CALC: A Cognitive Architecture of Learning and Comprehension

Abstract

Cognitive architectures and unified theories of cognition have the potential to offer significant insight into the process of student learning. This dissertation proposes a cognitive architecture which defines how the mind integrates information into meaningful expressions through the acts of comprehension and learning. The proposed Cognitive Architecture of Learning and Comprehension (CALC), a Situated Model of Comprehension (SMC), and a Socially Situated Model of Comprehension (SSMC), integrate theoretical and empirical evidence from cognition, psychology and semiotics into a coherent model of how the mind comprehends and learns.

A research study on how the mind comprehends new information was performed to identify relevant cognitive correlates of how individuals make sense of nonsense sounds and pictures. Two groups were presented with both reference and relational information (Relational group), or only reference information (Reference group) based on the SMC. It was hypothesized that the Relational group would have higher performance scores (how many they match) and confidence scores (how confident they were in their choice) on all measures. The Need for Cognition assessment was hypothesized to correlate with performance on the task. In the first experiment, a re-interpretation of Bouba-Kiki experiment, the Relational group scored statistically significantly higher than the Reference group for performance ($p = .021$), but not for confidence ($p = .316$). In the Alien Language test, where users had to match sounds and images of an unknown language, MANOVA found that the Relational group scored statistically significantly higher than the Reference group for performance ($p < .0005$), but not for confidence ($p = .651$). In the Alien Language Post-test, where users had to generate the sound for a given alien shape, ANOVA found a statistically significant difference between the groups ($p = .003$). The Need for Cognition assessment had insignificant correlation with the dependent variables and therefore was dropped as a covariate from the analysis. The finding that effortful cognition and confidence in answer choice did not correlate with performance calls into question how information is comprehended and acted upon outside of conscious awareness.