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To be or to become: An evolutionary model of learning and development

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Abstract: While adaptive thinking has been fruitfully applied to the study of mature phenotypes, it can also be applied to the study of developmental processes. Consider, for example, cognitive systems that specialize ontogenetically towards specific phenotypic outcomes, contingent on input. Rather than contrasting ontogenetic specialization with genetic evolution, we explore an adaptive dynamic program, which uses Bayesian updating, to investigate the evolutionary conditions that may have led to different specialization onsets in different cognitive systems. Our model assumes a tradeoff between specializing and sampling; specializing early may lead to a tighter correspondence with the environment, but sampling may yield a more accurate estimate of the state of the world. The model generates optimal developmental rules for a range of evolutionary conditions. These developmental rules are subjected to data to observe the phenotypic distributions they would produce, which may lead to insight into patterns of individual differences in adults. The model will be discussed in light of empirical research on the development of stress reactivity, contingent mate strategies, levels of aggression, and cultural learning of expertise.