COMPLEX SOUND SEQUENCES IN ITERATED LEARNING: CLUSTERS CAN BECOME MORE STABLE WHEN THEY SIGNAL MORPHOLOGICAL BOUNDARIES

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We report a spoken artificial iterated language learning experiment in which we investigated the transmission of final consonant clusters. Our main research question was how well clusters that are exclusively produced through suffixation (such as the /gz/ in *egg+s*) are transmitted in comparison to (a) exclusively stem-internal clusters (such as the /lk/ in *hulk*), and (b) clusters that occur both within stems and across boundaries (such as /ks/ in *fix* and *kick+s*).

In comparison to consonant-vowel sequences, consonant clusters count as highly 'marked' or 'dispreferred' in many linguistic theories (cf. Clements & Keyser, 1983; Prince & Smolensky, 2004; Dziubalska-Kołaczyk, 2002, 2019). They are difficult both to perceive and to produce, cross-linguistically rare (Maddieson, 1999, 2003), and historically unstable (e.g. Lutz, 1988). This implies that they are selected against in cultural evolution (Ritt, 2004; Christiansen & Chater, 2008). However, consonant clusters appear to be more frequent and more stable when they are 'morphotactic', i.e. when they span morpheme boundaries, as in English /gz/ in *egg+s*. It has been hypothesized that this is because they indicate morphological complexity and facilitate the processing of complex word forms (Dressler & Dziubalska-Kołaczyk, 2006).

From this reasoning an interesting question arises about final clusters that occur both across morpheme boundaries and within word stems, such as English /nd/ in simple *find* and complex *dine+d*, for example. In contrast to unambiguously morphotactic clusters like the /gz/ in *egg+s*, they do not reliably signal complexity and may even impede processing (Post et al., 2008). This suggests that they should be difficult to transmit and be unstable in cultural language evolution. On the other hand, however, it has also been argued that frequent morphotactic clusters may support the emergence and the stability of stem-internal homophones through analogy (Hogg & McCully, 1987). Evidence for both hypotheses has been found in processing studies (e.g. Celata et al., 2015) and diachronic research (e.g. Baumann et al., 2016, 2019). We investigate transmission of morphotactic, stem-internal, and ambiguous clusters by means of a spoken iterated artificial language learning experiment.

Following the basic design of such experiments (Kirby, Cornish & Smith, 2008), we asked participants to learn words from an artificial miniature language and to reproduce them from memory. The outputs of 'first-generation' participants served as learning input for a second 'generation'. This procedure was then repeated over ten participant-generations. In our specific experiment, thirty Austrian German native speakers learned a set of singular and plural nouns, some of which contained a highly marked plosive+/k/ cluster (e.g. /zʊtk/). They were trained on eleven nouns, each of which comprised an abstract image and a spoken label, and subsequently asked to reproduce the sound labels corresponding to each image. To address our research question, we set up three conditions. In condition one, all clusters occurred within singular stems (e.g. SG /zʊtk/ – PL /zʊtk+ɒ/). In condition two, all clusters were produced by adding the plural suffix {-/k/} to stems (e.g. SG /zʊt/ – PL /zʊt+k/). Finally, in condition three, the clusters occurred both within singular stems and across stem-suffix boundaries.

In our analysis, we compared the transmission of lexical, morphotactic, and ambiguous clusters. Our results showed that /tk/ clusters remained stable only when they signaled plural suffixation unambiguously, i.e. in condition (ii), where they were successfully transmitted across all ten participant generations. In contrast, both exclusively stem-internal clusters (condition i) and ambiguous clusters (condition iii) were reduced and/or lost early in transmission. Quantitatively, the significant interaction between cluster transmission and morphotactic condition was substantiated in multivariate regression models and a Pearson's correlation test.

We take our data as support for the position that morphotactic cross-boundary clusters are selected in cultural evolution, but only when they signal complexity unambiguously. If they have stem-internal homophones, on the other hand, this does not seem to be the case. Instead, ambiguous clusters seem to be as unstable, as clusters that occur only within stems and have no morphological signaling function at all. However, the possibility that cluster homophones may also support each other cannot be ruled out, since the relevant processes may occur in early stages of first language acquisition, while our experiment involved only adult participants.

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