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B. Description of the research

Background

Globally, dual language education is the norm, not the exception (Pew Research Center, 2015). In the United States (US), the population of bilingual children is significant and growing (22% of children speak a language other than English at home, Kids Count Data Center, 2016). Bilingualism offers job placement benefits: 66% of US employers prefer bilingual over monolingual employees (Gándara, 2014). Despite the rapid growth of dual language instruction, and the staggering portion of bilingual individuals across the world, our understanding of language in bilingual populations is severely limited. As a result, evidence-based research into how to teach two languages, and how to intervene when bilinguals display a language disorder is lacking. The current proposal will offer a fundamental understanding of how bilinguals comprehend multiple languages, which will lay the groundwork for pedagogical and policy insights for meeting the diverse needs of individuals who speak more than one language.

A fundamental component of understanding language is competition. To illustrate, given a word (e.g., *candle*), multiple words that sound similar to the input (e.g., *candy*, *camera*) are activated and compete for recognition, and those candidates that are not the target are gradually suppressed (Alloppenna et al., 1998; Marslen-Wilson, 1987; McClelland & Elman, 1986). This dynamic competition among words solves an important cognitive problem by helping listeners make rapid and flexible decisions about the identity of the words they hear. What is unknown is whether competition occurs across two languages in bilinguals. That is, when a bilingual hears a word in one of their languages (English; e.g., *pencil*), do they activate a word that sounds similar in their other language (Spanish; e.g., *perro*). This proposal will determine to what extent the two languages of bilinguals interact, which has important implications for theories of bilingualism as well as policies regarding education, bilingual language instruction, and intervention with bilinguals who have language disorders.

Participants

We will recruit 30 undergraduate participants from the University of Iowa psychology participant pool. All participants are bilingual English-Spanish speaking and have normal hearing and normal or corrected-to-normal vision. Bilingualism will be determined by using a language experience and proficiency questionnaire (Marian, Blumenfeld, & Kaushanskaya, 2007).

Study Design

Detecting these competition dynamics requires a temporally sensitive method such as eye-tracking in the Visual World Paradigm (VWP), to measure what words are considered over the milliseconds leading up to word recognition (Cooper 1974; Tanenhaus et al. 1995). We construct word pairs that sound the same at the beginning called phonological competitors (e.g. *lana-lazo*). There are four conditions in the proposed experiment: two testing within-language competition (English-English, e.g., *candle-candy*; Spanish-Spanish, e.g., *lana [wool]-lazo [rope]*) and two testing cross-language competition (English-Spanish, e.g., *pencil-perro [dog]*; Spanish-English, e.g., *sol [sun]-soap*). Sets of four words are constructed, in which two of the words are phonological competitors and the other two words are unrelated (e.g., *sol-soap-net-fish*).

For each trial, four images appear in each of the four corners of a computer monitor: the target (e.g., *sol* [*sun*]), the competitor (e.g., *soap*), and two unrelated items (e.g., *net* [*red*] and *fish* [*pez*]). A blue dot appears in the middle of the screen. After 500 ms the blue dot turns red and participants click on it. The red dot then disappears and the participant hears a word played over noise canceling headphones. Participants then click the corresponding picture while eye movements are monitored (e.g., McMurray et al., 2002).

Expected outcomes

To measure competition, we analyze eye-movements to the target word (e.g., *sol* [*sun*]), the competitor (e.g., *soap*), and the unrelated items over time. If participants significantly activate a competitor word, they will look more to the competitor word than a word that is unrelated. To illustrate, if bilinguals activate similar words across their two languages, we expect that after hearing the word “*sol*” in Spanish, they will look significantly more to a picture of “*soap*” than a picture of “*net*”. We predict that bilingual adults will show activation of similar words within a language, and across languages.

C. Role for the student involved in the research

Ms. Garcia is a 1st generation Latinx/a/ student. We have requested funding for the 2021 summer so that Ms. Garcia can take an active role in all aspects of the research project –study design, and collecting, processing, and analyzing data – during the summer. Ms. Garcia will be trained to use an EyeLink 1000 eye-tracker and will test study participants this summer, under the direct supervision of the primary investigator, Dr. Kristi Hendrickson. Further, Ms. Garcia will learn how to process, analyze, and graph eye-tracking data using a variety of software packages (e.g., Microsoft Access, Excel, Matlab and R). Further, she will work with Dr. Hendrickson to interpret the data in light of current theories of bilingual representation, and discuss how these basic science results inform educational and clinical practices important for bilingual populations. Ms. Garcia will have regular contact with Dr. Hendrickson through weekly one-on-one meetings..

D. Potential impact of the research (e.g., publication, grant application, policy relevance) Our long-term goal is to form a comprehensive developmental model of word recognition in bilinguals. This work will provide preliminary evidence to support a future R01 submission investigating word recognition across the lifespan (toddlerhood to adulthood) in groups that have variations in bilingual and biliterate proficiency (e.g., early dual language learners, heritage learners, adult English Language Learners [ELL], biliterate/bilingual adults, trilingual learners). Further, this project will result in conference presentations (e.g., American Speech-Language-Hearing Association Convention) and a publication. Finally, this research has public policy ramifications for bilingual education and intervention. Currently, educational practices within schools are based on research on monolinguals, yet, bilingualism is the norm. Results from this research will determine how the languages of bilinguals interact, which will lay the basic science groundwork for research that investigates the best way to education bilinguals or promote language development in bilinguals with language disorders.