Emergent and Early Bilinguals: The role of cognitive control in the processing of structural ambiguity

Language processing requires frequent reinterpretations of structures that are temporarily ambiguous, until more input is received that helps the parser reach the correct interpretation (cf. Frazier & Fodor, 1978; Frazier & Clifton, 1998; MacDonald Pearlmutter, Seidenburg, 1994; Tanenhaus, Spivey-Knowlton, Eberhard & Sedivy, 1995). This informational conflict triggers cognitive control (or inhibitory control), which has been shown to be a major player in disambiguation (Botvinick, Braver, Barch, Carter & Cohen, 2001; January, Trueswell & Thompson-Schill, 2009).

Cognitive control is also a variable of considerable interest during the acquisition of a second (L2) and third language (L3). For example, it has been shown that the prefrontal brain region associated with cognitive control plays a major role during the processing of a non-native, non-highly proficient language, a role which is less significant during proficient or native processing (Abutalebi, 2008). However, further research is needed to better understand the role that cognitive control plays in non-native language processing and, in particular, in processing ambiguous language.

To that end, the current dissertation includes three studies aiming to investigate the role of cognitive control in syntactic disambiguation by emergent (L2) bilinguals and early bilinguals who engage in frequent language-switching.

**Study 1**

The participants of this study are L2 learners of Spanish enrolled in 3rd-, 5th- and 7th- semester Spanish courses. Participants complete a self-paced reading task with two types of structural ambiguity. Reading times of the critical region will be compared to outcomes of the Attentional Network Task to consider how cognitive control correlates to reading times.

**Study 2**

The participants of this study are also L2 learners from 3rd-, 5th-, and 7th-semester Spanish courses, who completed a self-paced reading task with the same stimuli. However, following recent research in psycholinguistics, the task in this study uses the conflict adaptation paradigm to interleave the linguistic stimuli with non-linguistic flanker stimuli (e.g., Hsu & Novick, 2016; Huang, Gerard, Hsu, Kowalski & Novick, 2016), leveraging the Stroop effect (a phenomenon of prolonged cognitive engagement following conflict) to compare participants’ processing of these ambiguities at engaged vs. nonengaged states of cognitive control.

**Study 3**

The final study of this dissertation aims to contribute to the research on early bilinguals by investigating how frequent language-switchers respond to the same paradigm as that of Study 2. Given the relationship between cognitive control and language switching (e.g. Abutalebi et al., 2012), the study questions how cognitive control engagement affects subsequent ambiguity resolution, which in practice can inform us how language-switching affects sentence processing and garden-path resolution.

**Implications**

To date, this paradigm has only been used with monolingual native speakers and with intermediate learners of Italian, but the current three studies will elucidate how cognitive control plays a role in language processing at different stages of language learning and for different profiles of bilinguals. By comparing the results of Study 1 and Study 2, the dissertation will also have implications for designs in L2 research beyond correlational designs.

**References**

Abutalebi, J. (2008). Neural aspects of second language representation and language control. *Acta Psychologica*, *128*(3), 466–478. doi:10.1016/j.actpsy.2008.03.014

Abutalebi, J., Della Rosa, P. A., Green, D. W., Hernandez, M., Scifo, P., Keim, R., … Costa, A. (2012). Bilingualism tunes the anterior Cingulate cortex for conflict monitoring. Cerebral Cortex, 22(9), 2076–2086. doi:10.1093/cercor/bhr287

Botvinick, M., Braver, T., Barch, D., Carter, C., & Cohen, J. (2001). Conflict monitoring and cognitive control. *Psychological review.*, *108*(3), 624–52. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/11488380

Frazier, L., & Clifton, C. (1998). Sentence reanalysis, and visibility. In J. D. Fodor & F. Ferreira (Eds.), Reanalysis in Sentence Processing (Studies in Theoretical Psycholinguistics series) (pp. 143–176). Dordrecht: Kluwer Academic Publishers.

Frazier, L., & Fodor, J. D. (1978). The sausage machine: A new two-stage parsing model. *Cognition, 6* (4), 291–325.

Hsu, N. & Novick, J. M. (2016). Dynamic Engagement of Cognitive Control Modulates Recovery From Misinterpretation During Real-Time Language Processing*. Psychological Science,* 1-11.

Huang, Y. T., Gerard, J., Hsu, N., Kowalski, A., & Novick, J.M. (2016).*Cognitive control effects on the kindergarten path: Separating correlation from causation.* Poster presented at the 29th annual CUNY Conference on Human Sentence Processing, Gainesville, FL.

January, D., Trueswell, J. C., & Thompson-Schill, S. L. (2009). Colocalization of stroop and

syntactic ambiguity resolution in Broca’s area: Implications for the neural basis of sentence processing. *Journal of Cognitive Neuroscience*, *21*, 24342444. doi:10.1162/ jocn.2008.21179

MacDonald, M. C., Pearlmutter, N. J., & Seidenberg, M. S. (1994). Lexical nature of syntactic ambiguity resolution. *Psychological Review, 101*, 676–703.

Tanenhaus, M. K., Spivey-Knowlton, M. J., Eberhard, K. M., & Sedivy, J. C. (1995). Integration of visual and linguistic information in spoken language comprehension. *Science, 268*, 1632–1634.