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The Basque language in the minds of native and non-native bilinguals

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1. Introduction: an overview of the bilingual mind.

Bilinguals outnumber monolinguals: according to some recent estimates, between 60 and 75 per cent of the world's population is bilingual. It has been argued that the capacity to learn more than one language is an adaptive trait in human evolution (Hirschfeld 2008), and given what we know of interactions between human groups, is not unlikely that people throughout history have more often than not known more than one language. Language research initially tended to restrict itself to the study of monolinguals, and there was not much interest in the study of bilingualism, because it was generally (though tacitly) assumed that the representation and processing of a given language was not affected by another one, whether acquired simultaneously or later in life. Recent findings have completely overturned this assumption, and suggest instead that research beyond monolingualism holds a great potential for generating knowledge about the psychological nature of the human language faculty and the way in which language is organized in our minds.

François Grosjean, a pioneer researcher on bilingualism, warned in his foundational 1989 paper that the bilingual is not two monolinguals in one person. Current work on the cognition of bilingualism shows the extent to which this statement is true, as mental differences that relate to being bilingual or monolingual are discovered. Some of these differences involve cognitive abilities that lie outside of the linguistic systems, such as the capacity to ignore irrelevant information when changing tasks, or a certain degree of resilience towards symptoms of neurodegeneration. Other differences between monolinguals and bilinguals involve the interplay of the two linguistic systems they use: we now know that bilinguals simultaneously activate both languages, and must select or inhibit one at a time; we also know that the cost involved in having two lexicons instead of one are experimentally detectable. The developmental patterns of preverbal bilingual babies —who can very early on detect that more than one language is spoken in their environment— are also different from those of monolingual ones. Ultimately, the main differences between monolingual and bilingual minds eventually emanate from the intensive cognitive training undergone by bilinguals in their lifetimes, given the frequency and speed at which they switch from one language to another.

From a more narrowly linguistic point of view, people with more than one language in their brains provide crucial evidence regarding the neurocognitive nature of the human language faculty. Thus, for instance, aspects of grammar are sensitive to *when* in life they are acquired, and also to *what* was known before, so that native speakers and non-native speakers do not process certain aspects of the same grammar in the same way, even at high levels of language proficiency and given frequent use of the language. In contrast, vocabulary appears insensitive to when it is learned and what the words of a previously acquired language look like: given high proficiency in the language, non-native speakers are native-like with respect to vocabulary processing.

Broadly speaking, neurocognitive studies of language and bilingualism reveal that the patterns of activation related to language processing are consistent across languages and native speakers; research shows that the processing of different languages occurs in much of the same brain tissue (Kim et al. 1997, Perani et al. 1998), and in recent work we have also found that the processing of Basque by native speakers generates electrophysiological signals that are equivalent to those generated by the processing of other languages (Díaz, Sebastián-Gallés, Erdocia, Mueller and Laka 2011). When differences between languages are found, they obtain in bilinguals and they correlate with differences in proficiency levels attained in each language, and differences in age of acquisition for each language. This strongly suggests that age of acquisition and language proficiency are determinant factors in the neural underpinnings of language and bilingualism, so that early and proficient bilinguals do not “separate” languages in the brain, but as age of acquisition of the non-native language increases and proficiency decreases, the non-native language tends to be located in more extended and individually variable areas.

Given these findings, the factors that have received most research attention in neurobilingualism are the impact of language proficiency and of the age at which a language is acquired. The impact of the degree of similarity of the grammars located in one brain is a far less explored issue, as are the differences among different types of grammatical phenomena. As our knowledge advances, language diversity emerges as a likely relevant factor to be kept into account, and as the volume and level of detail of the studies carried out increases, it also becomes increasingly clear that, although all these factors have often been studied separately, there are strong connections between them: proficiency in the language, age of acquisition, and grammatical similarity are likely to be intertwined rather than separate factors. These are the topics that our research focuses on, as we strive to contribute to the general knowledge on bilingualism by exploring in detail Basque-Spanish bilinguals from our community.

2. Activation and control of the two languages in the bilingual brain.

The brain activates all the languages it knows when it has to use language. In particular, bilinguals activate both of their languages when they have to use one (Desmet and Duyck 2007). The simple hypothesis that bilinguals have two separate lexicons, one for each language, so that when they use one language, only its lexicon is activated has been shown wrong by many studies: both lexicons are active whenever the bilingual speaks, either in one or the other language. In a pioneering study, Van Heuven, Dijkstra and Grainger (1998) found that the lexical items from a bilingual’s native language are active while the bilingual is engaged in recognizing words from a non-native language. Further studies have shown that this activation of the lexical items irrespective of the language for different types of bilinguals and language-pairs. Further evidence that the native language is activated when using the non-native one had been uncovered by a large number

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of studies (among them Costa, Caramazza and Sebastián-Gallés 2000, Colomé 2001, Duyck 2005, Duyck et al., 2004, Schwartz et al. 2007), by means of many different phenomena. It has also been repeatedly shown that the non-native language is active when the native one is used (see for instance Duyck 2005, and Van Hell and Dijkstra 2002, among others). Similar results have been obtained in studies where participants, instead of reading, heard the words they had to recognize (for instance Marian, Blumenfeld and Boukrina 2008; Marian, Spivey and Hirsch 2003), and in studies where participants had to actually say the words (Costa, Santesteban and Caño 2005; Kroll, Bobb and Wodniecka 2006, Costa, Albareda and Santesteban, 2008, Santesteban and Costa 2006).

The most important evidence supporting the parallel activation assumption comes from the so called "cognate facilitation effects" reported in both comprehension and production modalities. Cognates are those words that are formally (orthographically and phonologically) similar across languages (e.g., the words *botella* and *botila* are cognate words of Spanish and Basque, respectively). In studies of lexical access during comprehension and production, cognate words have been reported to be faster to learn and more resistant to forgetting (e.g., De Groot and Keijzer 2000), less likely to fall in tip of the tongue states (Gollan and Acenas 2004), faster to produce (Costa, Caramazza and Sebastián-Gallés 2000), and more sensitive to cross-linguistic priming (Van Hell and De Groot 1998).

According to some researchers, the cognate effect arises because the retrieval of the phonemes belonging to cognate words is facilitated by the concurrent activation of the corresponding translations (Costa et al. 2000, 2005). For instance, in production, the phonological content of a cognate word would receive activation from its corresponding lexical representation and, given the phonological overlap, also from that of its translation. In contrast, the phonological representation of a non-cognate word would receive activation only from the corresponding lexical representation. In other words, when a Spanish-Basque bilingual aims to produce a cognate word like *botila*, the parallel activation of its Spanish translation *botella* would facilitate the retrieval of the phonemes shared by both words, because these phonemes will receive activation from both the target word and its cognate. In contrast, when the word to be produced is a non-cognate like *labana* ("knife", in Basque), its Spanish translation *cuchillo* would also be activated, but will not be able to facilitate the retrieval of the phonemes of the target word *labana*. This is because the target word and its translation do not share any phoneme, so that the retrieval of the phonemes of the target word *labana* will not receive extra activation from its translation word *cuchillo*. (Costa et al. 2000, 2005; Gollan and Acenas 2004).

This discovery naturally leads us to the question of how bilinguals manage to produce the words of the target language and prevent words from the non-target language from being uttered. If all the languages of the bilingual are active when language is processed, then there must be some further cognitive operation that controls what language is used at a time.

Proposals as to how bilinguals control their languages in order to produce the one they want to use generally agree that bilingual lexical access must involve some kind of attentional control mechanism (Costa 2005, Costa, Miozzo and Caramazza. 1999, Finkbeiner, Gollan and Caramazza 2006, Green 1998, Kroll et al. 2006, La Heij 2005). Some researchers argue that, in order to avoid competition between the simultaneously activated lexical items of the target and non-target languages, language control in bilinguals entails the active inhibition of the linguistic representations of the non-target language (this is known as the Inhibitory Control model proposed by David Green, 1998). However, other researchers argue that bilingual speakers do not need to actively inhibit the linguistic representations of the non-target language. Instead, Costa and collaborators (1999) suggest that the lexical nodes of the non-target language are activated but do not act as competitors during lexical access. In other words, according with the so-called Language Specific Selection model, the bilinguals' language control mechanism allows them to ignore the activation of the non-target languages' lexical items not considering them for selection.

The most important evidence in favor of the Language Specific Selection model and the absence of cross-linguistic competition during bilingual lexical access comes from the picture-word interference paradigm. In this paradigm, participants are asked to name pictures while ignoring printed words. Here, it has been

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repeatedly showed that speakers need more time to name a picture (e.g., of a table) presented with a semantically related distractor word as *chair* than a semantically unrelated word such as *dog*. This "semantic interference effect" has been taken as evidence for the existence of lexical competition during lexical access in monolinguals. Hence, Costa and colleagues (1999) suggested that, if a semantically related word in the target language interferes on the lexical access process, the target's translation would be the strongest possible distractor. However, highly proficient Catalan-Spanish bilingual speakers showed to be faster to name a picture of a table (*taula*, in Catalan) when the printed distractor word was its Spanish translation *mesa* than an unrelated word like *perro* (dog, in Spanish). Hence, Costa et al. (1999) interpreted these "translation facilitation effects" as evidence of the absence of competition of the non-target language during bilingual lexical access.

The most revealing evidence for inhibitory mechanisms in bilinguals has been provided by Meuter and Allport (1999) in an experiment on language-switching, where participants are asked to name a picture in one language or another, depending on the colour of the picture. In their experiment, Meuter and Allport (1999) asked low proficient bilinguals to name digits in their L1 (French, Spanish, German, Italian and Portuguese), and in their L2 (English) in switch and non-switch trials. This study showed that low-proficient bilinguals take longer to switch from their less dominant non-native language to their native one than the other way around. This effect has been named the "*asymmetrical switching cost*"; at first sight this result may appear counterintuitive, because it entails that it is "harder" to change from the language you know worse to the language you know better than it is to change from the language you know better to the language you know worse. However, this is the pattern of results predicted by the Inhibitory Control model. This is because, Green (1998) suggested that the amount of inhibition applied to one language depends on the proficiency level with which that language is spoken: the more proficient in a language, the more inhibition has to be applied over it in order to favor the other language. Moreover the more inhibition applied to a given lexicon, the longer and the harder it will take to overcome it on a subsequent trial. Hence, when low proficient bilinguals have to speak in the weaker, non-native language, the native language is activated, and therefore it has to be very strongly inhibited. As a consequence of the strong inhibition applied to it, if later these low proficient bilinguals want to speak in the dominant native language, they need to undo the strong inhibition applied to words form their native language. In contrast to this, changing from the strong native language to the weaker non-native language does not require undoing such a strong inhibition, since the words of the weaker language need not be strongly inhibited.

In Costa and Santesteban (2004) we further tested the language switching performance of low- and high-proficient bilingual speakers, and suggested that bilingual speakers might make use of both language selection mechanisms. More specifically, we replicated the asymmetrical language switching cost patterns in a group of low proficient Spanish-Catalan bilinguals (with larger costs to switch from L2 to L1 than vice versa). Additionally, as it would be predicted by the Inhibitory Control model, high proficient Spanish-Catalan bilinguals showed a symmetrical language switching cost pattern while switching between their two strong languages. However, in contrast with the predictions of the Inhibitory Control model, these high proficient bilinguals *also* showed a symmetrical language switching pattern while switching between their strong L1-Spanish or L2-Catalan and their weak L3-English (Costa & Santesteban 2004; Costa, Santesteban and Ivanova 2006). Based on these results, we suggested that, although low proficient bilingual speakers rely on inhibitory processes to select words in the intended language, a shift from inhibitory to Language Specific Selection mechanisms occurs in the case of high proficient bilinguals. Additionally, in Costa, Santesteban and Ivanova (2006) we showed that a symmetrical language switching costs obtains for a group of high-proficient Spanish-English translators that acquired their L2 at a late age (after 10), and by a group of high-proficient Spanish-Basque bilinguals who acquired Basque at an early age, suggesting that neither L2 age of acquisition (AoA) or linguistic distance (that is, how different the two languages of the bilingual are) play a role on the shift from inhibitory to Language Specific Selection mechanisms.

So, while the switching performance of low-proficient bilinguals leads to an asymmetrical pattern, depending on language dominance, in proficient bilinguals it

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yields a symmetric pattern, which does not only apply to the dominant languages, but also to non-dominant, later learned languages.

3. Why study Basque-Spanish bilingual syntactic processing?

In the last decades, a rapidly growing body of studies using experimental methods and neuroimaging techniques has explored syntactic processing, and as a result, findings from linguistics and the neurosciences are progressively reaching increasing levels of convergence and reciprocal relevance (Moro 2008, Pullvermüller 2002). However, the vast majority of language processing and neuroimaging studies focus on rather similar languages (English, Spanish, Italian, French, German, or Dutch, for instance). With the exception of a few recently emerging studies on Japanese, Chinese and Korean, the languages most intensively studied share many central design properties.

In Linguistic Theory, a significant expansion of the language pool investigated, and systematic cross-linguistic inquiry was crucial to uncover the interplay between universal and variable aspects of the language faculty (Greenberg 1963, Chomsky 1981). Research on language representation and processing in the brain must similarly also engage in cross-linguistic studies, so that we can differentiate language-particular effects from universal, invariant properties of language processing by the brain, and thus properly understand the interplay between the two. In order to achieve this goal, it is necessary to conduct studies and gather evidence from a wide array of languages pertaining to different typological groups, and it is particularly relevant to study bilinguals whose languages have opposite parametric specifications, that is, bilinguals who speak typologically very different grammars, like Basque-Spanish bilinguals do.

One main goal of our research strategy is to contribute to uncover the impact of variable versus universal design properties of language in its representation and processing by the brain. In particular, we seek to understand whether (and how) different typological/parametric properties of language impact on the neural representation of a speaker’s knowledge of language; that is, how opposite grammatical properties are represented and put to use in the bilingual mind. To

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address this central research question, we selectively target instances where grammatical specifications are opposed in value for the two languages of the bilingual population we study (Spanish/Basque), and compare them to instances where the specifications of the two grammars converge.

Here, we will review a series of experiments we have designed and conducted targeting three central domains of linguistic variation across languages: Word order (The Head-Parameter: Head-final/Head-initial languages), Argument Marking system (Ergativity versus Accusativity), and Verb Agreement types (subject agreement versus object agreement). These three domains have either hardly been studied from a neurocognitive perspective, or in some cases have never been considered at all before. In this manner, we are in a position to inquire into phenomena that have not been previously tackled, working at the frontiers of our knowledge.

There are 6.912 languages in the world today (Ethnologue's last count, www.ethnologue.com), showing both great diversity and significant similarities. After the second half of the XXth century, with the birth of generative grammar and the cognitive sciences, significant advances were made regarding the invariant, universal design aspects of human language. But language variability is still not sufficiently well understood from a theoretical (i.e. explicative) perspective, despite the wealth of valuable descriptions of linguistic types provided by modern linguistic typology (Newmeyer 2005). The *Principles and Parameters* Model (henceforth P&P, Chomsky 1981) constitutes a promising attempt to provide a principled account for the interplay and nature of the variant and invariant aspects of grammar (Baker 2001, 2003). Though there are still deep gaps in our understanding, and despite the fact that the model has been challenged and is far from verified, P&P still provides the only testable model for language variation (Yang 2003, Moro 2008). This makes parametric theory a particularly suitable model for experimental research; the model can thus serve as empirical test for neurocognitive models of language (Friederici2002, Bornkessel and Schlesewsky 2006, among others). For instance, the declarative/procedural (DP) model (Ullman 2001, 2004), claims that the computational component (grammar) belongs to the procedural system. Since the DP model argues that procedural cognitive processes have limited neuronal plasticity, it predicts that syntactic parameters in particular should show age-related effects.

Ever since Lenneberg (1967) suggested that there is a critical period for language acquisition, the impact of age of early linguistic experience for adult neural representation and processing has been a much debated issue, particularly regarding bilingualism. Whether adult knowledge of a non-native language is represented and processed as the native language has been intensely debated for almost two decades (White 2003), and we hope that our research will be able to contribute significantly to understanding this issue, both given the type of bilingualism we can study in the Basque Country, and also given the type of experimental techniques we employ, which, as we will see, can give us very fine-grained measures that are not otherwise detectable, regarding neural processing of language.

In our research, one aspect we explore is precisely the representation and processing of the syntactic component in adult Basque-Spanish bilinguals. In the last years we have undertaken a systematic study of adult Spanish/Basque bilinguals, exploiting the fact that Spanish and Basque have opposite values for several parameters (see Bosque & Demonte 1999 for a thorough description of Spanish grammar, and Hualde & Ortiz de Urbina 2003, de Rijk 2008 for a description of Basque). We investigate whether the specific grammatical phenomena targeted in our experimental work give rise to differences in the neural representation and processing of bilinguals of various types. Since nothing is known about how Basque grammar is processed in the brain, we first determine how the phenomena under study are processed by natives of Basque (and also Spanish, in the cases where there are no previous studies on the particular topic we tackle), and once we obtain those results from native speakers, we explore how non-native speakers who learned Basque at different ages represent and process these same phenomena. In order to proceed systematically, we start by studying non-natives with high proficiency levels and early ages of acquisition of Basque. Basque-Spanish and Spanish-Basque bilinguals are particularly suited to contribute to our understanding of bilingual language processing, because bilingualism is pervasive in all realms of Basque society and because the two languages have the same or opposite values for different syntactic properties.

	Verb agreement		**Argument alignment**		**Word Order**	
	Yes	*No*	*Nominative*	*Ergative*	*Initial*	*Final*
Spanish	+	-	+	-	+	-
Basque	+	-	-	+	-	+

Table1. Parametric settings of Basque and Spanish. “Plus” values represent a positive value of that choice in the linguistic parameter and “minus” values a negative value.

4. The impact of age and proficiency in the bilingual brain.

Studies on bilingual language processing currently provide a somewhat confusing picture: while some studies report that if a second language is not acquired early, it is not processed native-like, other studies report that age does not have an effect in bilingualism, so that proficient bilinguals are like natives regarding language processing.

Regarding the first group of results, we should refer to the pioneering work of Weber-Fox and Neville (1996): these researchers used Event-Related Potentials' technique to test various groups of Chinese speakers who had acquired English at different ages. Regarding syntax, participants who were exposed to English after the age of 11 showed a different processing pattern (different electrophysiological activity of the brain) from that found in native speakers. However, vocabulary-related phenomena elicited the same brain signature in all participants, natives and non-natives of various ages of arrival into the US. The study concluded that syntax shows maturational effects related to the age of language learning, whereas vocabulary-related tasks do not. A significant impact of early exposure to the language is also reported by Hahne and Friederici (2001) for native Japanese who learned German at a mean age of 27 years. Their brain signatures did not look like the native speakers' when they were processing German grammar, but they did when they were engaged in vocabulary-related tasks. Subsequently, many studies have reported similar findings (Hahne 2001, Chen et al. 2007, among others). All these studies conclude that certain aspects of syntax are sensitive to early experience.

Regarding the second group of results, there is also wide sample of studies that find that very proficient nonnative speakers show the same electrophysiological brain signatures as native speakers, independently of the age at which they learned their second language. For example, Friederici, Steinhauer and Pfeifer (2002) showed that native German speakers of a mean age of 24 years, who were taught an artificial language named BROCANTO, displayed the same brain signatures elicited by their native language when they processed the newly learned one. Rossi and colleagues (2006) investigated Italian speakers who had learned German at around 18 years of age and had either high or low proficiency in German. High-proficient speakers responded similarly to natives, but low proficient speakers did not. Kotz and collaborators (2008) similarly report that Spanish natives who are high-proficient speakers of English (learned at about 5 years of age) process English sentences like natives. These results strongly suggest that high proficiency leads to equivalent neurophysiological activity in syntactic processing despite a delay in exposure to the non-native language.

How can these apparently contradictory results be reconciled? Our hypothesis is that high proficiency allows for native-like processing only when there are no new parametric values involved in the acquisition of the non-native language. A detailed and linguistically informed review of reported age-induced differences reveals that they always involve a grammatical feature in the non-native language that is not present in the native one (for a detailed discussion of the literature in this respect see Zawiszewski, Gutierrez, Fernández, and Laka 2011). We hypothesize that when the native language lacks a specific syntactic trait, nonnatives do not become native-like even if they achieve high proficiency. Thus, if we review the studies that have investigated the impact of age and proficiency in language processing under the light of the P&P model, we observe that early exposure effects are found only when the first and second language had opposite parametric values, and we also find that proficiency results in native like processing when the two languages share the same value for that specific parameter.

5. How do Spanish-Basque bilinguals process two very different grammars?

There are fewer studies on syntactic processing in non-monolinguals in comparison to studies on lexical processing, but in the last years this area of research has experienced enormous growth. While evidence on nonnative syntactic processing is still sparse, "even so existing data clearly indicate that syntax is a phenomenon that deserves full consideration" (Kotz 2009).

If the studies that have examined the role of age versus proficiency in language processing are reviewed focusing on the syntactic phenomena they explored, it can be observed that differences in processing attributed to age of acquisition (AoA) tend to be found when the native grammar of the participant diverges significantly regarding the phenomenon tested in the non-native grammar, and high proficiency tends to yield native-like processing when the syntactic phenomenon tested in L2 has an equivalent correlate in the L1 of the participants.

If we consider Weber-Fox and Neville (1996), Mueller et al. (2005) and Ojima, Nakata and Kakigi (2005), Chen et al. (2007), we observe that age effects obtained whenever very proficient non-natives were processing a syntactic phenomenon that had no equivalent correlate in their native language: in the case of Weber-Fox and Neville (1996), they obtained when testing native Chinese speakers processing subjacency effects in English Wh-questions; Chinese lacks overt Wh-movement (it is a Wh in-situ grammar), while English is an overt Wh-movement language, so that the syntactic phenomenon tested involved a parametric property absent in the native language of the participants (see Cheng 1997); in Mueller et al. (2005), the phenomenon tested was classifier morphology, which German lacks completely. In Ojima et al. (2005) and Chen et al. (2007), the phenomenon tested was verb agreement, in natives of grammars that lack verb-agreement relations.

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Under this light, the results from ERP studies suggest that it is diverging grammatical phenomena that might be sensitive to age of exposure, rather than superficial morphosyntactic differences. Both age and proficiency have been hypothesized and scrutinized as relevant factors conditioning L2 processing, but perhaps less attention has been paid so far to the issue of what syntactic phenomena are tested, and why. In linguistics, one view of cross-linguistic variation holds that specific grammars result from combinations of a set of linguistic parameters. Thus, syntactic variation would result from differences in the values of this combination of parameters (Chomsky, 1981, see Baker 2001, 2003 for overviews), and the acquisition of syntax would consist in determining the values of these syntactic parameters for the input language.

We have thus investigated to what extent the linguistic distance between L1 and L2 can influence non-native language processing, and in order to do it, we have tested Basque native speakers and very proficient L2 Basque speakers whose native language is Spanish. We have particularly focused on three conditions that involve syntactic parameters: (i) sentence word order (the head parameter), (ii) case morphology, and (iii) verb agreement.

(i) Basque and Spanish diverge with respect to the value assigned to the head parameter. Whereas Spanish is head-initial, so that heads of phrases precede their complements, Basque is head-final: heads of phrases follow their complements, as in Turkish or Japanese:

(1)	Basque	Spanish
	a. [$_{PP}$ [$_{DP}$ [$_{NP}$ liburu] a] rekin] book-the-with	b. [$_{PP}$ con [$_{DP}$ el [$_{NP}$ libro]] with the book
	c. [$_{VP}$ [$_{DP}$ [$_{NP}$ liburu] a] irakurri] book-the read	d. [$_{VP}$ leer [$_{DP}$ el [$_{NP}$ libro]] read the book

(ii) These two languages also diverge with respect to argument alignment: Spanish is a nominative-accusative language, like English, while Basque is an ergative-absolutive language. Thus, in Basque, intransitive subjects (2a) look like transitive objects (2b) while transitive subjects have a different case-marker and agreement

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morphology (2b). In Spanish, subjects have the same form and agreement regardless of whether they are transitive or intransitive, and objects are different (2c,d):

(2) a. gizon-a etorri da
man-the arrived is
"the man arrived"
b. emakume-a-k gizon-a ikusi du
woman-the-erg man-the seen it-has-her
"the woman has seen the man"
c. el hombre ha venido
the man has arrived
"The man has arrived"
d. la mujer ha visto al hombre
the woman has seen acc-the man
"the woman has seen the man"

In fact, the very characterization of notions like "subject" and "object" is built upon nominative-accusative grammars, as the description of ergativity above in terms of "subject/object" makes apparent. There is no morphologically consistent class of "subjects" in ergative languages, at least not one that matches that class in nominative languages.

The head parameter and the nominative/ergative alignment are two fundamental syntactic parameters where Spanish and Basque diverge. However, Spanish and Basque converge in having (iii) verb agreement. Both languages have subject agreement, and Basque also has object agreement, as shown in (2b and 3).

(3) zu-k ni ikusi na-u-zu
you-erg me seen me-root-you
'you have seen me'

To our knowledge, the impact of argument-alignment on L2 processing has not been systematically investigated so far. Previous ERP studies on case morphology, all of them carried out on nominative-accusative languages showed that case violations elicit a centro-parietal positivity (P600) in 500-800 ms time window, usually preceded either by a Left Anterior Negativity (LAN) or by an N400 component in 300-500 ms time window. Basque provides us with the opportunity to test whether these effects hold also in ergative case-systems; some previous results reported by Díaz et al. (2011) suggest that the electrophysiological signatures elicited by ergative case violations do not differ from those found in nominative languages, eliciting a comparable P600 component.

Regarding verb-agreement, non-natives performed the behavioural task with similar accuracy levels and displayed an equivalent biphasic N400-P600 pattern as response to the ungrammatical stimuli as natives had in previous experiments (Zawiszewski and Friederici, 2009; Díaz et al., 2011). Regarding ergative case morphology, specific to Basque adn absent in Spanish, behavioural and ERP measures revealed significant differences between native and non-native speakers. In the grammaticality judgment task performed along with the ERP session, non-natives made significantly more errors than natives, despite their overall high language proficiency and early AoA. As for the ERP results, ungrammaticality elicited a broad negativity in both groups, but only the native group showed a P600 effect between 600-800 ms at the critical word position. In Zawiszewski et al. (2011) we offered two possible interpretations of these results: (i) the lack of P600 in the non-natives could reflect transfer from their native grammar (Spanish) so that participants interpreted the absolutive case as an equivalent of Spanish nominative case, and as a consequence did not process the sentence as containing a grammatical violation; (ii) non-native speakers could have neglected case information and relied on other extragrammatical factors such as animacy to infer the thematic role of the ungrammatical noun phrase.

Regarding the third syntactic property, the head-directionality parameter that governs the order of words in phrases, Spanish and Basque differ fundamentally, along the same dimension as English and Japanese: Spanish and English are head-initial languages, while Japanese and Basque are head-final languages. We have found a different brain signature (by means of ERP signal) for native and non-native speakers who had an early AoA (3 years) and high levels of language proficiency. Earlier, Erdocia, Laka, Mestres-Missé, Rodriguez-Fornells (2009) demonstrated that processing canonical SOV word order is faster and easier than processing the non-canonical OSV word order for native speakers, and regarding brain electrophysiology, OSV sentences showed increasing negativities at both subject and object positions and a P600 effect at verb position. These results signal that OSV sentences are costlier to process than canonical SOV for native speakers of Basque. Early and proficient Spanish-Basque bilinguals also employ more processing effort to process OSV sentences as compared to SOV ones. Spanish-Basque bilinguals performed indistinguishably from natives in the behavioural experiment, but ERP signatures departed from those observed in natives, suggesting on the one hand that behavioural measures are not accurate enough to detect this type of subtle differences in neural language processing that ERPs can detect, and on the other hand that natives and non-natives employ different neural resources to process sentence word order in Basque.

6. Conclusion.

All together, our findings indicate that divergent parameters have a significant impact in non-native syntactic processing even at high proficiency and low AoA. Natives and non-natives behave alike in tasks that involve equivalent linguistic phenomena for Basque and Spanish (verb agreement condition and semantic condition), but differ in tasks that involve diverging syntactic parameters (the head parameter and argument alignment (nominative/ergative)). The results indicate that, in particular, not all linguistic differences have the same impact in non-native language processing, and they suggest that divergent parameters have a deeper impact in non-native syntactic processing than other seemingly variable but superficially different aspects of language variability.

Our data lend support to the hypothesis that linguistic distance is one fundamental source behind native/non-native contrasts in the neural syntactic computation of proficient bilinguals. We have obtained indicating that linguistic properties that systematically diverge between the native and the non-native language of the bilingual yield a distinct processing signature different from that of natives, even in the case of early and very proficient bilinguals. Whether this distinct signature is due to an effect of transferring the parametric setting from the native language onto the non-native one (transfer), or whether it is due to a difficulty for setting two opposite values for one linguistic parameter in the bilingual, and the extent to which these two possibilities are mutually exclusive or necessarily concurrent cannot be determined given the available evidence, and future work is required to furter unravel the ultimate nature of the language-distance effect.

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