How could the Germanic weak inflection overthrow a regular and more frequent competitor? A computer simulation of language usage

Freek Van de Velde, Dirk Pijpops, and Katrien Beuls

The Germanic languages employ two general strategies of past tense formation. The first strategy is called the strong inflection, and switches the vowel of the verb’s stem, as in sing $\rightarrow$ sang and drive $\rightarrow$ drove. The second strategy is contrastively called the weak inflection, and adds a dental suffix to the stem, as in kick $\rightarrow$ kicked. The strong inflection is the oldest, in large part descendent from Indo-European, and consisted of several fairly regular ablaut-classes, that are still highly recognizable and even productive in languages like Dutch or German (Harbert 2007; Carroll, Svare and Salmons 2012; Knooihuizen and Strik 2014). Meanwhile, the weak inflection is a Germanic innovation and has been pushing out its competitor over the course of millennia (Cuskley et al. 2014).

These findings present a linguist with two riddles. One, how could the weak inflection gain ground against a competitor that was originally dominant in both type and token frequency, and still regular (Ball 1968: 164; Bailey 1997: 8)? Second, why did the weak inflection first take over the low frequency verbs and the low frequency ablaut classes (Carroll, Svare and Salmons 2012)?

To answer these questions, scholars have turned their attention to simulations, as a new way of investigating language change. Most of these simulations were models of iterated learning, in which language change is only possible through language acquisition (e.g. Hare and Elman 1995; Yang 2002). As such, the main focus has been on the acquisition of the past tense system, rather than its usage (Rumelhart and McClelland 1986; Pinker and Prince 1988; van Noord 2015).

However, we propose that to solve these riddles, we should not only look at the influence of acquisition on language change, but also at the influence of language use (cf. Croft 2000). This entails employing agent-based simulations that can model both language acquisition and usage. In such a simulation, agents are tasked to communicate with each other using a rudimentary language system, e.g. only containing past tense inflections, and will adapt this system to the perceived language usage of their fellow agents. In building such a simulation, it can be revealed that both riddles may be explained by a single cause.

The model was built in the Babel2-framework for agent-based modeling of language (Loetzsch et al. 2008). In the simulation, the agents are equipped with a past tense system in which the strong inflection is still completely regular. It is not assumed that language users handle the weak suffix and the several ablaut-classes differently. Instead, both the weak suffix and each separate ablaut class are represented as constructions that are amenable to the effects of usage, just like lexical elements. These constructions were implemented using Fluid Construction Grammar (FCG, Steels 2011). Each separate ablaut construction starts out dominant in both type and token frequency over the weak suffix construction. Also, in the simulation, there is no difference between strong and weak in language acquisition: agents recognize and acquire strong forms just as easily as weak forms, and never forget strong forms (cf. Taatgen and Anderson 2002: 124). Lastly, for every verb in the model, there exists at least a single applicable ablaut construction. That is, every verb can be conjugated strongly.

The only difference in the simulation between the strong ablaut constructions and weak suffix construction lies in language production. Whereas an agent can only apply a particular ablaut construction to a subset of verbs, i.e. those verbs with the proper vowel in the stem, the fledgling weak construction is, in principle, available to be applied to any verb. This difference alone already suffices to explain a gradual rise of the weak inflection against a dominant strong system, and can be shown to generate a Conserving Effect (Bybee 2006) on both the level of the verb and the ablaut class, such that the weak inflection encroaches first on the low-frequency verbs, and low frequency ablaut classes.
References


Hare, Mary and Jeffrey Elman. 1995. Learning and morphological change. Cognition 56(1). 61–98.


