

Mechanisms of phonological learning

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The role of prediction error in learning is a basic parameter that distinguishes among alternative learning mechanisms. For example, prediction error does not play any role in classic Hebbian learning models. In contrast, supervised error-driven learning models propose that prediction error determines learning rate, while attentional learning models suggest that prediction error can cause reallocation of attention to less familiar perceptual cues. Research in my laboratory has focused on the role of prediction error in learning phonological patterns. This work has suggested that prediction error does determine learning rate, with surprising observations resulting in faster learning (Kapatsinski 2018:103-107, 144-152; Olejarczuk et al., 2018). Prediction error appears to be particularly crucial in learning phonetically arbitrary alternations. However, prediction error by itself is not sufficient to change behavior. Rather, participants change behavior when doing so is estimated to *reduce* prediction error (Harmon et al., 2019). Furthermore, production of a difficult alternation – one that requires great changes to the base – is avoided even if the alternation is learned to be more acceptable than the corresponding faithful mapping (Smolek & Kapatsinski, 2018; Do, 2018). I will argue that these characteristics of phonological learning implicate a reinforcement learning mechanism (Harmon et al., 2019; Kapatsinski, 2018:253-258; Sutton & Barto, 1998). From this perspective, learning involves estimating the values of alternative action policies. Actions can be both overt production choices and covert choices such as how much attention is allocated to a particular phonetic dimension. Policies that are estimated to be of maximum value (in a particular context) are chosen for execution. Value is determined by both prediction error and execution difficulty, and a policy is abandoned only if another policy is estimated to be of greater value.

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