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Quantitative Explorations of Generativity Theory: Conducting Real-Time Simulations of Novel Human Behavior in Problem-Solving Contexts

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Abstract

According to Generativity Theory (GT), introduced by Robert Epstein in 1990, novel behavior in humans and other animals is an orderly result of the ways in which previously established behaviors (established by genetic or environmental histories) become combined over time in demanding situations – situations in which problems must be solved, for example. By definition, a problem-solving situation is one in which the behavior or the sequence of behaviors someone needs to be effective is lacking. In various publications published over the next 25 years, Epstein showed how GT – represented by a series of equations and a computational model – could be used to predict the emergence of novel behavior moment-to-moment in time in both pigeons and people. These predictions were post hoc, however. In a new experiment, we used the GT equations in real-time to predict novel human behavior as it was occurring – that is, to predict behavior that hadn't yet occurred. Three subjects solved several simple problems on a touch screen while the computational model simulated the performance in real-time, rapidly updating its predictions based on real-time feedback from properties of the ongoing performance of the subjects. In these simple problem situations, the computational model was able to stay ahead of the subjects for up to a second with greater than 80% accuracy (using Cohen's kappa). As we improve the model, we will try to (a) make increasingly accurate predictions, (b) make accurate predictions over increasingly longer time periods, and (c) make accurate predictions for increasingly difficult problems. Findings from this research might ultimately prove to have applications in any domain in which it might be useful to predict human behavior (law enforcement, the military, business, and so on). It might also contribute to a better understanding of human problem solving and creativity, as well as to philosophical discussions about free will.