**CD++ Model Data Form**

Title: Reactive Agents

Type:

Acronym/Short name: RA

Purpose for which Developed: to model, simulate, and verify the behavior of a flexible agent that moves based on its level of comfort and/or desire in each cell to exhibit the behavior of an agent that reacts to environmental situations or important game events.

Additionally, this provides a model of agents with area and cone exploratory behavior and agent movement with varying reactions speeds. The interplay between desire and discomfort can be simulated and visualized with flexible control over the agents’ preference to each such parameter.

Other Applications for which it is Suitable: Any behavior of entities that need to move to all eight cardinal and ordinal directions following one or more rules.

Date Developed/Implemented: 21-DEC-2020

Domain: Game Environments, Virtual Environments

Current Version: 1.0

URL:

Description (including characteristics): The core concept of comfort and desirability is derived from the “*Combining Influence Maps and Cellular Automata for Reactive Game Agents*” article by *Penelope Sweetser* and *Janet Wiles.*

Our model derives from the ideas presented in this article and presents a more complicated model of reactive agents using CD++. In our model, the game terrain is represented by a W x W cell grid, where W is the system size. Each cell in the system multiple state variables representing the amount of heat, pressure, and wetness if an agent were to occupy that cell. We define nine different cell types (Volcano, Lava, Heated, Tornado, Gust, Breeze, River, Storm, and Drizzle) and three different primary agents (Human, Fiery Monster, Vapor Alien) that can occupy these cells.

At each time step, each agent determines the *level of comfort* it feels when standing atop a cell. The level of comfort decreases as cell values increase. Agents start anywhere in the terrain and try to cross the terrain from left to right without colliding with any other agent in the system. While having this right-moving behavior, they always consider their current level of comfort and may move in opposite directions or take turnarounds if necessary to be as comfortable as possible. Depending on the current *level of comfort*, these comfort-driven agents might react faster if they’re feeling highly or extremely uncomfortable.

In addition to comfort, cells might also have certain desirability associated with them. Five different desire-driven agent types (R-01, R-02, R-03, R-04, R-05) are modeled with a varying preference towards comfort and desire. Finally, Exploratory agents are also modeled with area and frontal-cone exploration capabilities.

Links to Related Documents (External Paper)

Short Title: Combining Influence Maps and Cellular Automata for Reactive Game Agents.

URL: https://link.springer.com/chapter/10.1007/11508069\_68

Description: This paper presents an agent design that combines cellular automata for environmental modeling with influence maps for agent decision-making. The agents were implemented into a 3D game environment, the EmerGEnT system, and tuned through three experiments. The result is simple, flexible game agents that can respond to natural phenomena (e.g., rain or fire) while pursuing a goal.

Keywords: Game Environments, Reactive Agents, Cellular Automata, Cell-DEVS, DEVS, Environmental Modeling

Developer:

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Comments: This model works, it`s ok