

The relationship between second-language lexical encoding accuracy and individual differences in perception, cognitive abilities, and vocabulary size

Danielle Daidone and Isabelle Darcy
Indiana University

Models of L2 speech perception have typically focused on the effect of the L1 at the level of phonetic categories (e.g., Best & Tyler, 2007; Flege, 1995), with the implicit assumption in the field being that the accuracy of phonetic category perception directly translates to accuracy of these sounds in the lexicon. However, research on L2 lexical encoding has shown that learners with accurate discrimination often still do not have target-like L2 lexical representations (e.g., Amengual, 2016), suggesting that factors beyond perception may be at play.

It is likely that variability in lexical encoding accuracy relates to learners' differing abilities to select the relevant information in the signal, hold sounds in memory, or reduce the influence of their L1 phonological grammar during word learning. Previous studies have shown that attention control (e.g., Darcy, Mora, & Daidone, 2014), inhibitory control (e.g., Darcy, Mora, & Daidone, 2016), phonological short-term memory (PSTM) (e.g., Aliaga-García, Mora, & Cerviño-Povedano, 2011), and L2 vocabulary knowledge (e.g., Bundgaard-Nielsen, Best, Kroos, & Tyler, 2012) are all possibly involved in enhancing the processing and storage of L2 sounds or modulating cross-linguistic phonological influence on perception or production. Thus, this study investigates not only the relationship between lexical encoding and perception, but also the relationships between lexical encoding and inhibitory control, attention control, PSTM, and L2 vocabulary size, which have largely been unexplored in studies of L2 phonolexical representations.

English-speaking learners of Spanish (N=35) were tested on their lexical encoding of the Spanish tap-trill, tap-/d/, trill-/d/, and /f-p/ contrasts through a lexical decision task. In this task, participants heard a stimulus and indicated whether this was a real Spanish word or not. Nonwords were created by switching the correct segment with the other segment in the contrast, e.g. *jefe* 'boss' → *jepe*). Perception ability was measured with an oddity task, attention control with a flanker task, inhibitory control with a retrieval-induced inhibition task, PSTM with a Russian serial non-word recognition task, and vocabulary size with the X_Lex vocabulary test.

For the lexical decision task, *d'* scores were calculated using only those trials for which participants indicated they knew the relevant word in a word familiarity questionnaire. Pearson correlations were run to examine the relationships between the lexical decision results for each contrast and the individual differences measures, which were converted to z-scores. Significance tests were adjusted for multiple comparisons using Benjamini and Hochberg's False Discovery Rate procedure, at the 0.05 level. Exploratory multiple linear regression analyses were also conducted and bootstrapped 95% confidence intervals were calculated for the unstandardized regression weight (B) and the change in R^2 (ΔR^2) for each variable.

Significant correlations were found between the oddity tap-/d/ condition and the lexical decision results for tap-trill ($r(35)=.52, p=.001$), tap-/d/ ($r(35)=.49, p=.003$), and trill-/d/ ($r(35)=.56, p<.001$). PSTM correlated with only the lexical decision tap-trill condition ($r(35)=.43, p=.009$). Vocabulary score correlated with all lexical decision conditions ($r(35)= .45-.67$, all $p<.01$). No other correlations were significant. The regression for the tap-trill condition revealed that higher PSTM was associated with higher lexical decision scores (B 95% CI [0.26, 0.94], ΔR^2 95% CI [.03, .45], $p=.002$), and higher vocabulary scores were also associated with more accurate lexical decision performance in this condition (B 95% CI [0.19, 1.12], ΔR^2 95% CI [.03, .43],

$p=.003$). For the tap-/d/ contrast, only vocabulary score was a significant predictor (B 95% CI [0.16, 0.91], ΔR^2 95% CI [.01, .41], $p=.010$), which was also true of the trill-/d/ contrast (B 95% CI [0.31, 0.75], ΔR^2 95% CI [.16, .69], $p<.001$). The regression for /f-p/ was not significant.

These results show that the factor with the largest impact on L2 lexical encoding was generally L2 vocabulary size. This suggests that the acquisition of more phonologically similar words forces learners' phonological system to create more detailed representations in order for them to be differentiated. Also, it is probable that having more experience with hearing words leads to more detailed and delineated representations because learners' exemplars are based on more examples. Furthermore, when presented with sounds that are differentiated along a dimension not used in the L1 (i.e., tap and trill), learners with higher PSTM have an advantage, likely because they are better able to hold L2-relevant phonetic details in memory long enough to be transferred to long-term representations.

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