compared to the expected word, which is interpreted as signalling the degree of activation and integration of lexico-semantic information of the predicted concept. However, notice the N400 also reflects inferential comprehension monitoring at the sentence level, that is, the ability of comprehenders to detect that the unexpected word mismatches with the prediction biased by the sentential context. Moreover, some of the studies reporting N400 effects have also reported a late frontally-distributed post-N400 positivity (PNP, see Van Petten & Luka, 2012 for a review) when the lexical prediction is replaced by the unexpected concept. The PNP has been related to several revision functions such as difficulty to integrate information when constructing, reorganizing or updating an utterance interpretation (Brouwer, Fitz, & Hoeks, 2012); the need to update information when incoming words are not followed from readers' predictions (Kuperberg, 2016); disconfirmed lexical predictions (frontally located) or an attempt to check or re-analyse problematic information (parietally located, Van Petten & Luka, 2012); and an increase of cognitive resources to implement revision, updating or conflict-monitoring/resolution processes (Boudewyn, Long, & Swaab, 2015). Consistently, in the lexical prediction literature, the PNP has been hypothesized to indicate the cost that comprehenders experience when the predicted word is no longer valid at the sentence level, which has been also demonstrated at the text level (e.g., Brothers, Swaab, & Traxler, 2015). Interestingly, all this literature suggests a connection between the PNP component and the updating information process.

Despite the scientific literature on lexical prediction has yielded mixed results since the N400 and PNP components are not always found under the same L2 comprehension conditions (e.g., Martin et al., 2013; Zirnstein et al., 2018), several studies have shown that their occurrence during L2 comprehension depends on cognitive control. For instance, Zirnstein et al. (2018) presented high constraint sentences (e.g., "*After their meal, they forgot to leave a ____ for the waitress*") including an expected ("*tip*") or unexpected ("*ten*") word, and found that both N400 and PNP effects depended on bilinguals' L2 proficiency and cognitive control (AX-CPT task): Lower L2 proficient bilinguals showed worse lexical prediction (larger N400) than higher L2 proficient bilinguals, and those with lower inhibitory control incurred more costs (larger PNP) than bilinguals with larger inhibitory control ability, in the unexpected word[1]. These findings indicate that bilingual young adults are, at least in part, able to carry out inferential monitoring (observed in the N400 effect) and updating information (PNP effect) during L2 sentence comprehension, but this is dependent on several linguistic and cognitive factors such as whether bilinguals are highly proficient in their second language and/or whether they have good cognitive control, among other factors. Importantly, in relation to the latter, L2 processing demands more working memory resources than L1 processing (e.g., Dussias & Piñar, 2010; Kaan, et al., 2016), and as more cognitive resources need to be allocated to lower-level linguistic processes (such as

[1] Notice these researchers interpreted the absence of PNP as bilinguals' ability to reduce the costs associated with the unexpected word, rather than a worse ability to revise their lexical prediction.

words or sentences), fewer resources are available for higher-level semantic-discourse processes, where less proficient L2 comprehenders often manifest difficulties (e.g., Horiba & Fukaya, 2015). Thus, a straightforward hypothesis here is that bilinguals' L2 working memory capacity strongly determines their ability to implement successful comprehension monitoring and updating information during L2 text comprehension.

As long as we know, there is only one study that has investigated both inferential comprehension monitoring and inferential updating information during L2 text comprehension (Pérez, Hansen, & Bajo, 2019). In this study, we evaluated native English adults, highly proficient in Spanish. They were assessed in the situation model revision task (Pérez et al., 2015), cognitive control (AX-CPT task), L2 proficiency (linguistic background, vocabulary and verbal fluency), as well as L1 and L2 working memory (operational span task). More concretely, we investigated high-level text cognitive processes during L1 and L2 comprehension by focusing on individual differences in cognitive control and L2 proficiency. Our results showed that bilinguals were able to monitor their inferential comprehension in both languages, but this was less efficient in the L2. In addition, regarding cognitive control, comprehension monitoring did not depend on this factor. In contrast, individual differences in cognitive control explained inferential updating (N400 effect) during the construction of the situation model. Concretely, more efficient inferential updating in the L1 was associated with a balance between proactive and reactive control, whereas a more native-like L2 updating was related to a stronger proactive control. According to the dual-mechanisms of control framework (Braver, 2012), *proactive control* is a pre-emptively implemented control mode, based on sustained goal maintenance and anticipatory monitoring during task performance, whereas *reactive control* involves a momentary and transient activation of the task goal in the light of conflict or interference. Taking into account this distinction, Pérez et al. (2019) interpreted their L1 findings as the ability of native comprehenders to anticipate information by actively generating the prediction suggested by the context (proactive control), and subsequently disengage from that prediction to accommodate a new inference (reactive control). In contrast, efficient inferential updating in L2 comprehension seemed to only involve a more active control mode (proactive control). Beyond the complexity of this pattern of results, our findings shed light on the hypothesis that bilinguals' working memory might underlie their ability to carry out efficient inferential updating during text comprehension.

In the previous study, working memory was assessed as a control measure, but we did not analyse for it. Because the aim of the present chapter is to understand how working memory underlies high-level text comprehension processes, we reanalysed Pérez et al.'s (2019) data to more directly explore whether individual differences in working memory predicted L2 and L1 comprehension processes. In line with prior results (Pérez et al., 2019), inferential comprehension monitoring occurred in both languages. This time, however, comprehension monitoring was determined by working memory. Specifically, in the native language, higher L1 span readers performed marginally better inferential monitoring (longer reading times in the update condition) than higher L2 span readers, whereas the opposite was statistically significant in the second language, where higher L2 span readers were better than higher L1 span readers (see Figure 1). These findings suggest that bilinguals' working memory capacity constrained the ability to inferentially monitor both L1 and L2 comprehension during the construction of a situation model. At first sight, this pattern seems to contradict our findings with monolingual participants showing that inferential monitoring was not related to working memory in young adults (Pérez et al., 2015, 2016). However, this relation between working memory and inferential monitoring in bilinguals provide support to the idea that bilingualism changes the way some linguistic processes are performed. Many studies have shown that coactivation of the two languages in bilinguals is not limited to low-proficiency L2 users reading in their L2 since highly proficient L2 speakers also activate their L1 while reading in their L2 (Dijkstra, Grainger, & Van Heuven, 1999; Martín, Macizo, & Bajo, 2010). In addition, L1 reading is also influenced by coactivation of L2 (e.g., Gullifer, Kroll, & Dussias, 2013). Overall, activation of the non-target language is evident for highly proficient bilinguals both when reading in their L1 and L2. Thus, language coactivation might be at the base of the persistent finding that L1 lexical access is slower in bilinguals across lifespan development (e.g., Hansen, et al., 2017; Ivanova & Costa, 2008). Accordingly, it is possible that coactivation of the two languages turn linguistic processing more demanding so that processes that in principle do not involve working memory capacity (e.g., comprehension monitoring), might be in need of it when performed by bilinguals.

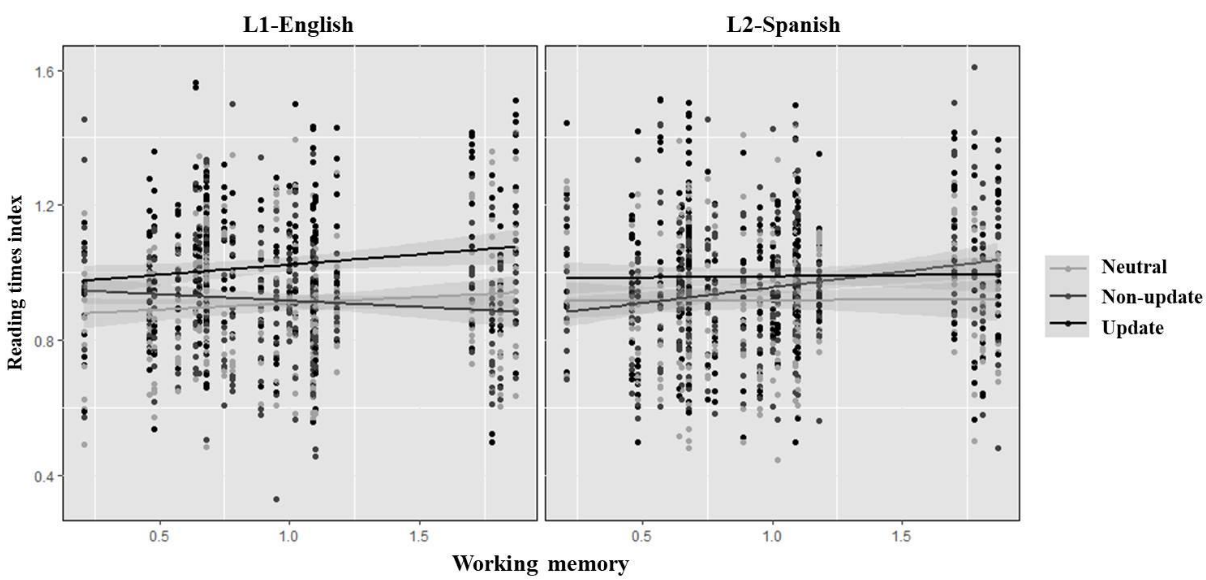

Figure 1. Reading times index (fourth sentence divided by the mean of the first three sentences or context; in milliseconds. It constitutes a “pure processing time” measure) for the fourth

sentence, as a function of language, condition and working memory (L2 divided by L1[2]). The three-way interaction was significant, F (2, 1738) = 6.72, $p < .01$, $\eta_p^2 = .008$, which divided by language showed that the interaction of condition and working memory was marginally significant in the L1, F (2, 882) = 2.60, p =.07, and significant in the L2, F (2, 827) = 3.56, $p <$ .05.

Moreover, working memory also explained individual differences in the updating information process, where higher L1 span readers showed better inferential updating (less negativity in the N400 component[3] for the expected condition) than higher L2 span readers in the first language, but no differences were found during L2 comprehension (see Figure 2). These effects support the idea that working memory underlies the performance of inferential updating during L1 text comprehension, which is in line with previous findings indicating that verbal working memory is necessary to perform updating of the situation model in the native language (Pérez et al., 2015, 2016). In contrast, inferential updating was not explained by working memory in the second language, which leads us to think that inferential updating was less efficient (or even absent) in L2 comprehension. This is relatively consistent to results showing that inferential updating relies on cognitive control (Pérez et al., 2019), where second language comprehension was quantitatively (rather than qualitatively) different from native comprehension.

[2] Less than 1 means better working memory in the L1 compared to the L2, and more than 1 means the opposite.
[3] Unfortunately, at the moment of writing this chapter we had no access to the original electrophysiological data to analyse the PNP component, which remains a pending task to unfold the whole pattern of results.

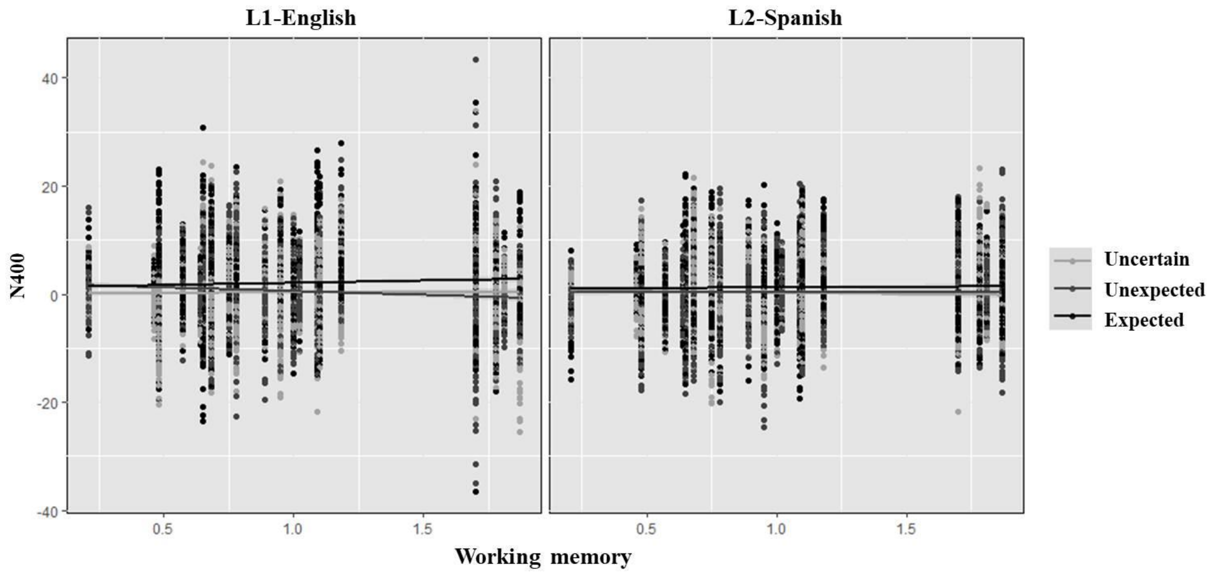

Figure 2. Electrophysiological activity (N400) for the disambiguating word, as a function of language, condition and working memory (L2 divided by L1). The three-way interaction was marginally significant, F (2, 10112) = 2.86, p = .06, η_p^2 = .001, which divided by language demonstrated that the interaction of condition and working memory was significant in the L1, F (2, 5338) = 5.81, p <.01, but not in the L2, F (2, 4897) = 0.22, p = .80. However, because the main interaction was just marginally significant (with a low η_p^2 value), these findings must be interpreted with caution.

To sum up, studies investigating high-level comprehension processes during a second language indicate that both comprehension monitoring and updating information recruit cognitive control at the sentence level. This has been partially confirmed in text comprehension, were inferential updating of a situation model during L2 comprehension seems to depend on proactive control. Finally, the new analysis performs on Pérez et al.'s (2019) data confirmed the involvement of working memory on the two high-level comprehension processes. Specifically, higher L1 working memory readers were marginally better inferentially monitoring their comprehension in the native language, whereas lower L1 (higher L2) working memory readers were better doing so in the second language. Similarly, the relation between working memory and updating was observed in the first language, where higher L1 working memory readers were better inferentially updating their situation model during native comprehension. In contrast, working memory did not explain differences in the second language, suggesting inferential updating was less efficient in second language comprehension. Importantly, we should be cautious with the interpretations of the L2 effects, as the literature on L2 high-level text comprehension processes is scarce and less consistent than in the L1. In spite of that consideration, our findings suggest that late proficient bilinguals comprehend texts in a quantitatively less efficient manner than native speakers.

5. General conclusions

Working memory is the capacity to actively represent, maintain and manipulate information, as well as to retrieve stored knowledge from long-term memory. All these memory processes are involved in the construction of a situation model during text comprehension and, in fact, working memory has a positive correlation in both first (Schroeder, 2014) and second language (Shin, 2020) reading. Accordingly, working memory might underlie performance on high-level comprehension processes such as inference making, monitoring and updating information.

Research on L1 text processing has shown that the evaluation phase of comprehension monitoring (i.e., mismatch detection) is not dependent on working memory capacity, at least in young adults (Pérez et al., 2015, 2016). For instance, De Beni et al. (2007) showed that working memory differences and self-monitoring meta-comprehension were associated with comprehension difficulties in narratives in old-old adults (75-85 years), but not in young adults (18-30 years) or young-old adults (65-74 years). Actually, evaluation is considered a routine, passive, and nonstrategic process (Kendeou, 2014), which suggests that the ability to monitor inconsistent information during L1 comprehension is not constrained by working memory capacity, even at an inferential level of processing. A very different picture appears in the updating information process when reading in the native language. More concretely, low working memory readers experience problems updating their situation model compared to high working memory readers (Pérez et al., 2015), and this seems to be specifically associated with the verbal domain of working memory (Pelegrina et al., 2015; Pérez et al., 2016). This effect has been interpreted as difficulties of low verbal working memory readers to inhibit no longer relevant (outdated) text information, which causes interference with the activation of relevant linguistic information (Butterfuss & Kendeou, 2018). Importantly, this interpretation has been recently confirmed by the demonstration that updating of the situation model is essentially explained by inhibitory control mechanisms over the general capacity of working memory (Pérez et al., 2020).

Regarding L2 comprehension, some studies on lexical prediction during sentence comprehension have shown a direct link between inferential comprehension monitoring and cognitive control (N400 effect; Zirnstein et al. 2018), suggesting a possible connection with working memory (Kaan, et al., 2016). Moreover, although comprehension monitoring does not seem to be explained by reactive or proactive control during L1 or L2 text comprehension in bilingual adults (Pérez et al., 2019), the inclusion of working memory affects inferential monitoring performance in both the L1 and the L2 (reanalysis of Pérez et al.'s 2019 data). Concretely, readers with higher L1 working memory marginally detected inferential inconsistent information more efficiently than lower L1 (higher L2) working memory readers in the native language. Although this result is inconsistent with previous findings showing that working memory is not involved in the evaluation phase of comprehension monitoring in monolinguals (Pérez et al., 2015, 2016), it is in accordance with other data showing that bilingualism modulates the way in which many linguistic processes are performed, producing costs and benefits (Ivanova & Costa, 2008). Thus, bilinguals' difficulties to process verbal information might be due to the more demanding conditions produced by language coactivation (Martín et al., 2010). Nonetheless, further research would be necessary to clarify this matter. Moreover, the opposite pattern was found in the second language. That is, higher L2 working memory readers were more efficient at detecting inferential inconsistent information than readers with higher L1 (lower L2) working memory during L2 text comprehension. As long as we know this is the first study demonstrating this relationship in language comprehension. However, there is some evidence reporting an executive control advantage in conflict-monitoring (oculomotor Stroop task) depending on second language proficiency (Singh & Mishra, 2013). Therefore, cognitive control in general and working memory capacity in particular, seems to underlie the ability to monitor inferential information during L2 text comprehension.

Furthermore, studies on lexical prediction during sentence comprehension have also found a connection between cognitive control and a post-N400 positivity (PNP effect; Zirnstein et al. 2018). Importantly, the PNP has been associated with several revision functions (e.g., Boudewyn et al., 2015; Brouwer et al., 2012; Kuperberg, 2016; Van Petten & Luka, 2012), indicating an insightful link between the PNP and the updating information process. Indeed, Zirnstein et al.'s (2018) study suggested that L2 updating during sentence comprehension is subjected to individual differences in cognitive control (inhibitory control). This interpretation is in line with findings demonstrating that inferential updating at the situation model recruits cognitive control (stronger proactive control) during L2 text comprehension (Pérez et al., 2019).

However, the reanalysis of Pérez et al.'s (2019) data manifested a connection between working memory and inferential updating only during L1 text comprehension. L2 inferential updating was not explained by individual differences in working memory, suggesting that the previous interpretation is not as convincing as it seems. We believe this differential pattern of results found in L2 comprehension may be determined by the type of task used to measure individual differences. Interestingly, although Zirnstein et al.'s (2018) and Pérez et al.'s (2019) studies computed cognitive control in a different way (inhibitory control vs. reactive/proactive index, respectively) the two studies assessed cognitive control by the AX-CPT task. In contrast, working memory was evaluated by an operational span task (Pérez et al., 2019) and calculated by dividing L2 by the L1 score. Accordingly, differences in the recruitment of cognitive resources (e.g., higher demands in the AX-CPT task compared to the operational span task) could be at the bottom of this complex pattern of results. Once again, further research is required to disentangle this issue.

Finally, we would like to shed some light on the possible relationship between the different working memory tasks mentioned in this chapter and text comprehension. Any span task such as the reading span, backward digit recall span, operational span or working memory updating task, is designed to assess working memory storage and processing, in order to engage executive attention processes. Thus, the fact that this type of tasks is recruited during the construction of a situation model signals the need to implement executive functions to build a coherent and accurate text mental representation. In addition, although the four specific tasks are considered to tap the verbal domain of working memory, they probably do so in a different grade, where a continuum could be traced going from the backward digit recall span task, which is least linguistically demanding because only digits are involved, to the reading span task, which is the one requiring most linguistic content due to the presentation of sentences (compared to both the operational span and the working memory updating tasks, which only require words). Reading comprehension, especially at the text level, involves linguistic information, so the verbal load of each span task certainly explain comprehension ability. Moreover, beyond the nature of the stimuli, the experimental procedure of the task also affects the specific text comprehension processes. For instance, Pérez et al., (2015) stated that the working memory updating task (Carretti, Belacchi, & Cornoldi, 2010) "*requires participants to a) activate and maintain each new word in working memory to compare its size with previously presented words, b) maintain activation of the smallest objects in the specified set size, and c) inhibit any previously activated words that no longer meet the criteria (i.e., to inhibit a large size object when they heard the name of a smaller object). Therefore, the recall set of words had to be constantly revised as new words were presented.*" (p. 1109). This means that the working memory updating task, as its name indicates, targets more directly the updating information process than other span tasks. A last consideration should be made in relation to the relationship between working memory capacity and updating information, as Pérez et al.'s (2020) found that once inhibitory control was included, working memory did not explain individual differences in multimodal updating. This suggests that, although text comprehension relies on working memory, some of the cognitive processes perform at this level entail further (or more specific) processing, which makes to think that working memory alone cannot account for the whole picture.

In conclusion, despite the fact that written information is easily accessible in today's world (especially since the advent of the Internet) and we constantly comprehend texts in our daily life (e.g., books, newspapers and/or scientific articles, digital forums, etc.), the construction of a coherent and accurate mental representation of the state of affairs described by a text does not seem to be an easy enterprise. A deeper understanding of the cognitive processes underlining text comprehension and their relationship with working memory capacity might help to develop new theoretical models of language comprehension, as well as to design educational strategies (e.g., training programs) targeting the prevention of comprehension problems in most vulnerable populations such as children, older adults and/or second language learners.

6. References

Alptekin, C., & Erçetin, G. (2011). Effects of working memory capacity and content familiarity on literal and inferential comprehension in L2 reading. *Tesol Quarterly*, *45*, 235–266.

Baddeley, A. (2000). The episodic buffer: a new component of working memory?. *Trends in Cognitive Sciences, 4*, 417–423.

Baker, L. (1985). How do we know when we don’t understand? Standards for evaluating text comprehension. *Metacognition, Cognition, and Human Performance*, *1*, 155–205.

Baker, L., Zeliger-Kandasamy, A., & DeWyngaert, L. U. (2014). Neuroimaging evidence of comprehension monitoring. *Psihologijske Teme*, *23*, 167–187.

Blanc, N., Stiegler-Balfour, J. J., & O'Brien, E. J. (2011). Does the certainty of information influence the updating process? Evidence from the reading of news articles. *Discourse Processes*, *48*, 387–403.

Bohn-Gettler, C. M., & Kendeou, P. (2014). The interplay of reader goals, working memory, and text structure during reading. *Contemporary Educational Psychology*, *39*, 206–219.

Boudewyn, M. A., Long, D. L., & Swaab, T. Y. (2015). Graded expectations: Predictive processing and the adjustment of expectations during spoken language comprehension. *Cognitive, Affective, & Behavioral Neuroscience*, *15*, 607–624.

Brothers, T., Swaab, T. Y., & Traxler, M. J. (2015). Effects of prediction and contextual support on lexical processing: Prediction takes precedence. *Cognition*, *136*, 135–149.

Brouwer, H., Fitz, H., & Hoeks, J. (2012). Getting real about semantic illusions: rethinking the functional role of the P600 in language comprehension. *Brain Research*, *1446*, 127–143.

Butterfuss, R., & Kendeou, P. (2018). The role of executive functions in reading comprehension. *Educational Psychology Review*, *30*, 801–826.

Cain, K., & Oakhill, J. V. (1999). Inference making ability and its relation to comprehension failure in young children. *Reading and Writing, 11*, 489–503. doi:http://dx.-doi.org/10.1023/A:1008084120205

Carretti, B, Belacchi, C., & Cornoldi, C. (2010). Difficulties in working memory updating in individuals with intellectual disability. *Journal of Intellectual Disability Research: JIDR*, *54*, 337–345. doi:10.1111/j.1365-2788.2010.01267.x

Case, R., Kurland, D. M., & Goldberg, J. (1982). Operational efficiency and the growth of short-term memory span. *Journal of Experimental Child Psychology*, *33*, 386–404.

Cowan, N. (1999). An embedded-processes model of working memory. *Models of working memory: Mechanisms of active maintenance and executive control*, *20*, 506.

Dahl, R. (2016). *Revolting rhymes*. Penguin UK.

Daneman, M., & Carpenter, P. A. (1980). Individual differences in working memory and reading. *Journal of Verbal Learning and Verbal Behavior, 19*, 450–466.

De Beni, R., Borella, E., & Carretti, B. (2007). Reading comprehension in aging: The role of working memory and metacomprehension. *Aging, Neuropsychology, and Cognition, 14*, 189–212. doi:http://dx.doi.org/10.1080/13825580500229213

Dijkstra, T., Grainger, J., & Van Heuven, W. J. (1999). Recognition of cognates and interlingual homographs: The neglected role of phonology. *Journal of Memory and language*, *41*, 496–518.

Dussias, P. E., & Piñar, P. (2010). Effects of reading span and plausibility in the reanalysis ofwh-gaps byChinese-English second language speakers. *Second Language Research, 26*, 443–472.

Farmer, T. A., Fine, A. B., Misyak, J. B., & Christiansen, M. H. (2017). Reading span task performance, linguistic experience, and the processing of unexpected syntactic events. *Quarterly Journal of Experimental Psychology*, *70*, 413–433.

Foucart, A., Martin, C. D., Moreno, E. M., & Costa, A. (2014). Can bilinguals see it coming? Word anticipation in L2 sentence reading. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *40*, 1461.

Fuchs, L. S., Fuchs, D., Compton, D. L., Hamlett, C. L., & Wang, A. Y. (2015). Is word-problem solving a form of text comprehension?. *Scientific Studies of Reading*, *19*, 204–223.

García-Madruga, J. A., Vila, J. O., Gómez-Veiga, I., Duque, G., & Elosúa, M. R. (2014). Executive processes, reading comprehension and academic achievement in 3th grade primary students. *Learning and Individual Differences*, *35*, 41–48.

Gernsbacher, M. A. (1990). *Language comprehension as structure building*. Lawrence Erlbaum Associates, Inc, Hillsdale, NJ.

Gernsbacher, M. A. (1997). *Attenuating interference during comprehension: The role of suppression*. (85–104). Academic Press, San Diego, CA.

Gernsbacher, M. A., & Faust, M. E. (1991). The mechanism of suppression: A component of general comprehension skill. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *17*, 245–262. doi:http://dx.doi.org/10.1037/0278-7393.17.2.245

Gullifer, J. W., Kroll, J. F., & Dussias, P. E. (2013). When language switching has no apparent cost: Lexical access in sentence context. *Frontiers in Psychology*, *4*, 278.

Hansen, L. B., Morales, J., Macizo, P., Duñabeitia, J. A., Saldaña, D., Carreiras, M., Fuentes, L. J., & Bajo, M. T. (2017). Reading comprehension and immersion schooling: evidence from component skills. *Developmental Science*, *20*, e12454.

Hopp, H. (2013). Grammatical gender in adult L2 acquisition: Relations between lexical and syntactic variability. *Second Language Research*, *29*, 33–56.

Horiba, Y., & Fukaya, K. (2015). Reading and learning from L2 text: Effects of reading goal, topic familiarity, and language proficiency. *Reading in a Foreign Language*, *27*, 22–46.

Ivanova, I., & Costa, A. (2008). Does bilingualism hamper lexical access in speech production?. *Acta Psychologica*, *127,* 277–288.

Joh, J., & Plakans, L. (2017). Working memory in L2 reading comprehension: The influence of prior knowledge. *System*, *70*, 107–120.

Just, M. A., & Carpenter, P. A. (1992). A capacity theory of comprehension: individual differences in working memory. *Psychological Review*, *99*, 122.

Kaan, E., Kirkham, J., & Wijnen, F. (2016). Prediction and integration in native and second-language processing of elliptical structures. *Bilingualism*, *19*, 1.

Kendeou, P. (2014). Validation and comprehension: An integrated overview. *Discourse Processes*, *51*, 189–200. doi:10.1080/0163853X.2013.855874

Kintsch, W. (1998). *Comprehension: A paradigm for cognition.* Cambridge University Press, New York, NY.

Kintsch, W., & van Dijk, T. A. (1978). Toward a model of text comprehension and production. *Psychological Review*, *85*, 363–394. doi:http://dx.doi.org/10.1037/0033295X.-85.5.363

Kuperberg, G. R. (2016). Separate streams or probabilistic inference? What the N400 can tell us about the comprehension of events. *Language, Cognition and Neuroscience*, *31*, 602–616.

Linck, J. A., Osthus, P., Koeth, J. T., & Bunting, M. F. (2014). Working memory and second language comprehension and production: A meta-analysis. *Psychonomic Bulletin & Review*, *21*, 861–883.

Linderholm, T., Cong, X., & Zhao, Q. (2008). Differences in low and high working-memory capacity readers' cognitive and metacognitive processing patterns as a function of reading for different purposes. *Reading Psychology*, *29*, 61–85.

Martín, M. C., Macizo, P., & Bajo, T. (2010). Time course of inhibitory processes in bilingual language processing. *British Journal of Psychology*, *101*, 679–693.

Martin, C. D., Thierry, G., Kuipers, J., Boutonnet, B., Foucart, A., & Costa, A. (2013). Bilinguals reading in their second language do not predict upcoming words as native readers do. *Journal of Memory and Language*, *69*, 574–588.

McKoon, G., & Ratcliff, R. (1980). The comprehension processes and memory structures involved in anaphoric reference. *Journal of Verbal Learning and Verbal Behavior*, *19*, 668–682.

McNamara, D. S., & Magliano, J. (2009). Toward a comprehensive model of comprehension. (pp. 297–384) Elsevier Academic Press, San Diego, CA. doi:http://dx.doi.org/ 10.1016/S0079-7421(09)51009-2

Miyake, A., Friedman, N. P., Emerson, M. J., Witzki, A. H., Howerter, A., & Wager, T. D. (2000). The unity and diversity of executive functions and their contributions to complex “frontal lobe” tasks: A latent variable analysis. *Cognitive Psychology*, *41*, 49–100.

Muijselaar, M. M., & de Jong, P. F. (2015). The effects of updating ability and knowledge of reading strategies on reading comprehension. *Learning and Individual Differences*, *43*, 111–117.

Palladino, P., Cornoldi, C., De Beni, R., & Pazzaglia, F. (2001). Working memory and updating processes in reading comprehension. *Memory & Cognition*, *29*, 344–354. doi:http://dx.doi.org/10.3758/BF03194929

Pelegrina, S., Capodieci, A., Carretti, B., & Cornoldi, C. (2015). Magnitude representation and working memory updating in children with arithmetic and reading comprehension disabilities. *Journal of Learning Disabilities*, *48*, 658–668.

Pérez, A., Cain, K., Castellanos, M. C., & Bajo, T. (2015). Inferential revision in narrative texts: An ERP study. *Memory & Cognition*, *43*, 1105–1135.

Pérez, A., Hansen, L., & Bajo, T. (2019). The nature of first and second language processing: The role of cognitive control and L2 proficiency during text-level comprehension. *Bilingualism: Language and Cognition*, *22*, 930–948.

Pérez, A., Joseph, H. S., Bajo, T., & Nation, K. (2016). Evaluation and revision of inferential comprehension in narrative texts: an eye movement study. *Language, Cognition and Neuroscience*, *31*, 549–566.

Pérez, A. I., Paolieri, D., Macizo, P., & Bajo, T. (2014). The role of working memory in inferential sentence comprehension. *Cognitive Processing*, *15*, 405–413.

Pérez, A., Schmidt, E., Kourtzi, Z., & Tsimpli, I. (2020). Multimodal semantic revision during inferential processing: The role of inhibitory control in text and picture comprehension. *Neuropsychologia*, *138*, 107313.

Perfetti, C. A., & Goldman, S. R. (1976). Discourse memory and reading comprehension skill. *Journal of Verbal Learning and Verbal Behavior*, *15*, 33–42.

Pimperton, H., & Nation, K. (2010). Suppressing irrelevant information from working memory: Evidence for domain-specific deficits in poor comprehenders. *Journal of Memory and Language*, *62*, 380–391. doi:http://dx.doi.org/10.1016/j.jml.2010.02.005

Potocki, A., Sanchez, M., Ecalle, J., & Magnan, A. (2017). Linguistic and cognitive profiles of 8-to 15-year-old children with specific reading comprehension difficulties: The role of executive functions. *Journal of Learning Disabilities*, *50*, 128–142.

Rapp, D. N., & Kendeou, P. (2007). Revising what readers know: Updating text representations during narrative comprehension. *Memory & Cognition*, *35*, 2019–2032. doi:http://dx.doi.org/10.3758/BF03192934

Ryskin, R., Levy, R. P., & Fedorenko, E. (2020). Do domain-general executive resources play a role in linguistic prediction? Re-evaluation of the evidence and a path forward. *Neuropsychologia*, *136*, 107258.

Schroeder, P. J. (2014). The effects of age on processing and storage in working memory span tasks and reading comprehension. *Experimental Aging Research*, *40*, 308–331.

Shin, J. (2020). A meta-analysis of the relationship between working memory and second language reading comprehension: Does task type matter? *Applied Psycholinguistics*, *41*, 873–900.

Shin, J., Dronjic, V., & Park, B. (2019). The interplay between working memory and background knowledge in L2 reading comprehension. *Tesol Quarterly*, *53*, 320–347.

Singh, N., & Mishra, R. K. (2013). Second language proficiency modulates conflict-monitoring in an oculomotor Stroop task: evidence from Hindi-English bilinguals. *Frontiers in Psychology*, *4*, 322.

Van der Schoot, M., Reijntjes, A., & van Lieshout, E. C. (2012). How do children deal with inconsistencies in text? An eye fixation and self-paced reading study in good and poor reading comprehenders. *Reading and Writing*, *25,* 1665–1690.

Van Petten, C., & Luka, B. J. (2012). Prediction during language comprehension: Benefits, costs, and ERP components. *International Journal of Psychophysiology*, *83*, 176–190.

Wagoner, S. A. (1983). Comprehension monitoring: What it is and what we know about it. *Reading Research Quarterly*, 328–346.

Was, C. A., & Woltz, D. J. (2007). Reexamining the relationship between working memory and comprehension: The role of available long-term memory. *Journal of Memory and Language*, *56*, 86–102.

Zirnstein, M., van Hell, J. G., & Kroll, J. F. (2018). Cognitive control ability mediates prediction costs in monolinguals and bilinguals. *Cognition*, *176*, 87–106.