

Acquiring phonemes: Is frequency or the lexicon the primary cue?

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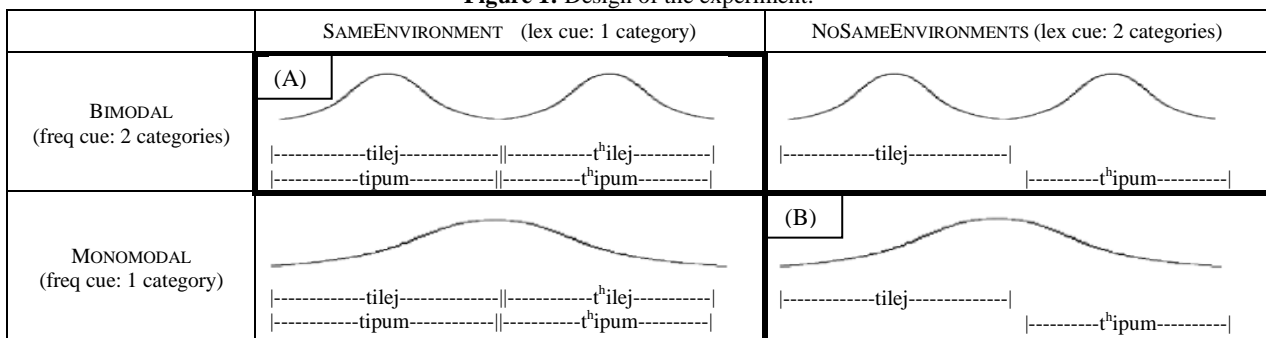
One of the most influential proposals concerning how infants acquire phoneme categories claims that infants make use of frequencies of tokens of phones (Maye and Gerken, 2000). This proposal assumes that phoneme acquisition occurs before word formation. Although this **frequency-based account** has been influential among acquisitionists, it has been claimed that this account alone is unable to arrive at the correct number of phonemes when given data taken from natural language. This has prompted some researchers to suggest a **lexicon-based account**, in which infants utilize lexical items to aid the acquisition of phoneme categories (Feldman et al., 2013; Swingley, 2009; others). While both the frequency-based account and the lexicon-based account have been supported in artificial language learning tasks for both adult and for infant participants, no study has yet compared the interaction of these two effects. This experiment is concerned with determining which of these two is used as the primary (i.e. dominant) cue by language learners.

The frequency cue: According to the frequency-based learning hypothesis, infants make use of relative frequencies of sound tokens to infer how many categories belong to the language (s)he is being exposed to. An infant exposed to a bimodal distribution of tokens along some phonetic dimension(s) will infer that there are two phonemes (two categories), whereas an infant exposed to a monomodal distribution will infer that there is only one phoneme (one category). This has been supported in artificial learning tasks on both adults and on infants (Maye et al, 2000, 2002).

The lexical cue: According to the lexicon-based learning hypothesis, infants do not acquire phonemes in isolation from learning words. Rather than acquiring phonemes *before* learning words, infants may use frequently-heard words to aid them in the acquisition of phoneme categories. In this view, infants begin with a bias against the existence of minimal pairs, and will assume that words which sound the same overall (for example, [tagu] and [t^hagu]) are the same lexical item, and that single lexical items consist of the same sequence of phonemes (so, in this example, the learner would conclude that [t] and [t^h] belong to a single phoneme category). This has been supported in artificial learning tasks on both adults and on infants (Feldman et al, 2013).

Most acquisitionists (e.g., see Kuhl, 2004; Gervain and Mehler, 2010 for reviews) assume that the frequency-based account is the primary method in which language learners form phoneme categories. However, no experiment has yet compared the effects of frequency with the effects of the lexicon. As a starting point in answering this question, this study will present English-speaking adults with **conflicting information** from the frequency cue and the lexical cue, in order to determine which is the primary cue. Specifically, participants will be exposed to one of the two possible conditions in which these two cues conflict, shown in bolded squares in the figure below: (A) a bimodal distribution of phones ranging from [t] to [t^h] (thereby receiving a **frequency cue** that there are **two** phoneme categories), embedded in similar-sounding lexical contexts such as [tilej] and [t^hilej] (thereby receiving a **lexical cue** that there is **one** category), or (B) a monomodal distribution embedded in differing lexical environments (frequency cue: 1 category; lexical cue: 2 categories). Based on studies concerning lexical consolidation (Marslen-Wilson et al, 1996; Leach and Samuel, 2007), it is predicted that the lexical cue, rather than the frequency cue, is the primary cue used by language learners forming phoneme categories. Although further study involving infants is suggested, determining which of these is the primary cue gives us insight into the respective roles of top-down and bottom-up processing in sound category formation.

Figure 1: Design of the experiment.



Selected references

Feldman, N., Myers, E., White, K., Griffiths, T., Morgan, J. 2013. Word-level information influences phonetic learning in adults and infants. *Cognition*, 427-438. / Leach, L., Samuel, A. 2007. Lexical configuration and lexical engagement. *Cognitive Psychology*, 55, 306-353. / Maye, J., Gerken, L. 2000. Learning phonemes without minimal pairs. *BUCLD 24*, 522-533. Sommerville: Cascadilla Press. / Stager, C.L., Werker, J.F. 1997. Infants listen for more phonetic detail in speech perception than in word-learning tasks. *Nature*, 388, 381-382. / Werker, J., Tees, R. 1984. Cross-language speech perception. *Infant Behavior and Development*, 7, 49-63.