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Title

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Journal

Proceedings of the Annual Meeting of the Cognitive Science Society, 48(0)

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Publication Date

2026

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Formal Conceptual Blending as a Fundamental Tool for Artificial Mathematical Intelligence and for the Fine-Tuning of Large Language Models

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Abstract

One of the foundational pillars of Artificial Mathematical Intelligence (AMI) is the taxonomy it has developed of Seminal Cognitive Operations (SMOs) underlying abstract mathematical cognition. Among these, conceptual blending is central. We survey formal approaches to conceptual blending and show how they generate and constrain mathematical reasoning across domains, enabling a quantum jump in building artificial co-creative mathematical agents. The AMI framework fills a longstanding gap in formal systems by integrating principled concept formation into formal reasoning. We additionally propose a regimen for fine-tuning LLMs with mathematical problems ranging from elementary to highly challenging, to bring formal conceptual blending into a constructive chain-of-thought process, resulting in sound final responses.