The Dynamics of Problem-Solving in the Age of AI: Evidence from Elite Chess

Abstract

Artificial intelligence (AI) is widely recognized for improving decision accuracy and enhancing problem-solving performance, yet its impact on the temporal dynamics of search behavior remains underexplored. Drawing on the behavioral theory of the firm, we examine how AI reshapes the dynamics between exploration and exploitation over time. We propose that, in the absence of AI, actors exhibit cyclical shifts between exploration and exploitation, and introduce the concept of algorithmic convergence, whereby AI increases outcome reliability, shifts behavior toward greater exploitation, and alters the temporal structure of search. Using time-series analyses of 4,262 chess games played by grandmasters at the Tata Steel Tournament (1975–2023), we find evidence of alternating exploration–exploitation patterns in the pre-AI era. Following the introduction of powerful chess engines, these patterns shift toward higher levels of exploitation, while cycles become faster. Complementary interviews with elite players support these findings. Our study shows that AI not only enhances decision quality but also homogenizes and accelerates search dynamics, advancing understanding of how AI reshapes problem-solving dynamics over time.

This paper is joint work with Lukas Vogelgsang, Jennifer Haase and Martin Hoegl.

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