CHAPTER 10

HOW BILINGUALISM AFFECTS SYNTACTIC PROCESSING IN THE NATIVE LANGUAGE

Evidence from eye movements

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MANY studies published over the past two decades have used measures of online language processing to show that the languages of a multilingual speaker are engaged in constant, pervasive interaction, and that these interactions are bidirectional: not only does the first language affect the second language, but the second language also influences the first.

Remarkably, these bidirectional influences can be seen at every level of language use. In immersion contexts, second language (L2) speakers experience reduced access to the first language (Linck et al., 2009), and extensive contact with the second language can affect first language (L1) phonology (e.g., Flege, 1987; Flege & Eefting, 1987a), syntactic processing (Dussias & Sagarra, 2007), sentence production (Hartsuiker et al., 2008), and naming performance of common objects (Malt & Sloman, 2003). There is now growing evidence demonstrating that the seemingly stable L1 system is open to influence when individuals learn and become proficient in an L2 (e.g., Gollan et al., 2008; Ivanova & Costa, 2008; Runnqvist et al., 2013; Kasparian & Steinhauer, 2017a).

The insight that there are bidirectional influences between the two languages of a bilingual speaker has implications for the study of language attrition; because the linguistic system is dynamic and interactive at all levels of representation, it is reasonable to expect that variations in language dominance, use, and exposure can lead to changes in the system—some subtle, some significant. In our view, these changes are not necessarily the result of what has increasingly been labelled 'attrition' in the literature, but rather are a natural consequence of the interactive nature of the languages at play. The goal of this chapter is twofold. The first is to survey recent contributions to the research on bilingual language processing that serve to demonstrate how exposure to a second language, even for

a brief period of time, can impact processing in the native language. Given this evidence, we will argue that claims of language attrition may not be as clear-cut as one may think when online language processing is taken into account. A second goal is to show that eye-tracking is a premier behavioural method by which we can come to understand fine-grained changes in online language processing. In doing so, we hope to illustrate how the study of online language processing via eye-tracking can help to clarify issues in language attrition (e.g., Berends et al., 2015).

10.1 THE INTERACTIVE NATURE OF THE BILINGUAL SYSTEM

One finding that remains uncontroversial after almost two decades of psycholinguistic research with bilingual speakers is that the two languages of a bilingual speaker are active, even when the intention is to use only one language. When bilinguals read, when they listen, or when they prepare to speak in one of their two languages, the language not in use is also active (Kroll et al., 2006; for an extensive review, see Dijkstra, 2005). For example, when bilinguals are asked to name cognate words (such as 'piano' in Spanish and English) in only one language, the language not in use is also active and influences performance, resulting in a cognate facilitation effect (i.e., bilinguals produce and recognize cognates faster than non-cognates). Although this work could be criticized on the grounds that the 'out-of-context' nature of word recognition and word naming experiments may itself induce the observed effects, extensive research also demonstrates that it is much more difficult than we might have thought to reduce or eliminate the presence of cross-language activity. First, the same cognate facilitation effects observed in out-of-context word recognition experiments can be observed when cognate words are embedded in sentences (e.g., Schwartz & Kroll, 2006; Duyck et al., 2007; Van Hell & De Groot, 2008; Libben & Titone, 2009). Second, the cross-language competition is not restricted to the lexicon. Although more research has examined these interactions for words than for sentences, recent studies show that the grammars of the bilingual's two languages are also open to one another in a manner far more permeable than what might have been predicted. Studies within the syntactic priming literature have shown that monolingual speakers are more likely to produce a sentence using a grammatical structure if they have just produced a sentence using that same structure (Bock, 1986). In bilingual research, the main question has been whether priming will be observed when switching languages from the prime to the target sentence. Although there are some exceptions (e.g., Bernolet et al., 2007), the general finding is that cross-language priming can be obtained (Hartsuiker et al., 2004). In general, the parallel activity of a bilingual's two languages creates cross-language interactions that influence performance at every level of language, including phonology (e.g., Spivey & Marian, 1999; Jared & Kroll, 2001; Marian & Spivey, 2003; Ju & Luce, 2004; Blumenfeld & Marian, 2007), orthography (e.g., Dijkstra & Van Heuven, 1998; Van Heuven et al., 1998), syntax (e.g., Hartsuiker et al., 2004), and meaning (e.g., Sunderman & Kroll, 2006).

The parallel activation of the bilingual's two languages is not restricted to languages that share structural or functional characteristics. An example of cross-language interaction

between structurally distinct languages is the case of bimodal bilinguals, who use a spoken and/or written language and a signed language. Morford et al. (2011) found that the speed with which deaf American Sign Language (ASL) English bilinguals made semantic relatedness judgements for English word pairs (*movie-paper*) was affected by whether the hand formations of the ASL translations were themselves similar or different in form. This result is remarkable because no ASL was present during the experiment. In an earlier study involving a logographic and an alphabetic language, Thierry & Wu (2007) found early neural sensitivity (measured via the recording of EEG (electroencelphalogram)) to a word's Chinese translation when Chinese-English bilinguals performed a semantic relatedness judgement task in English only. These bilinguals performed the semantic relatedness task without Chinese actually being present during the experimental session, and in a context in which they were immersed in an English-speaking environment. This demonstrates that the languages of a bilingual speaker are engaged in constant, persistent interaction, even in the presence of obvious differences between the bilingual's two languages (e.g., Emmorey et al., 2008; Hoshino & Kroll, 2008). What's more, the results in Morford et al. and in Thierry & Wu show that conscious awareness of the other language is not required to observe interactive effects between the L1 and the L2, suggesting that parallel activation is a feature of the architecture of the bilingual language system (Morford et al., 2011).

The finding that cross-language activation and interaction is pervasive in bilinguals has ramifications for the study of language attrition. This is especially true in the case of language processing, which can be modulated with relative ease. At one extreme end, some bilingual speakers experience an abrupt shift in language use towards their L2, perhaps due to marriage, immigration, or education. After decades of lack of use of the L1, these speakers may experience difficulty in lexical retrieval and large-scale interference from the L2 (Schmid, 2011a; Schmid & Keijzer, 2009; Schmid et al., 2004), and in many cases can be labelled as having undergone L1 attrition. At the other extreme, study abroad students, after mere weeks of immersion, experience subtle but quantifiable differences in lexical access vis-à-vis non-immersed peers in their first language (Linck et al., 2009). Is the latter case also a clear-cut example of attrition? In part, the field lacks a clear consensus on (1) what attrition is; (2) how soon attrition effects can begin; and (3) how permanent the effects of attrition are.

The goal of this chapter is to survey recent contributions to the research on bilingual language processing that serve as illustrations of how exposure to a second language, even for a brief period of time, can impact processing in the native language. Critically, we take the evidence of change to the native language not as an indication of permanent language attrition or loss, but rather as evidence that variation to the native language is a natural consequence of the intrinsic plasticity of the linguistic system (Kroll et al., 2015). In fact, monolingual speakers demonstrate this plasticity too, adapting to and extending the use of unfamiliar structures from a language variety different from their own variety (e.g., Fraundorf & Jaeger, 2016), and even showing reduced sensitivity when presented with ungrammatical structures for a short period of time (Hopp, 2016a). These effects, both in bilingual and monolingual speakers, may be attributable to priming, but to the extent that the facilitatory effects of priming during language comprehension are not limited to known structures but also affect entirely unknown structures (Fraundorf & Jaeger, 2016), it suggests that priming is not necessarily a reflection of transient activation (Pickering & Branigan, 1998; Traxler & Tooley, 2008); rather, it can strengthen the mappings between

meanings and linguistic structures (Leonard, 2011), thereby leading to the learning and modification of linguistic representation (e.g., Bock & Griffin, 2000; Konopka & Bock, 2005; Savage et al., 2006; Ferreira et al., 2008; Hartsuiker et al., 2008; Fine & Jaeger, 2013). We begin with a brief overview of eye-tracking and how eye movements are a fine methodological tool to investigate shifting sensitivities to linguistic cues in sentence processing. We then illustrate our approach to language interaction by examining two instances of the reconfiguration of the L1, which we argue are natural extensions of a dynamic linguistic system—monolinguals to a lesser extent demonstrate this dynamicity as well. Then, we ask whether eye-tracking can illustrate the reactivation of L1 processing strategies after re-exposure in a compressed timeframe.

10.2 Eye-movement records as a premier behavioural tool to study L1 language change

How is eye-movement data informative to studying changes in the processing of the first language? Theories of sentence processing are generally interested in the online or incremental nature of comprehension processes. As soon as each word is encountered, readers and listeners are assumed to make structural decisions about how to integrate each word within the ongoing syntactic structure. The incremental nature underlying sentence processing allows researchers to use eye movements and fixations to make inferences on the ease of integration into prior sentential context. Eye-tracking has been used for both auditory and reading comprehension studies and with a variety of populations. The logic that underlies these studies is quite simple: there is a plausible link between what readers/hearers look at and for how long as they process linguistic input. Thus, when reading, readers linger longer and regress back to words that are harder to process as compared to easy or predictable words (see Rayner, 1998; Clifton & Staub, 2011; Keating, 2014, for comprehensive reviews). Similarly, researchers working within the auditory domain utilize the visual world paradigm (Tanenhaus et al., 1995)—an eye-tracking technique whereby participants listen to auditory stimuli in the presence of a visual scene—to study the time-course of spoken language processing. Because listeners will look at relevant referents as they are named in the auditory input, researchers can manipulate the presence/absence of linguistic features (e.g., phonetic overlap, grammatical gender, case marking, anaphora, givenness, etc.) to investigate the time course of looks to a target item (see Tanenhaus & Trueswell, 2006; Altmann, 2011; Huettig et al., 2011, for reviews). In what follows, we present a necessarily brief overview of the central findings of eye-tracking research in reading and auditory processing.

Over three decades of eye-movement research have shown that when eye movements are recorded during reading, there are systematic relations between fixation durations and the characteristics of the fixated words (Rayner, 1978; Just & Carpenter, 1980; Ehrlich & Rayner, 1981). Readers spend more time fixating on harder words (e.g., lower frequency words) and on more important words (e.g., nouns and verbs) than on easier words. Longer words are also more likely to be fixated on than shorter words, and words that are likely to be skipped

are short, function words. We also know that eye movements are particularly sensitive to textual variables. For example, when the text becomes more complex or contains uncommon or contextually implausible words, eye-fixation duration increases, and saccade length (i.e., small jumps made by the eye to move through text) decreases (Duchowski, 2002).

This variation in fixations can be captured in the gaze duration of readers (i.e., the initial amount of time a reader spends in a region, as defined by the researcher—typically as single words or phrases—from first entering it until the eyes move to another word). Word frequency has the most influential effect on gaze duration: a high-frequency word decreases gaze duration (O'Regan & Lévy-Schoen, 1987; Rayner & Pollatsek, 1987) compared to a lower-frequency word, even when length, number of syllables, meaning, and sentence frame are controlled for. Unpredictable words also have immediate effects on fixation duration. Readers tend to look at unpredictable words longer than predictable words and they skip over predictable words more frequently than unpredictable words (Ehrlich & Rayner, 1981). Moreover, when disambiguating information in a structurally ambiguous sentence is inconsistent with the syntactic interpretation assigned by a reader, there is considerable disruption in eye movement. Thus, participants reading a syntactically ambiguous sentence show long fixation durations at the disambiguating region, launch regressive saccades from the disambiguating point to the syntactically ambiguous constituent, or reread the sentence for a second time. The fact that inconsistencies associated with the structural analysis of a particular word (or collection of words) are noticed by readers as soon as they arise suggests that recordings of eye movements can be very informative when studying the structural decisions that people make during reading. Another major advantage of the eye-movement recording technique is that it allows researchers to obtain evidence about what is happening during the comprehension of a sentence moment by moment, as processing unfolds, without significantly altering the normal characteristics of either the task or the presentation of the stimuli. Eye movements are a normal characteristic of reading, and while eye-movement records are collected, participants are free to move their eyes along the printed line of text.

In a similar vein, eye-movement records are highly informative to auditory comprehension (i.e., the visual world paradigm, Tanenhaus et al., 1995). As in the case of reading studies, lexical (e.g., lexical frequency, phonological cohorts, and neighbourhood density) and grammatical manipulations (e.g., grammatical gender, cloze probability, verb semantics) during auditory processing may induce faster and greater looks to target stimuli in cases of facilitated processing, and slower and reduced looks to target stimuli in cases of delayed processing. The visual world paradigm has helped to elucidate that listeners do not wait until the end of a word before they begin to process its meaning (Allopenna et al., 1998). Similarly, listeners can anticipate upcoming target items based on the verb's meaning (Altmann & Kamide, 1999). Listeners are also adept at using grammatical cues such as grammatical gender, word order, or case marking to anticipate target items in informative contexts (e.g., Lew-Williams & Fernald, 2007; Hopp, 2016a, for grammatical gender; Kaiser & Trueswell, 2004, for word order; Kamide, Altmann, & Haywood, 2003; Knoeferle et al., 2005, for case marking). Because participants are freely scanning a visual scene as they listen to auditory input, the visual world paradigm is particularly useful for investigating online sentence processing in populations with reduced literacy, speakers of minority languages and stigmatized forms of speech, as well as language attriters. In the latter case, the visual world paradigm may be a powerful tool for language attrition researchers

because it does not require the use of judgement or acceptability tasks, and most participants are not conscious of how linguistic stimuli may impact how they inspect a visual scene.

Recent advancements in eye-movement technology also make available eye-tracking equipment that is extremely versatile, and replaces traditional, fixed eye-tracking systems with more flexible head-mounted systems, or remote systems that do not require the use of a headband or head (i.e., chin or forehead) support. In addition, to obtain the dependent measure, participants are not required to perform a secondary task (such as a button press) that might disrupt the normal comprehension process. Furthermore, thanks to several decades of eye-movement research, we have a very good understanding of the amount of visual information processed while our eyes fixate on text or when processing images.

10.3 Illustrative Cases

Eye-movement records have been employed in second language and bilingualism research primarily to ask how proficient speakers of two or more languages manage the presence of two languages in a single mind. If it were the case that these individuals could be characterized as two monolinguals in one head, then this question would not be very interesting. However, as stated earlier, the available evidence from the word recognition and sentence processing literature suggests that when two linguistic systems are housed in a single brain, they interact closely with one another, and these interactions influence the way in which L2 speakers read and understand spoken words in each of their languages. Below, we review several studies that will serve as illustrations about how eye-tracking methodology can be used to study these interactions.

10.3.1 Reconfiguration of the L1

Valdés Kroff et al. (2017) examined whether intense contact with Spanish–English code-switched speech had consequences for the processing of grammatical gender in L1 Spanish. In many bilingual communities, speakers regularly switch from one language to another, often several times in a single utterance. The ability to engage in fluent code-switching is a hallmark of high proficiency in two languages (Miccio et al., 2009), as successful and fluent code-switching requires a high degree of knowledge of and sensitivity to the grammatical constraints of both languages. Grammatical gender was examined because it is a lexically specified feature of nouns that triggers syntactic agreement with other function and open-class elements, such as determiners and adjectives. Grammatical gender was interesting for yet another reason. In the production literature of Spanish–English code-switches, one widely attested pattern is that when a code-switch occurs within a noun phrase composed of a determiner and a noun, the determiner overwhelmingly surfaces in Spanish and the noun in English, e.g., *el building* and not *the edificio* (Liceras, Fernández Fuertes, et al., 2008; Herring et al., 2010). Researchers have also documented a production asymmetry in grammatical gender assignment in these mixed noun phrases. The Spanish masculine article *el* ('the') surfaces with English nouns regardless of the grammatical gender of the noun's translation equivalents—for example, *el juice* (Spanish 'jugo', masculine), *el cookie*

(Spanish 'galleta', feminine). In contrast, mixed noun phrases involving the Spanish feminine article *la* (also translated as 'the') are rare and occur in restricted environments, such that only English nouns whose Spanish translation equivalents are feminine surface with *la* in code-switching (e.g., *la cookie* but not *la juice*; Jake et al., 2002; Otheguy & Lapidus, 2003). These production distributions in Spanish–English code-switching stand in contrast to monolingual Spanish, where the grammatical gender of a noun and its accompanying article must obligatorily match, and where masculine and feminine nouns are evenly distributed (Eddington, 2002; Otheguy & Lapidus, 2003).

As mentioned above, Valdés Kroff et al. (2017) investigated whether L1 Spanish–L2 English speakers who had been immersed in a code-switching environment used grammatical gender information encoded in Spanish articles to anticipate the gender of an upcoming noun (as Lew-Williams & Fernald, 2007, have shown with monolingual speakers of Spanish). Given the asymmetry observed in production data, it seemed plausible that the gender marking of articles would facilitate to a lesser extent the processing of code-switched speech. To investigate this, the eye movements of Spanish-English bilinguals were recorded. Participants saw two pictures that represented objects whose nouns were either of the same or different grammatical genders, and listened to code-switched sentences (i.e., *Hay un niño que está mirando el candy*/'There is a boy looking at the candy'). Words were spoken with a Spanish article that either matched the gender of the word's Spanish translation equivalent (e.g., *el candy*$_{\text{MASC}}$, Spanish *el caramelo*) or did not match (target: *el candle*$_{\text{FEM}}$, Spanish *la vela*). A control group of monolingual speakers of Spanish was also recruited. Participants were asked to listen to each sentence and to click on the named object. Where the grammatical gender of the Spanish names for each of the pictures was different between the two pictures, the gender information in the article was informative. Monolingual Spanish speakers showed the expected anticipatory effect on masculine and feminine different-gender trials. Results for the Spanish-English bilingual speakers revealed an anticipatory effect, but only on different-gender trials where the auditory stimulus was feminine. When the auditory stimuli were masculine in different-gender trials, participants did not launch anticipatory looks but rather waited to hear the target noun, meaning that they did not use masculine articles as cues for anticipatory processing.

At first glance, these results could potentially be consistent with an attrition account; after all, the bilingual participants experienced what appeared to be a permanent change to their L1 linguistic system (cf. Bergmann, Meulman, et al., 2015 for a discussion that L1 attrition studies in post-puberty migrants have not found evidence for weakening of gender); however, a follow-up production study with a subgroup of the same participants revealed that these bilinguals were highly accurate at producing the correct gender in Spanish-only noun phrases. The findings suggest that while there may be constraints on the sort of cross-language exchanges in bilinguals, the presence of these influences suggests a dynamic language system that changes in response to contact with other languages and to how the two languages are used among other bilingual speakers.

In an eye-tracking-while-reading study, Dussias & Sagarra (2007; see also Fernández, 2003) investigated the effect of intense contact with English on the resolution of syntactically ambiguous relative clauses in Spanish. Native Spanish and native English speakers differ in how they interpret temporarily ambiguous relative clauses such as *Alguien disparó al hijo de la actriz que estaba en el balcón* ('Someone shot the son of the actress who was on the balcony'). When asked the question *¿Quién estaba en el balcón?* ('Who was on the

balcony?'), monolingual Spanish speakers typically respond with 'the son' (i.e., high attachment preference) and monolingual English speakers with 'the actress' (low attachment preference, e.g., Carreiras & Clifton, 1999). Dussias & Sagarra found that L1 Spanish-L2 English bilinguals immersed in an English-speaking environment for a prolonged period of time favoured the low attachment strategy associated with English when reading in Spanish (their native language) in contrast to a non-immersed but proficiency-matched bilingual group who continued to favour a high attachment strategy. Importantly, overall comprehension was not affected (non-immersed group: 93%, immersed group: 91%) nor was average reading time.

Although not reviewed here, the influence of the first language on the second is a well-documented and robust finding (see Schwieter, 2015, for an extensive overview). The studies reviewed in this section demonstrate the lesser-known influence of the second language on the first. Taken together, these studies reflect the permeability of the two linguistic systems and not a gradual loss of sensitivity to L1 processing per se. How do we reconcile these bidirectional influences with an attrition account? Potentially, one criterion is how permanent these influences may be. In the next section, we review whether L1 speakers can be shifted back into demonstrating monolingual-like processing through reactivation.

10.3.2 Reactivation of the L1

Several recent studies have provided examples of how an L1 assumed to have undergone attrition can be reactivated despite years of non-use. Park (2015) examined the effects of re-exposure in Korean adoptees living in Sweden. The adoptees had been exposed to Korean before adoption for differing lengths of time, and were all learning Korean (effectively) as an L2 after years of non-use. To test whether or not re-exposure to Korean was affected by their experience during early childhood, Park administered two phonetic perception tasks to compare these adoptees to L1 Swedish speakers who were L2 learners of Korean. While the results were marginally significant, the trends were in the expected direction: the Korean adoptees performed better than their Swedish counterparts in distinguishing both vowels and stops in Korean. Likewise, those who had been adopted at a later age showed the greatest performance overall. Thus, the author concludes that, even after years of non-use and likely attrition, the native language can be 'reactivated' with new exposure, resulting in subtle yet detectable differences (see also Flores, Chapter 40, this volume). More recently, Choi, Cutler, & Broersma (2017) demonstrated that the benefits reported for adoptees' perception of the sounds of their birth language also transfer to production.

In the area of sentence processing, an eye-tracking study conducted by Chamorro, Sorace, & Sturt (2016) examined the effects of language attrition and re-exposure to the L1 on the use of the differential object marker (DOM) in Spanish. Three different groups were tested: Spanish monolinguals with little to no knowledge of English (who had recently arrived in Edinburgh, UK), and two groups of L1 Spanish attriters who had been living in the UK for more than five years and were near-native speakers of English. One of the latter groups of language attriters had been re-exposed to Spanish before participating in the experiment. The results were striking: all three groups showed sensitivity to violations involving the DOM in an offline judgement task but only the attrition group who had not

been re-exposed to Spanish showed reduced sensitivity in online reading task using eye-tracking. Remarkably, the group that had been re-exposed to Spanish exhibited sensitivity patterns similar to the monolingual group after just one week of exposure.

But do these findings extend to other language domains? A series of on-going eye-tracking experiments seems to suggest so. We mentioned earlier a study by Dussias & Sagarra (2007), who found that bilingual speakers experienced changes in the processing of their L1, and which the authors attributed to exposure to their L2. Given this finding, one might wonder whether proficient bilinguals who had adopted processing strategies of the second language when parsing their L1 can return to using L1 parsing after a period of re-exposure. To examine this question, Carlson et al. (in prep.) first ran a pre-test to identify Spanish-English bilinguals as 'high attachers' or 'low attachers' while they processed syntactically ambiguous relative clauses (e.g., *Alguien disparó al hijo de la actriz que estaba en el balcón* 'Someone shot the son of the actress who was on the balcony'). Next, they exposed participants to a five-day 'intervention study' (that ran for one hour each day), during which they read short paragraphs containing relative clauses in which the syntactic ambiguity was resolved opposite to their natural attachment preference. That is, participants who favoured high attachment received a low attachment treatment, and those who favoured low attachment received a high attachment treatment. In addition, within each group half of the participants were randomly selected to receive the intervention in Spanish and the other half in English. Participants returned to the lab after the intervention study to participate in two subsequent eye-tracking studies: one that assessed the immediate effect of the intervention and one that assessed the effect of the intervention a week after it was completed. The findings showed that those participants who originally preferred high attachment switched to a low attachment preference after the intervention, and maintained the low attachment preference by the second post-test. Similarly, participants who originally showed a low attachment strategy switched to high attachment. Critically, whether the intervention was in Spanish or in English did not affect the pattern of results, suggesting that structures that are shared, by virtue of the fact that they overlap between the two languages, can be fairly easily 'lost' but also 'reactivated'. Importantly, the shared nature of the structure seems to confer a particular advantage: exposure to the structure itself rather than exposure to the language can revert an attachment preference, underscoring the highly dynamic nature of the language systems and not *prima facie* language loss.

The studies reviewed here show that when online processing is taken into account, it can be said that even individuals considered to be language attriters still maintain sensitivity to potentially vulnerable elements in their L1. This suggests that online measures of language processing can provide a more complete picture of language use in populations of possible attriters, and that even brief periods of re-immersion in the first language can shift processing strategies back to monolingual-like preferences.

10.4 Conclusion

In this chapter, we have reviewed some of the recent developments on the permeability of the native language system, focusing primarily on the sentence comprehension. Our review is far from exhaustive because this is an active area of research that is rapidly expanding,

but our hope was to illustrate the view that changes to the native language are better understood as an indication of the openness of the networks that support language knowledge and language use in general, and as a consequence of a fundamental trait of the architecture of the linguistic system. Although the malleability of the native system can be evidenced in both monolingual and bilingual speakers, bilinguals represent a 'natural experiment' on the openness of the native language system; changes to the native language in response to the experience and context of use of an L2 result naturally when individuals come in contact with and use more than one language. At the same time, the use of eye-tracking has provided a unique set of insights about emerging questions that we have only had an opportunity to review briefly in the present chapter. If we step back from the specifics of the experiments that we have discussed, the overarching theme in our review is that the bilingual's two languages are remarkably open to one another, with cross-language interactions that persist from word to sentence processing, and with changes to the native language that provide a model for testing claims about the plasticity of cognitive and neural representations. One unanswered question moving forward is whether there is a threshold when this natural permeability and interaction between the two linguistic systems becomes a more permanent loss. The bilingual's two languages operate within a rich cognitive network that supports the comprehension processes on which we have focused. It is beyond the scope of our chapter to address this question; however, we hope that in the next phase of research on L1 attrition, the view that we have presented here represents a counterpoint to constrain what research defines as attrition.

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