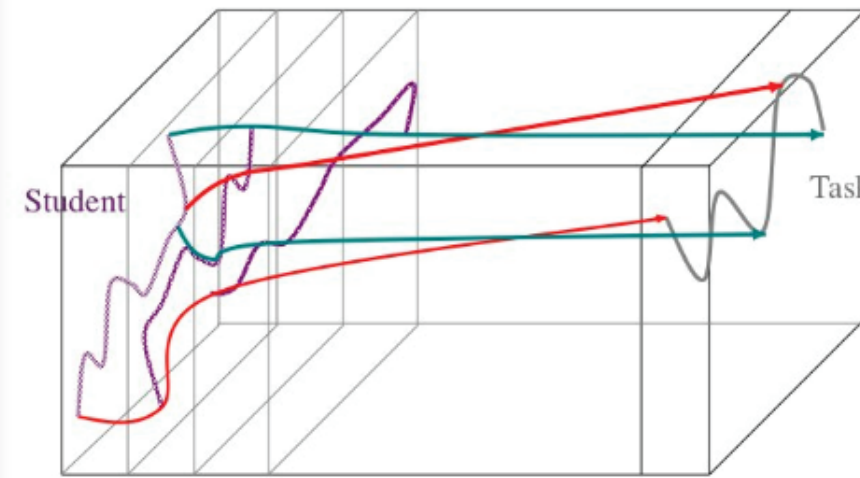


# Modeling Emotions in Simulated Learning

## Consciousness

The "C" layer of the COVE model utilizes 6 of the 16 CHC factors to model conceptual knowledge: general storage and retrieval (Gc, Glr, Gkn); and specific storage and retrieval abilities (Gq, Grw, Gp).



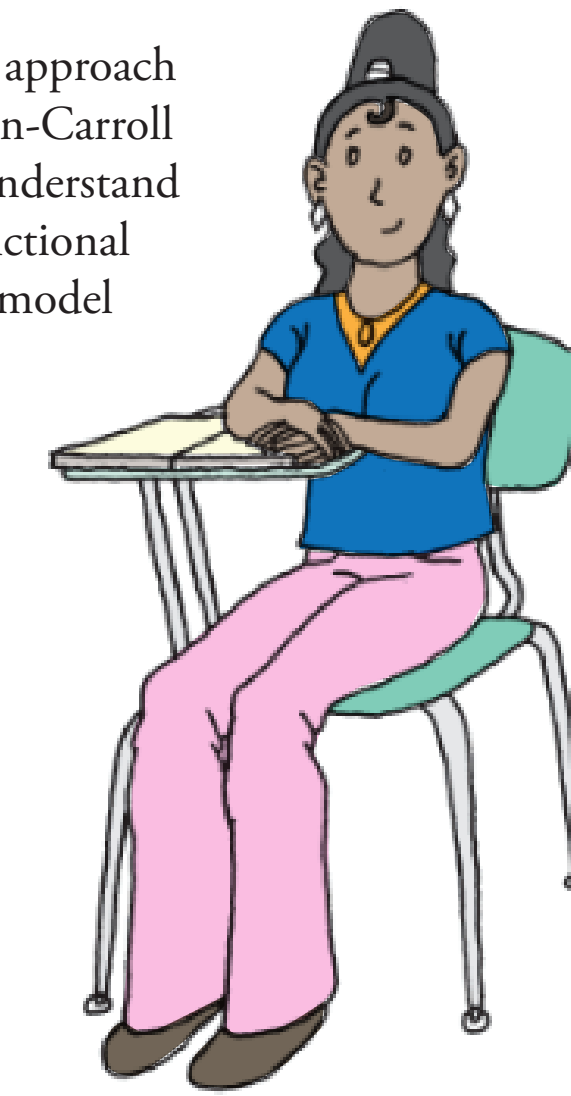
Incremental changes in the COV variable are computed based on an underlying set of rules, which relate the agent's variables to each other as well as the target task in the E layer. The rules embody an overlapping set of theories related to the learning sciences that include the zone of proximal development, cognitive load theory, circumplex theory, and a theory relating circumplex theory to the OCEAN model.

OCEAN variables are set on a scale of 21 units (.1) from -1 to 1, with 0 at the midpoint, which allows the software agent to possess emotional valences and base its behavior on a range of actions. The "O" layer of the agent learning model can represent 21^5 or over 4 million OCEAN emotional personality states that have not yet been linked to categorical models of emotion.

## OCEAN

The "O" layer of the COVE model utilizes five CHC factors involved in processing and reasoning (Gf, Gs, Gt, Gps, Gsm) as well as the 5-Factor Model or OCEAN model of psychology.

- Openness to learning
- Conscientiousness toward tasks
- Extraversion to introversion
- Agreeableness
- Neuroticism - emotional stability



## Visual Auditory Kinesthetic

The "O" layer of the COVE model utilizes five CHC factors involved in processing and reasoning (Gf, Gs, Gt, Gps, Gsm) as well as the 5-Factor Model or OCEAN model of psychology.



The physiological "V" variables are set on a 21 position scale from 0 to 1, representing a threshold level in addition to a range of ability or preference. The concept of preference is useful for connecting the model to "learning styles theory" and that of ability is useful for connecting to theories of intelligence. For example, if someone is not blind, then to what extent do they tend to favor or prefer to organize learning through the visual pathway?

## Environment

The E layer is the external environment, which in a classroom includes the task set before a student by the teacher and things the teacher might say to the student, as well as what others in the class say and do in reaction to the same stimuli.

### What Teachers Do (Independent Variables)

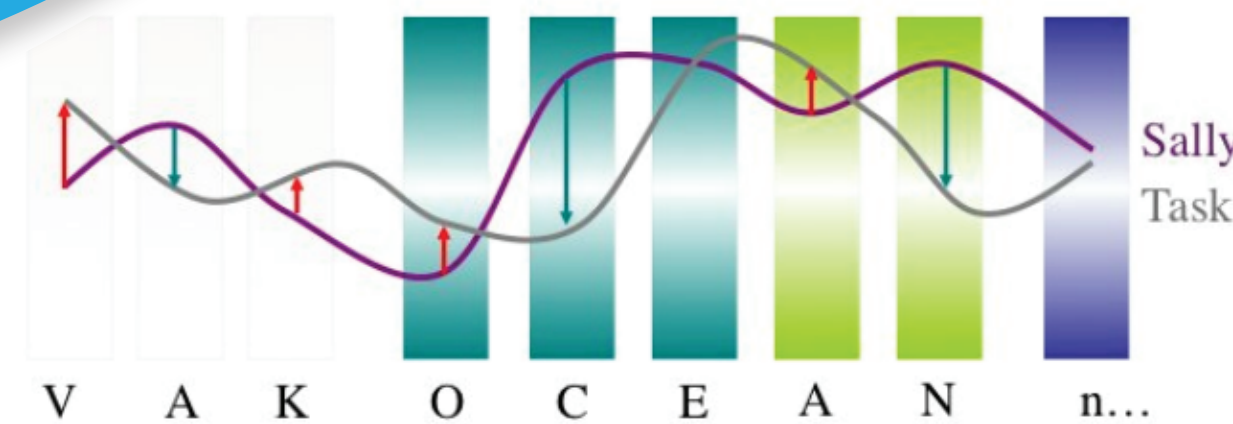
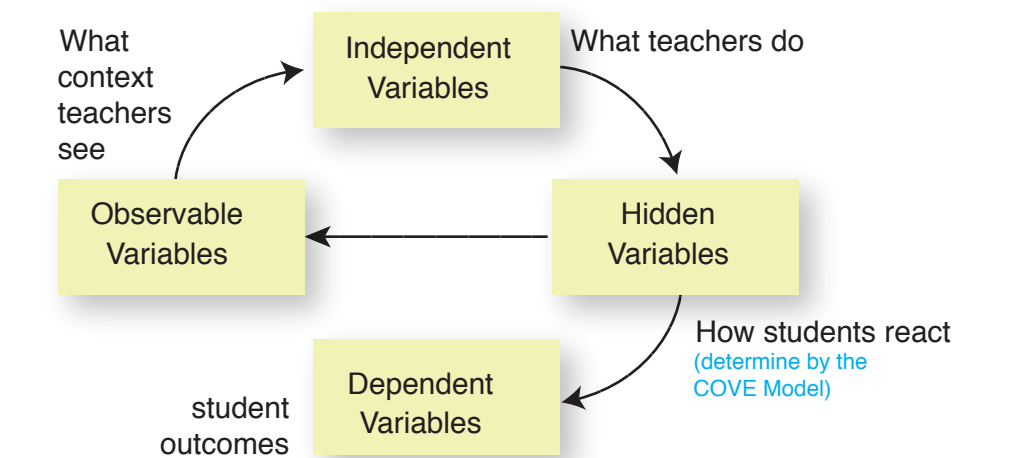
#### Select Tasks

- Emotional, Physical & Cognitive current states of students interact with task requirements
- A Zone of Proximal Development determines time-to-success on task and effects students attitudes

#### Talk to simStudents

- Questions, observations, or assertions about academic or behavioral issues

### simSchool's "Engine"



In brief, simSchool uses a dynamic modeling approach in which the user is a teacher who is an independent actor that chooses tasks and talking interactions, which in turn act as attractors for the simstudents. The artificial intelligence driving each simulated student is a 9 dimensional hill-climbing algorithm. Each student attempts to reach equilibrium by attaining the goals of a given task if the task and setting do not impose too many barriers and the system is not perturbed by any other user actions. The time it takes simstudents to reach equilibrium with a task is determined by how their personality variables (V-layer physical, O-layer emotional and C-layer cognitive variables) interact with the E-layer requirements of the tasks and the teacher's talking choices.