

Lexical Competition and Articulatory Enhancement in American Sign Language

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Recent research in the domain of spoken language phonology has found that words that have a greater degree of lexical competition are prone to both acoustic and articulatory enhancement (e.g., Baese-Berk & Goldrick 2009; Scarborough 2013; Hall et al. 2017). Lexical competition can be measured in multiple ways, including the notion of minimal pairs (words with minimal pairs tend to be enhanced as compared to those without them) and neighbourhood density (ND; words in denser neighbourhoods tend to be enhanced as compared to words in sparser neighbourhoods). As van der Kooij (2002) points out, signed languages tend to have fewer minimal pairs than spoken languages, which leads researchers to rely more on ND as a measure of lexical competition. While some work has been done on ND effects in signed languages, it has mostly focused on its effects on perception (e.g., Corina & Hildebrandt 2002; Carreiras et al. 2008).

In this paper, we investigate whether there is articulatory enhancement associated with greater ND in American Sign Language (ASL). As our measure of articulation, we use the notion of *visible amplitude*, introduced by Tkachman et al. (under review), which is a visual-world analog of acoustic amplitude. It is calculated using the root-mean-square of a motion velocity time-series extracted directly from video of a sign, via a video analysis technique known as Optical Flow Analysis (OFA; see e.g., Horn & Schunck 1981). It essentially provides a measure of what the magnitude of movement is during the production of a sign.

We examine the correlation between the visible amplitude of signs and their “minimal” ND as given in the ASL-Lex database (Caselli et al. 2017). The minimal ND of a sign is the number of other signs in the database that share with the target at least one of the five main formational characteristics coded for in ASL-Lex, i.e., number of hands, major location, major movement, selected fingers, and flexion of fingers.

We analyze 691 videos of signs from the ASL-Lex database. After controlling for other possible effects using a multiple linear regression, we find that minimal ND is a significant predictor of visible amplitude ($p = 0.02$). The direction of the effect is as predicted, i.e., on average, signs with a larger ND have greater visible amplitude [$\beta = 0.0003$, $p = 0.02$]. Figure 1 shows the added-variable plot for these results, i.e., it shows the relationship between visible amplitude and minimal ND, partialling out the effects of the other predictor variables.

These results suggest that indeed, lexical competition may affect articulation in signed languages similar to spoken languages. That is, increased competition leads to increased magnitude of movements in signs. These findings can be understood in the context of language as a communicative system; increasing the distinctiveness of a signal is most likely to happen when there is the greatest chance of miscommunication (cf. Lindblom 1990; Hall et al. 2018).

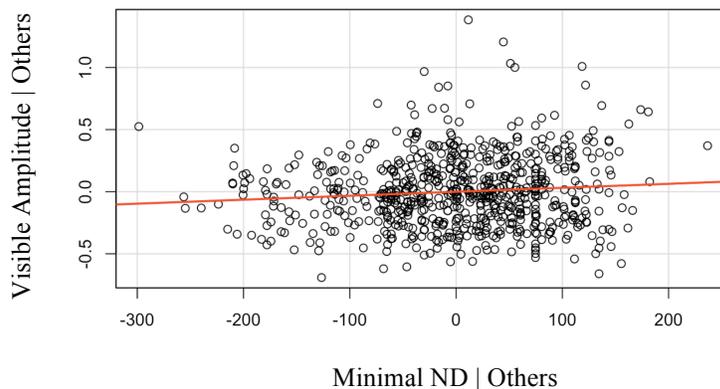


Fig. 1: Effect of neighbourhood density on visible amplitude, partialling out other predictors

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