

## **When Pānini's Principle leaks: The implications of parallel distributed processing and feedback for language change and language structure**

In both language acquisition and language change, highly accessible forms are often extended to new contexts and uses, sometimes at the expense of forms that would have expressed the meaning better if they were chosen (Harmon & Kapatsinski, 2017; Koranda et al., 2022). For example, a young child may call a cow a kitty before the form cow is learned well enough, despite knowing that a cow is not a cat (Naigles & Gelman, 1995). Accessibility-driven extension is an inevitable consequence of the basic mechanism of parallel distributed processing: forms (and other actions) are activated by distributed representations of contexts in parallel. Distributed representation means that similar contexts or uses share nodes, the basic representational elements of a neural network (Hinton et al., 1986; e.g., cats and cows are both cute animals and so would share the elements representing cute-animalness). These shared nodes will activate compatible frequent forms more than they activate less frequent forms, even if the infrequent forms might match the entirety of the meaning intended by the speaker better. For example, because cats and cows are both cute animals, and the child has usually called cute animals kitties, they are likely to also call a cow a kitty, even if they know, upon reflection, that there is a better term. Accessibility-driven extension can account for several interesting phenomena in language change: frequent forms having more senses than infrequent forms (Zipf, 1949), uses of frequent forms showing a family-resemblance structure (Lakoff, 1987), and morphological paradigm leveling in favor of frequent forms (Tiersma, 1982). Here I show that the same idea accounts for the emergence of the first exceptions to previously exceptionless rules in contradiction of Pānini's Principle (Kapatsinski, 2010a, 2010b). At the same time, speakers appear to often be able to avoid accessibility-driven choices when given time to reflect – a speaker who has accessed kitty when trying to name a cow can reconsider their choice. I have recently proposed that this avoidance is accomplished by a form-to-meaning-to-form negative feedback loop within the production system that delays the onset of speaking and suppresses an activated form when its production is likely to have unintended consequences (Kapatsinski, 2022). Interestingly, despite its conservative purpose, the negative feedback loop also generates some linguistic innovations, such as backformation and circumlocution, and, more generally, may be responsible for much of true linguistic creativity -- following the path less trodden.