Modeling Decision Tree Search in a Two-Player Game

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Presentation Abstract Summary Thinking ahead is a key feature of human cognition, which is necessary for negotiation, navigation and career planning. However, most decision-making studies investigate choices between two alternatives with immediate payoffs, and studies of sequential decision-making commonly use tasks with only 10-100 possible states (Huys et al., 2012; Solway & Botvinick, 2015). To investigate whether understanding derived from these studies generalizes to complex decision-making tasks, we study human decision-making and learning in a variant of tic-tac-toe with 10^15 possible states. We collected data from 100 participants in 3 different experiments, ranging from free play against human opponents to human-vs-computer games under time pressure. We develop an AI-inspired computational model with three main components: a feature-based evaluation function, a tree search algorithm to find the value-maximizing move, and a mechanism to model lapses of attention. We demonstrate that this model accurately captures people's choices by comparing it against 25 alternative models. Next, we investigate which model components vary as players gain experience, or when we introduce limits on their response time. We find that more experienced players build larger trees and make fewer attentional lapses, while the feature weights remain unchanged. The effect of time pressure is captured as reduced tree search.

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