

An Agent-Based Model of Human Achievement and Self-Efficacy Development

Paul Chiusano, Alex Chovanec, Mike Samples
Center for the Study of Complex Systems
University of Michigan
{pchiusan, achovane, msamples}@umich.edu

Extended Abstract

The notion that most people are not taking close to full advantage of their abilities or potential to achieve is a widespread cultural sentiment. While “overachieving” is arguably a stabler state than underachieving, underachievers still not only exist in society—they appear to constitute the majority of individuals. Similarly, while variety is the “spice of life,” it seems that many individuals opt to confine their life efforts to a small number of endeavors. We are interested in developing a model of human achievement which captures some of the rich, complex behavior observed in individuals and groups of individuals developing their abilities and self-efficacy.

Our approach differs from adaptive specialization models in organizational theory and insect sociology in that we are explicitly modeling agents’ beliefs. We consider a model of human achievement in which agents are unaware of both their own abilities and the actual difficulty levels of activities in the world and rely instead on their (not necessarily accurate) estimations of these values. We draw on the extensive literature in social cognitive theory on motivation and self-efficacy to guide us toward reasonable agent learning rules.

The world for our model consists of a collection of agents connected by some social network. The world has various types of activities that need to be (or can be) performed by agents. Activities may be competitive (like publishing a paper) or uncompetitive (whistling). Activities have an *actual difficulty level* associated with them.

Agents have parameters associated with each type of activity in the world: *actual ability* and *perceived ability*. They also have a function which evaluates the activity’s *perceived difficulty*. The model is run by having a “fate” function continually select agents for activities (alternately, agents may volunteer for activities). An agent can choose to participate, and his decision is based on his expected likelihood of success (perhaps *perceived ability* – *perceived difficulty*).

Perceived difficulty is based not only on the agent’s own experiences and attitudes, but on those of his neighbors. Thus, agents learn vicariously: when they observe those around them succeeding at an activity, they decrease their perception of the activity’s difficulty and become more likely to attempt it themselves. Likewise, when agents observe those around them failing, the agents’ perceptions of difficulty increase, and they become less likely to attempt the activity. As is suggested by social cognitive theory, agents are most influenced by others that seem similar to themselves.

If an agent decides to participate in an activity, we examine his actual ability and

probabilistically return a “success” signal if it is greater than the ADL of the activity. Otherwise, we send a “failure” signal. In either case, the agent’s actual ability is increased and the agent incorporates whatever feedback he receives. This in turn affects his future decisions (an agent who was successful at an activity in the past is more likely to attempt it in the future, etc.)

Running the model, we might hope for the emergence of regions of overachievers and underachievers, or, in the case of a multi-activity world, the emergence of specialization. We can then ask questions like: what traits characterize successful vs. unsuccessful agents? What are the most “effective” groupings of agents and strategies for success? Do agents usually have accurate perceptions of their abilities? There is a connection here to attribution theory—we might ask which explanatory styles (if any) lead to convergence of an agent’s perceptions with reality. Which explanatory styles lead to greatest success for an agent?