



U.S. Army Research, Development and Engineering Command

ADAPTIVE GAME-BASED TUTORING: MECHANISMS FOR REAL-TIME FEEDBACK AND ADAPTATION

ARL

TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

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Army Learning Concept 2015:

- Technology Focused
- Self-paced and Self-guided
- Interactive
- Individualized
- Accessible



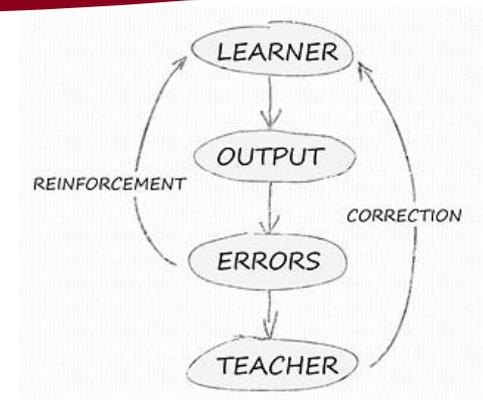
- **Simulation-Based Training (SBT)**
 - proven to be effective tools to facilitate learning and cognitive development
 - Replaces traditional instructional techniques with role-playing and self-regulated exercises
 - Provides a safe environment for ‘practicing’ the application of task-oriented skills
- **Serious Games**
 - SBT applications with pedagogical heuristics guiding software, art, and story development
 - Includes elements of entertainment games intended to promote FLOW and Motivation
 - Extend benefits to home use



- **FEEDBACK**

- Crucial to Learning and ‘Flow’
- Relay impact of moment-to-moment decisions and actions of outcomes
- Incorporates Implicit and Explicit information
 - Implicit feedback: tied to direct context of interaction within learning environment
 - **Explicit feedback: provides ‘verification’ and ‘elaboration’ of information as performance relates to overall objectives**

Games are limited in this capacity



Learner Model

- Representation of a learner's current knowledge state within a domain

Pedagogical Model

- Application of learning theory to balance challenge and guidance during a learning event

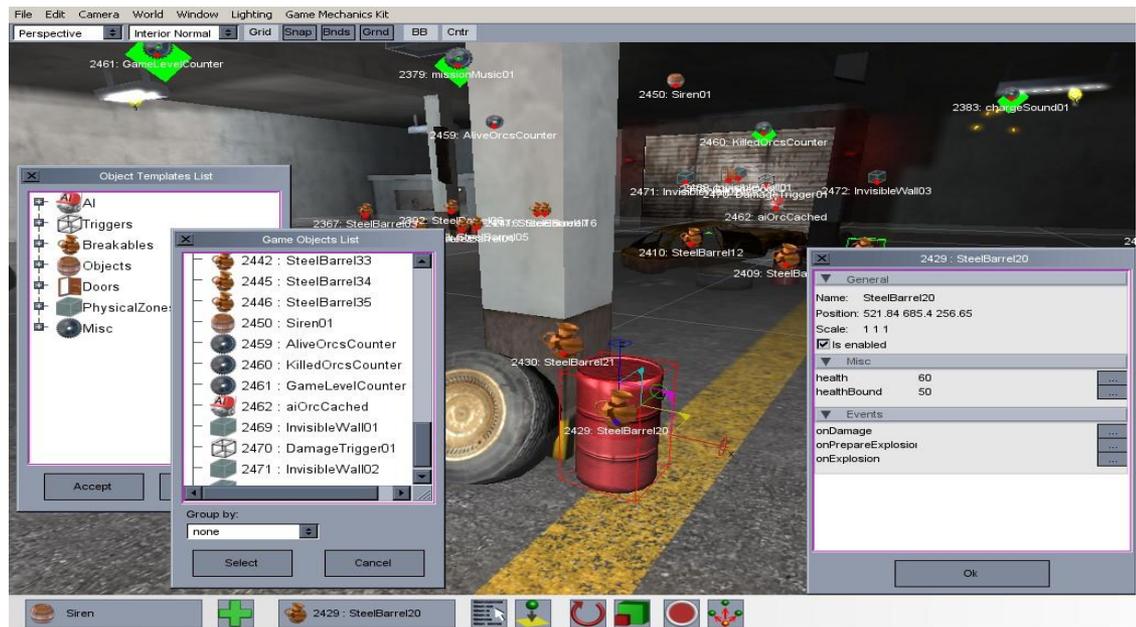
Domain Model

- Contains all relevant information linked to a task or subject (i.e., domain knowledge structure, expert models, etc.)

Communication Model

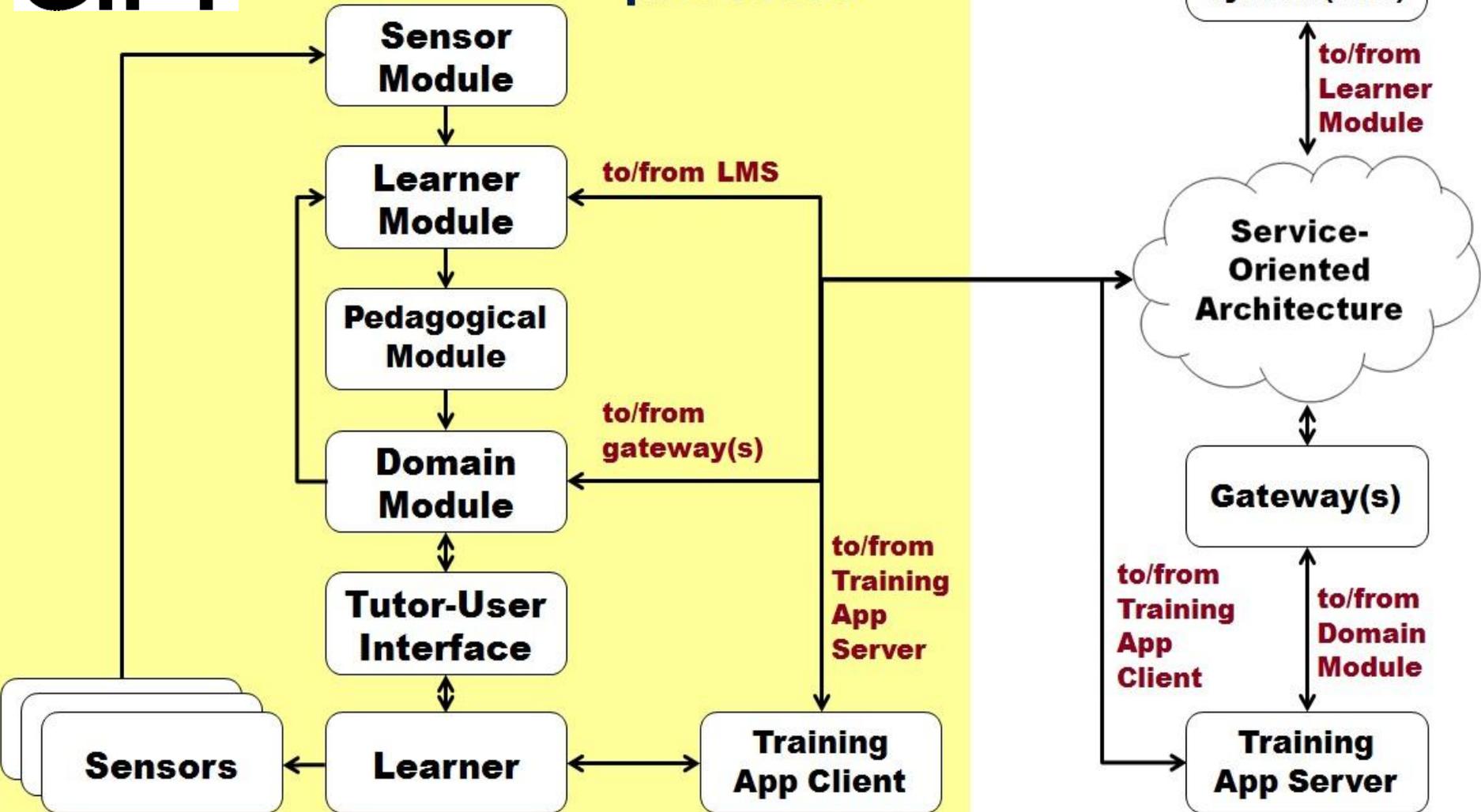
- Controls tutor-learner interaction through determinations of how best to present information

- Games are frequently developed with unique messaging structures
 - Developers often do not abide by CBTS/Simulation Interoperability Standards [1]
- Games are dependent on their Application Programming Interface (API)
 - Requires custom scripting for content injection and scenario adaptation
 - Depending on the platform, the API can be unavailable or difficult to work with

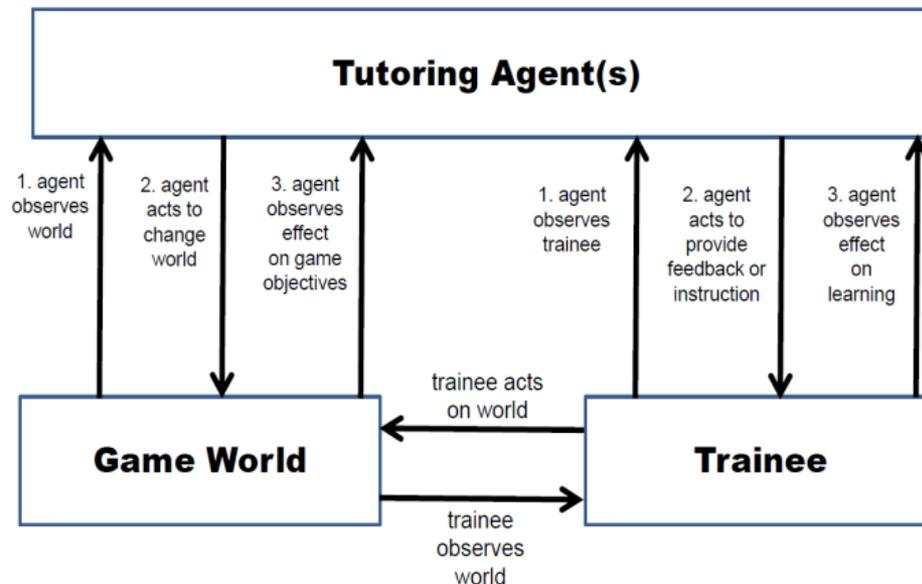




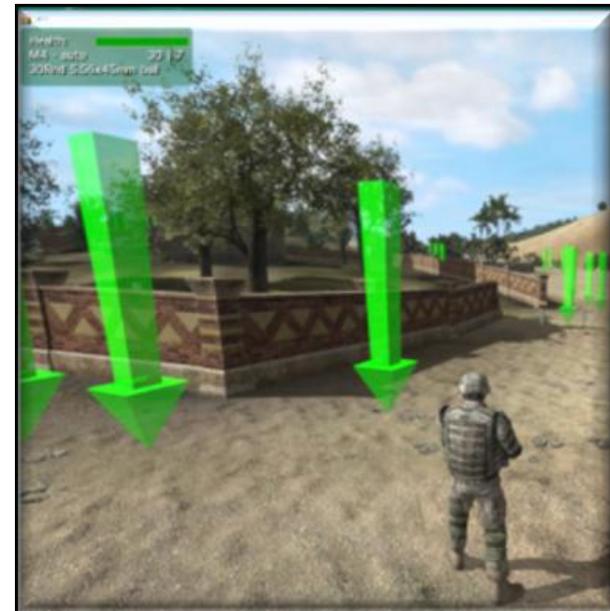
local tutoring processes



- **Challenge**
 - No standardized approach for interpreting learner interaction
 - System concepts (i.e., inputs, processes, and outputs) vary between platforms [2]
- **Requirement**
 - Development of a connection layer that translates game network traffic for interpretation by a Computer-Based Tutoring System [3]

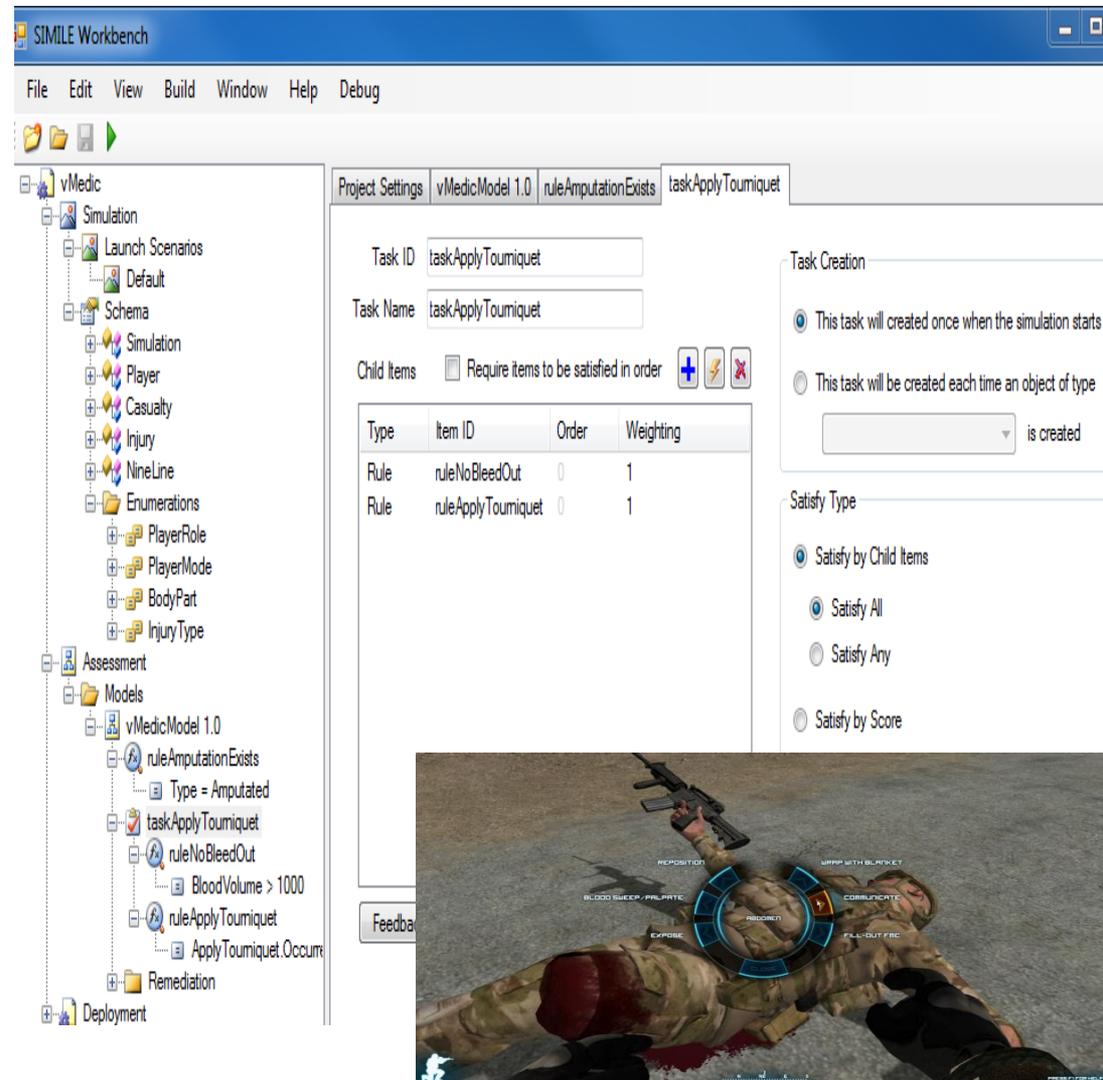


- **Challenge**
 - Provide feedback and adapt scenario elements as a learner progresses through task execution
- **Requirement**
 - Communication mechanism between the game world and the domain model
 - **Connect prescribed pedagogical interventions to associated game-specific actions**
 - Hints
 - Prompts
 - Demonstrations
 - Change of Difficulty



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- **Standardized, adaptable, and generic mechanism for learner assessment in simulated training environments**
- **Middleware with tools for the creation of assessment models that are distinct and separate from the simulation itself**
 - **Example Shown: Model rules for applying a tourniquet in the TC3 vMedic Trainer**



SIMILE Workbench

File Edit View Build Window Help Debug

Project Settings vMedicModel 1.0 ruleAmputationExists taskApplyTourniquet

Task ID: taskApplyTourniquet

Task Name: taskApplyTourniquet

Child Items: Require items to be satisfied in order

Type	Item ID	Order	Weighting
Rule	ruleNoBleedOut	0	1
Rule	ruleApplyTourniquet	0	1

Task Creation:

- This task will be created once when the simulation starts
- This task will be created each time an object of type is created

Satisfy Type:

- Satisfy by Child Items
- Satisfy All
- Satisfy Any
- Satisfy by Score

Feedback



- **A Focus on Research**
 - **Two Themes**
 - **Standardized Stealth Assessments**
 - **Evidence-Centered Design (ECD)**
 - **Feedback and Adaptation in Game Environments**
 - **Feedback Modalities**
 - **New elements available to communicate with learner**
 - **Real-Time Scenario Adjustments**

