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On the role of metacognition in bootstrapped learning

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Abstract: The challenge of designing a human-level learner demands a computational theory of the higher learning abilities, including processes that are labeled in the literature "bootstrapped learning", "metacognitive scaffolding" and "self-regulated learning" (SRL). In order to solve the challenge, it is essential to understand general laws of these processes at a computational level. The present work lays the grounds for such a computational theory through (a) analysis of general laws describing cognitive chain reactions using simulations of an abstract model of bootstrapped learning, and (b) analysis of mental state dynamics involved in specific examples of self-regulated problem solving. The part (b) is based on a theoretical mapping between an SRL model (Zimmerman, 2000) and a mental-state-based cognitive architecture (Samsonovich, De Jong and Kitsantas, International Journal of Machine Consciousness, 1, 111-130, 2009). Both parts of the study show that the role of metacognition is critical for successful cognitive growth.