# FINAL PUBLISHABLE SUMMARY REPORT

Reading requires knowledge of at least two types of codes: orthographic (knowledge about letter identities and letter position) and semantic (knowledge about the meaning of words). Orthographic and semantic codes continuously interact, and are mediated by lexical (i.e., whole-word) representations. Thus, perception and recognition are influenced by both bottom-up and top-down knowledge. This type of interactive activation provides a mechanism by which the brain can map orthographic codes onto semantic codes. However, there are still several open questions concerning this interactivity, which is highly related to word properties. In fact, very few studies have directly focused on how lexical and semantic information is stored in the brain. More importantly, this lack of evidence is even more marked regarding bilingual readers. Contrary to monolinguals for who one specific orthographic form is mapped onto one specific semantic representation, bilinguals have two different orthographic codes that can be mapped onto a single semantic representation. **Although previous studies have contributed a great deal to the understanding of bilingual word recognition, a fundamental debate continues in various aspects such as whether the lexical and semantic representations are shared or distinct, or whether the language context can influence the activation of the word identification system. More specifically, the central question of the project was whether or not automatic activation of cross-language lexical representations (i.e., in L2) produces a similar effect as within-language representations (i.e., in L1) when bilinguals are presented with letter strings stimuli in a language-specific context**. This project took place in the Basque Country, in which a large portion of the population deals with two languages (Spanish and Basque) in their daily life and so this environment offered unique possibilities for studying language processing in bilingual population. In fact, some learned both languages in childhood in their families (balanced bilinguals), while others have learned their second language in primary (unbalanced bilinguals).

The similarities and differences between bilinguals' activation of within-and between-language lexico-semantic representations were investigated in a monolingual task context. Balanced bilinguals (Part 1 of the project) and unbalanced bilinguals (Part 2 of the project) completed a picture-word matching task while EEG was recorded. The ERP technique combined with classical behavioral measures provides new insights into the time-course of bilingual word processing. Its application contributes to the knowledge of components involved in visual word recognition, such as the N400, a component that has been hypothesized to reflect the mapping of lexical form onto meaning. **More specifically, the experiments aimed at a deeper investigation bilingual word recognition by providing new insights into the time-course of bilingual word processing in a given language context while manipulating the orthographic similarities of the stimuli within- and between-language.**

Balanced and unbalanced bilinguals were presented with pairs of pictures and letter strings, and they were asked to decide whether the letter string corresponded to the name of the preceding picture. The critical stimuli were pseudowords (e.g., orthographically regular and pronounceable nonwords) derived from a set of Spanish and Basque words that could be either related or unrelated to a set of pictures (e.g., the picture of a dog and the Spanish-like pseudoword "purro", derived from "perro" [dog] or the Basque-like pseudoword "txekur" for the Basque word "txakur" [dog]). In order to set up the language context of the experiments, pairs of fillers were added and could be (1) picture-word pairs in which the word was always unrelated to the previous picture (i.e., filler items) and (2) picture-word pairs in which the word was the name of the previous picture (i.e., "same" items). Critically, the language of the words in those conditions could be either all in Spanish or all in Basque determining the language context for the whole experimental session. That is, each participant came twice to perform the experiment once in the Spanish context and once in the Basque context.
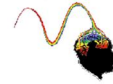
Firstly, regarding the balanced bilingual group, behavioral results showed that decisions for related pseudowords were slower and less accurate compared to unrelated pseudowords. Critically, the relatedness effect was larger in the target language context. At an electrophysiological level, the relatedness effect started to emerge earlier for within-language pseudowords than for between-language pseudowords. In the N400 time-window, a generalized effect of relatedness was found, with an even larger effect for within-language pseudowords. Secondly, regarding the unbalanced bilingual group, the overall results replicated the results observed with balanced bilinguals. More critical is that the language context did modulate relatedness effects only when the target language was the dominant language of the participants. When participants were emerged in a language context that was their dominant language, the N400 component was larger for within-language pseudowords than for between-language pseudowords. In contrast, when the language context was the non-dominant language of the participants, similar relatedness effects were found for both types of pseudowords.

Altogether, these patterns of results demonstrated that even in a monolingual context, pseudowords that derived from words in both languages can still activate some lexico-semantic representations. Thus, bilinguals activate words in both languages in a nonselective manner. Critically, even though a main effect of Relatedness was found on the N400 component, the effect was larger in the target language context relative to the non-target language context. To our knowledge, this is the first direct demonstration of different effects of relatedness between within- and between-language. This project revealed that language context plays a major role during word processing for balanced and unbalanced bilinguals. The target language is more strongly activated in a monolingual context even for very highly proficient bilinguals. A second major finding is that, when looking at language dominance, the language context modulates relatedness effects only when the target language is the dominant language of the participants. Thus, the language context is a strong attractor for lexico-semantic activation only when the context is the dominant language.

In conclusion, these results of the project highlighted that (1) bilinguals activate words in both languages in a nonselective manner, (2) the language context modulates the strength of the effects in bilingual lexical access and (3) the language dominance of the participants modulate the lexico-semantic activation. Examining the bilinguals' brains had provided critical information about interconnectivities between lexical and semantic levels. Indeed, taking into consideration word properties (such as orthographic neighbors) that tap into the lexical level, has revealed some connectivity between lexical and semantic representations that was not limited to the target-language. At a more general level, research of bilingual word recognition so far has largely focused either on one-language access, or on semantic memory. Lexical and semantic interactivity has been largely ignored. This project was able to fill this gap regarding how connections between lexical representations and concepts are implemented in the brain. The results of the project also revealed how the language context influence processing in word recognition across balanced and unbalanced bilinguals. The comparison between these two groups of bilinguals has provided more details regarding the degree of overlap between semantic representations in two different languages and so provided new evidence regarding the relation between this high interconnectivity at the semantic level and the degree of proficiency in a second language.