Mergers, Migration, and Signaling

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Summary Mergers play a crucial role in the process of language change, yet prove difficult for formal analysis. Here we present a game-theoretic framework, *signaling games*, that allows us to explore the cognitive and social factors that influence the spread of mergers. We develop two models, the first based solely on cognitive factors and the second based solely on social factors. Both models are used to derive conditions for mergers to go to completion within a speech community. However, neither model is sufficient to account for two different empirical thresholds (Johnson, 2010). In light of this, we consider the structure of social networks as a means of evaluating the predictions made by both models. This work provides a mathematical means for the formulation and testing of sociolinguistic hypotheses.

Data We consider the spread of the low-back merger (Labov, Ash, and Boberg, 2006) along the Rhode Island-Massachussets border documented by Johnson (2010). The merger occurs by expansion: the phoneme resulting from the merger occupies the space of the original two phonemes. As in other cases of merger by expansion, the change occurs rapidly (Herold, 1990), going to completion within a few years starting in roughly 1990 in South Attleboro, MA and 2000 in the town of Seekonk, MA. Johnson hypothesizes that the previously stable boundary between merged and non-merged populations is undone by migration. Children learn the phonological system of their parents, but quickly reorient towards a peer group upon entering school. An influx of merged children above a certain threshold should be sufficient to cause the merger to go to completion. These thresholds are roughly 50% for South Attleboro and 20% for Seekonk. Two models of mergers as signaling games are used to derive these thresholds.

Signaling Games A signaling game (Lewis, 1969) is a strategic interaction between two agents, a Sender and a Receiver. The Sender has a type, in this case an intended meaning. The Sender sends a message, based on this type, to the Receiver, who, in turn, takes an action to interpret the message. The outcome of this process is determined by the type of the Sender, the message sent, and the action taken by the Receiver. The Sender and Receiver have preferences over these outcomes. These preferences might be for successful communication or for using the same signals to convey meaning. We formalize these preferences in terms of their cognitive and social effects.

Cognitive Factors Herold (1990) conjectures that mergers spread due to errors in interpretation made by non-merged hearers in contact with merged speakers. Yang (2009) models this intuition, using minimal pair frequencies and vowel confusability to predict the threshold of merged migrants required to cause a merger. While not framed as such, this model can be thought of as a signaling game. Non-merged speakers condition their signals on an intended meaning, whereas merged speakers only use one message. Non-merged hearers rely on the phonemic difference as a semantic cue, whereas merged speakers assume the more frequent interpretation of the pairs made homophonous by the merger (Boland and Blodgett, 2001; Bonin and Fayol, 2002). We can calculate the relative utility of these strategies based on how often merged and non-merged speakers succeed and make mistakes. This in turn allows us to calculate the threshold of merged speakers required for the merger to go to completion, which approximates the empirical threshold of 20% for Seekonk.

Social Factors The human compulsion for imitation is particularly evident in linguistic accommodation (Gregory, 1990; Branigan et al., 2000; Brennan and Clark, 1996). In particular, speakers rapidly converge towards similar pronunciations in conversations (Pardo, 2006). This can be taken as a preference for coordination on the same phonemes across lexical items. Both merged and non-merged speakers want to coordinate on the same phonemes in the words they use. Given the frequencies of all words containing the two phonemes and vowel confusability, we can calculate how often merged and non-merged speakers succeed or fail in coordinating. This allows us to calculate the threshold of merged speakers required for the merger to go to completion, which approximates the empirical threshold of 50% for South Attleboro.

Discussion Signaling games offer a general way of formulating hypotheses regarding the spread of mergers. Paired with frequency data and measures of vowel confusability, we can test these hypotheses and derive the observed empirical thresholds. Both cognitive and social factors offer insight into the process, but neither is sufficient to explain both of the observed thresholds. We suggest how the structure of social networks (Jackson, 2008) offers a means to further examine these two factors and determine if either can be reconciled with the two different thresholds.

References

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