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# Using memory to accelerate planning

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## Abstract

In both cognitive science and AI, planning research is characterized by a fundamental challenge: algorithms are costly. Consequently, much work concerns simplifying the required computations, or biasing them to more favourable regions of the solution space. One promising candidate for this is memory; memory is a powerful tool for guiding behaviour, especially in tandem with parametric learning models. However, a complete understanding of how these processes should and do interact in the mind remains elusive.

We present statistical evidence from an extremely large dataset of chess games that memory empirically accelerates planning in the opening. In particular, we show that this interaction is rational: it is sensitive to the criticality of the given position, its popularity, and the latency since the last experience. We capture these dynamics in a normative model that integrates memory into Monte-Carlo tree search with an uncertainty-based stopping rule to emit move times.

**Keywords:** Chess; memory; planning; response times; value of information