An electrophysiological study on the time course of bilingual word recognition

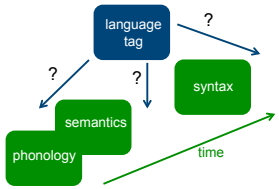
Loretta Yiu, Kriya Krisnabai-Gitanjali, Michael Pitts, & Enriqueta Canseco-Gonzalez

Department of Psychology, Reed College

Introduction

▪ Previous studies have suggested a mixed model of serial and parallel processing during monolingual language comprehension[1,2], with phonological information accessed first, followed by semantic and then syntactic information.

▪ Models of bilingual word recognition propose an additional step: language tags, which identify the specific language a word is in and allow bilinguals to monitor the appropriate language to use at a given time.[3]



What does the bilingual brain access first: the language of a word or its meaning?

Methods

Participants

▪ 20 Spanish-English bilinguals

▪ 9 females, mean age = 22.6, range = 18-29

	Spanish	English
Mean age of acquisition:	3.95 (SD=7.15)	3.65 (SD=2.53)
Level of proficiency[a] (out of 10):		
Speaking	8.00 (SD=1.21)	9.05 (SD=1.09)
Understanding	8.65 (SD=0.98)	9.25 (SD=0.97)
Reading	7.5 (SD=1.47)	9.10 (SD=1.02)

[a]Language proficiency scores based on self-report on the Language Experience and Proficiency Questionnaire (LEAP-Q).

Stimuli

160 words total:

- 40 Spanish objects
- 40 Spanish animals
- 40 English objects
- 40 English animals

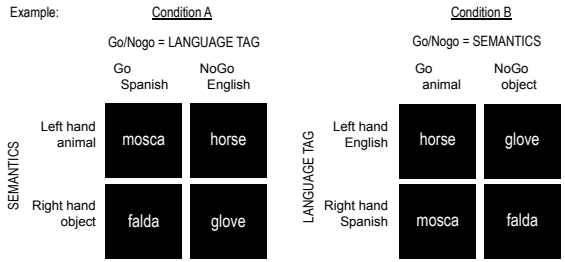
Design

▪ Dual-choice go/nogo task based on semantic (object/animal) and language tag (Spanish/English) information:

  ▪ one determined which hand to use to respond (left or right)

  ▪ one determined whether to respond or not (go or nogo)

▪ Each participant was tested in the following two (counterbalanced) conditions:



** Left hand/right hand, go/nogo responses counterbalanced across participants
** Words presented individually in random order for 1500 ms with random ISI between 1300-1700 ms

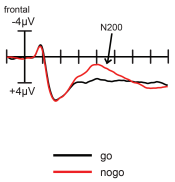
Results

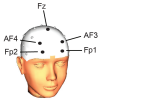
Event-related potentials (ERPs) were time-locked to word onset.

N200: negativity over frontal sites reflecting neural activity involved in response inhibition, isolated by subtracting Go ERPs from Nogo ERPs (difference waves)

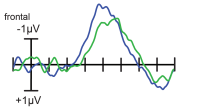
EEG Results

Go/Nogo = Language Tag

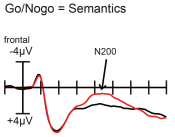




Differences Waves (nogo minus go)

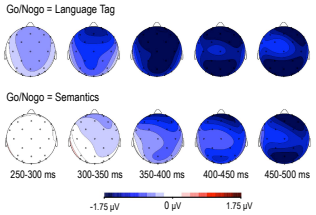


Go/Nogo = Semantics



**ERPs and difference waves displayed as an average of five frontal electrodes

N200 Scalp Distributions

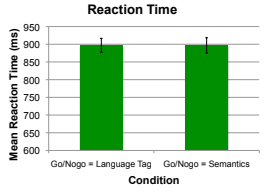


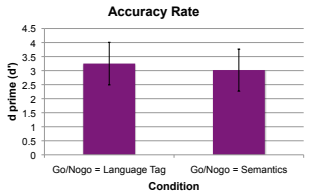
Results Summary

▪ The N200 effect started earlier for the language tag condition (~292 ms) compared to the semantics condition (~326 ms), $p = 0.01$.

▪ Mean reaction times did not differ between the two conditions but accuracy was slightly better for the go/nogo = language tag condition, $p < 0.05$.

Behavioral Results



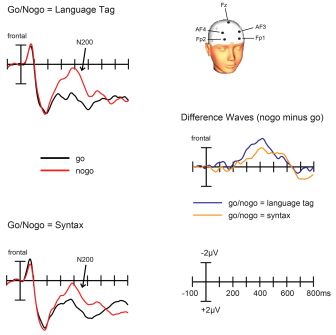


Experiment 2 (preliminary)

• What does the bilingual brain access first: the language of a word or its syntactic category?

• N = 20 Spanish-English bilinguals (11 females, mean age: 20.5, range: 18-25)

• Mean onset latency of the N200 effect was 27 ms earlier for the language tag than the syntax condition.



General Conclusions

▪ The mean onset latency of the N200 effect suggests that language tag information is available earlier than semantic information during reading comprehension.

▪ Preliminary findings also suggest that access to language tag information precedes access to syntactic information.

▪ In short, when bilinguals are forced to access one or another type of information during word recognition, they access the language membership of a word before its meaning or its syntactic category. Future studies should investigate whether this temporal ordering holds when the word is embedded in a sentence.

Acknowledgements

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Selected References

[1] Muller, S., & Hagoort, P. (2006). Access to lexical information in language comprehension: Semantics before syntax. *Journal of Cognitive Neuroscience, 18,* 84-96.

[2] Rodriguez-Fornells, A., Schmitt, B.M., Kutas, M., & Munte, T.F. (2002). Electrophysiological estimates of the time course of semantic and phonological encoding during listening and naming. *Neuropsychologia, 40,* 778-787.

[3] Dijkstra, T., & van Heuven, W.J.B. (2002). The architecture of the bilingual word recognition system: From identification to decision. *Bilingualism: Language and Cognition, 5,* 175-197.