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Biological and Artificial Perspectives on Metacognition

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Abstract: Metacognition may be broadly understood as awareness, monitoring, and regulation of an intelligent agent's own internal processing, a "thinking about thinking". The cognitive complexity and self-maintenance value of this introspective skillset has considerable current interest in the study of both biological and artificial intelligence, with intriguing parallels. Study of metacognition in some nonhuman species and Biologically-Inspired Cognitive Architecture (BICA) systems reflect evidence of, at best, an attenuated form of the elaborated human manifestation, with ongoing difficulties in operationalizing metacognitive components and traits. A linked exploration of these "inhuman" forms of metacognition may better clarify the locus of divergence from the human form and illuminate the role of the skill in supporting potentially emergent cognitive traits, from self-recognition to Theory of Mind understanding. The current review will take a comparative approach in assessing metacognitive systems in nonhuman biological and artificial agents in pursuit of clarity for future methodological and conceptual directions.