

Cognitive Niches: An Ecological Model of Emergent Strategy Selection

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How do people select among different strategies to accomplish a given task? Across disciplines, the strategy selection problem represents a major challenge. We propose a quantitative model that predicts how selection emerges through the interplay among strategies, cognitive capacities, and the environment. This interplay carves out for each strategy a cognitive niche, that is, a limited number of situations in which the strategy can be applied, simplifying strategy selection. To illustrate our proposal, we consider selection in the context of two theories: the fast and frugal heuristics framework, and the ACT-R architecture of cognition. From the heuristics framework, we adopt the thesis that people make decisions by selecting from a repertoire of simple decision strategies that exploit regularities in the environment and draw on cognitive capacities, such as memory and time perception. ACT-R provides a quantitative theory of how these capacities adapt to the environment. Based on internet statistics, the resulting model quantitatively predicts people's familiarity with and knowledge of real-world objects, the distributional characteristics of the associated speed of memory retrieval, and the cognitive niches of classic decision strategies, including those of the fluency, recognition, integration, lexicographic, and sequential-sampling heuristics. In doing so, the model specifies when people will be able to apply each strategy and how accurate, fast, and effortless people's decisions will be.