Opacity over time: Charting the paths of fricative voicing in English plurals

This paper investigates the diachronic trajectory of an opaque phonological alternation: the voicing of stem-final fricatives in English plural nouns. We find that this historical rule has fragmented, and propose that Yang's (2005) Tolerance Principle regarding the storage of lexical exceptions may explain its patterning. The results speak to questions of when variation may lead to change and how both connect to the process of language acquisition.

Regressive voicing affects a number of words ending in voiceless fricatives in present-day English (PDE): for instance, the words *wife* [waɪf], *path* [paΘ], and *house* [haʊs] have as their plurals [waɪvz], [paðz], and [haʊzəz]. This alternation can be traced back to Old English (OE), in which plurals were formed by the addition of an [-əs] suffix (e.g. [paΘ], [paðəs]; Ringe & Eska, 2013). Stem-final fricatives in OE were thus intervocalic in their plural form, resulting in a natural and regular process of voicing. However, as Ringe & Eska outline, a number of processes led to this alternation becoming opaque, including the loss of [ə] in the plural suffix (except after sibilants). The upshot is that PDE contains several words that retain the alternation, but many others of the same phonological shape which do not. We investigate whether this opacity has led to change, and whether any attested diachronic developments proceed similarly across the three fricatives (/f/, /Θ/, /s/).

Following a survey of three dictionaries of present-day American English (AmE), we identified 22 /f/-final, 17 /Θ/-final, and 3 /s/-final words—all monosyllables—for which at least one dictionary provided a voiced plural form. We then auditorily coded the voicing of the stem-final segment for all plural tokens of each word in both the Switchboard (Godfrey & Holliman, 1997) and Fisher (Cieri et al., 2004) corpora of AmE, resulting in a database of 1456 tokens. Data were analysed using mixed-effects logistic regression in R.

Confirming what Becker et al. (2012) found in a judgment task, stem-final plural voicing is variable, occurring 70% of the time in our dataset. In fact, the rate of voicing significantly differs across the three consonants, with /f/-final stems voicing significantly more than either /s/-final ($p = 0.001$) or /Θ/-final ($p < 0.001$). Additionally, /s/-final words (of which tokens of *house* constitute the majority) show change in apparent time, with younger speakers voicing less than older ($p = 0.001$), but the other two fricatives show no significant effect of age ($p > 0.1$; Figure 1). The historical voicing rule thus appears to have fragmented.

We propose that the differing diachronic trajectories in Figure 1 may be explained by Yang's (2005) Tolerance Principle, which asserts that language learners can tolerate a productive rule with listed lexical exceptions so long as the number of those exceptions does not exceed N/ln(N), where N is the number of words that meet the structural description of the rule. We observe that, of the 87 monosyllabic /s/-final stems in the English Lexicon Project (Balota et al., 2007), the number which exceptionally voice in the plural (3) is well below the number of tolerable exceptions (19). It thus appears that learners have a productive "form the plural of /s/-final words without regressive voicing" rule with 3 exceptions, which are now being assimilated. In the case of /f/-final and /Θ/-final words, though, there are too many items which voice in the plural to be tolerated as exceptions to a rule, but conversely there are too many items which **don't** voice in the plural for **them** to be tolerated as exceptions to the opposite rule. Under Yang's model, this means that no productive rule can be written either way—forms must be listed—which we take to explain the diachronic stability of each environment. Models of representation can thus shed light on patterns of change.

Figure 1