Examining the Goal-Proximity Decision Mechanism: Maze-navigation, incidental learning, Tic-Tac-Toe, and exploration of SecondLife virtual worlds.

by

Vladislav D. Veksler

An Abstract of a Thesis Submitted to the Graduate

Faculty of Rensselaer Polytechnic Institute

in Partial Fulfillment of the

Requirements for the degree of

DOCTOR OF PHILOSOPHY

Major Subject: Cognitive Science

The original of the complete thesis is on file
In the Rensselaer Polytechnic Institute Library

Examining Committee:

Wayne D. Gray, Thesis Adviser

Michael J. Schoelles, Member

Ron Sun, Member

William A. Wallace, Member

Rensselaer Polytechnic Institute
Troy, New York

August, 2009
(For Graduation December, 2009)

ABSTRACT

The current thesis proposes a model of human choice in the absence of prior reward/punishment. The proposed mechanism, GPD (goal-proximity decision mechanism), predicts that when presented with options, with all else being equal, a person will choose the option most strongly associated with their current goal. Association strengths between objects, in turn, are based on the experienced temporal proximity of these objects. GPD is examined for empirical validity, efficiency, and scope, and contrasted with a reward-based trial-and-error model of human choice, RL (reinforcement learning). Experiment 1, employing a forced-choice navigation paradigm, provides evidence that GPD can account for human performance where RL cannot, accounting for human efficiency on trials preceding any reward/punishment. Experiment 2, via the incidental learning paradigm, provides further support that humans can perform above chance level without any reward signal. Finally, GPD is examined in the context of the Tic-Tac-Toe board game, and Second Life™ virtual world exploration. The two simulation environments extend the scope of GPD, expose the differences in the impact of two associative learning rules (error-driven and Hebbian) on GPD performance, and suggest how GPD and RL may be integrated in future research (with GPD being most useful for initial goal-driven behavior, and RL taking over once reward information is available). Additionally, the Second Life virtual world is examined as a testbed for future work with the GPD mechanism, showing great promise as a rich, complex, and dynamic simulation environment.