Chapter 17
AI-Augmented Developmental Instruction for Improving Contemplative Practices in the Face of Complexity

Andrew G. Stricker
https://orcid.org/0000-0002-4184-0554
The Air University, USA

Cynthia Calongne
Colorado Technical University, USA

Barbara Truman
https://orcid.org/0000-0002-7839-1772
University of Central Florida, USA

David J. Lyle
Air Education and Training Command, USA

J. J. Jacobson
University of California – Riverside, USA

ABSTRACT

A simulation design is introduced for using artificial intelligence (AI)-augmented developmental instruction for improving contemplative practices in the face of complexity. The focus of the design is on developmental instruction in the use of contemplative cognitive and moral reasoning practices to improve self-awareness and means to better discern and address complicated and complex challenges. Developmental instruction is supported by an AI-augmented tutoring aid provided during a simulated mission to Mars within an immersive 3D-world. A set of tasks are introduced during the Mars simulation to assist with the development of contemplative practices. The AI-augmented tutoring aid assists participants in the simulation to better understand and apply contemplative practices involving cognitive and moral reasoning meta-thinking suitable for each task. High levels of fidelity, involving visual, auditory, and interactive model-based reasoning (MBR) tools help to embed the senses, thoughts, and actions of participants in the feeling of traveling and being on Mars.

DOI: 10.4018/978-1-5225-9679-0.ch017

INTRODUCTION

Since the second half of the twentieth century, physics has gradually lost the concision and simplicity of its classical theories. Modern theoretical models have become more and more complex, vague, and uncertain. Experimental verifications has become more difficult as well. (The Three-Body Problem, Cixin Liu, 2014)

In Cixin Liu's science fiction novel, *The Three-Body Problem*, he introduces to readers several big questions related to complexity facing science and the developmental journey among key scientists in the novel about how their self-awareness grows in discerning and addressing complexity. Liu's novel, winner of the Hugo Award for Best Novel, interweaves hard science with speculative fiction. Indeed, the title of the novel itself is a plot device for the unfolding story making use of the hard science that there is no solution to the general three-body problem in quantum mechanics. In general terms, the motion of three bodies in relation to each other is generally non-repeating, except in special cases. A complete solution for a particular three-body problem would provide the positions for three particles for all time (across time), given three initial positions and initial velocities. Unfortunately, no closed-form solution can be definitively offered for such a problem. This phenomenon is inherent to the chaotic nature of the time evolution of three-body or "n-body" (more than 2-body) systems. On a larger scale, for example, the three-body problem represented by the Moon, the Earth, and the Sun, takes a restrictive form whereby periodic calculated approximations are used to make predictions of trajectories of orbiting objects. In the case of space flight, a four-body problem (spacecraft, Earth, Sun, Moon), for example, can shift approximately to a three-body problem when gravity becomes negligible as the spacecraft travels further from a large mass and reverts back to a four-body problem when approaching an additional large mass such as another planet (e.g., Jupiter) and a moon (e.g., Europa) in addition to the Sun. In this example, the periodic calculated approximations require a computer to continuously analyze the calculated solutions.

The three-body problem helps to highlight the nature of some challenges encountered with evolving complex human-activity systems wherein no known solutions exist and the time evolution of system features is generally non-repeating and in flux (irreducible complexity). Such situations call for regular sense-making, approximations, and emergent strategies for solutions that cannot be tested in advance and will need to be adapted over time. But, not all challenges encountered by people with human-activity systems take the speculative form of a three-body problem. Rather, there are two-body problem forms (e.g., in classical mechanics; for example, a satellite orbiting a planet wherein the center of mass is always constant) involving the means to obtain a correct solution even though the system possesses complicated features (e.g., calculating the central force upon the satellite in orbit over time; uncertainty can be reduced given enough time and discovery of key features for a closed-form solution). Thus, some people can expect to encounter challenges representing forms of two-body problems (complicated) and three-body problems (complex). Generally speaking, post-secondary education can prepare most people with the means to initially address complicated challenges and offer the means for developing skills to improve over time. Unfortunately, however, most people are not well prepared to address challenges involving multidimensional aspects of irreducible complexity. This explains the need for developmental instruction for improving contemplative practices in the face of complexity. The following sections in this chapter explore in greater depth the nature of complexity, why there is a need to help people learn about differences between complicated and complex challenges, and describes a simulation design mak-

Related Content