Modeling Human Creativity and Problem-Solving with Quantum-Inspired Cognitive Architectures

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***Abstract*—Creativity and problem-solving are central components of human intelligence, yet they remain difficult to model within classical cognitive and computational frameworks. Traditional approaches, grounded in symbolic reasoning or probabilistic optimization, often struggle to capture the non-linear, context-sensitive, and exploratory nature of creative thought. Quantum-inspired cognitive architectures offer an alternative modeling paradigm by drawing on mathematical principles from quantum probability and quantum information theory—such as superposition, interference, and contextuality—without assuming physical quantum processes in the brain. This paper examines how quantum-inspired models can represent creative cognition as a dynamic process involving parallel idea generation, contextual recombination, and non-deterministic insight formation. By conceptualizing mental states as superposed cognitive representations and problem-solving as a sequence of state transitions influenced by contextual measurements, quantum-inspired architectures provide a unified framework for modeling divergent thinking, insight, and adaptive reasoning. The study synthesizes theoretical foundations from quantum cognition, creativity research, and artificial intelligence, and discusses implications for the design of intelligent systems that more closely emulate human creative and problem-solving capabilities.**

Creativity and problem-solving are widely regarded as defining features of human intelligence, underpinning innovation in science, technology, art, and strategic decision-making. Creative cognition enables individuals to generate novel ideas, reframe problems, and explore unconventional solution paths, while problem-solving involves navigating complex constraints to achieve goal-directed outcomes [1]. Despite decades of research in cognitive psychology and artificial intelligence, modeling these processes in a way that captures their flexibility, unpredictability, and contextual sensitivity remains a significant challenge [3].

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Classical cognitive architectures and computational models have traditionally approached creativity and problem-solving through rule-based systems, heuristic search, or probabilistic optimization. While such models have achieved success in well-defined problem domains, they often assume sequential reasoning, fixed representations, and stable evaluation criteria [9]. In contrast, empirical studies of human creativity reveal cognitive processes characterized by parallel idea activation, fluid conceptual boundaries, and sudden insight transitions. These features suggest that creative cognition operates in a probabilistic and context-dependent manner that exceeds the expressive

