Human Behavior Models and Unreal Tournament

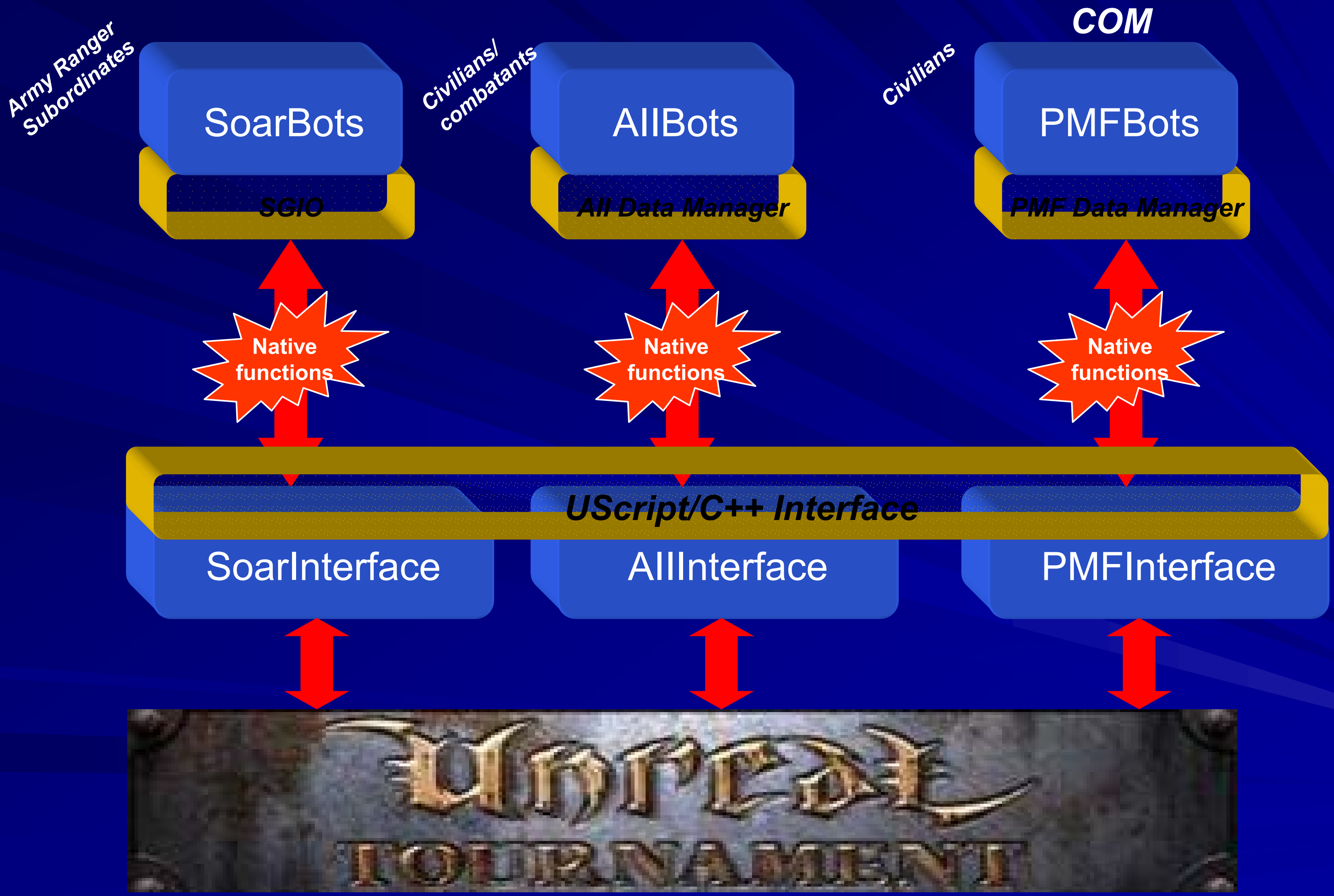
Soar Workshop
June 27, 2003

Ryan McAlinden
Institute for Creative Technologies
mcalinden@ict.usc.edu

Introduction

- Objective: Demonstration of simulation-independent, goal-directed tactical Human Behavior Models (HBMs) that reflect Non-Player Character (NPC) behavior, navigation, and emotion
- Team
  - Institute for Creative Technologies (ICT)– Lead software integrator
  - University of Michigan– Soar
  - Biographic Technologies– AI.Implant
  - University of Pennsylvania– Performance Moderator Functions (PMFs)
  - Quicksilver Software, Inc– Unreal Tournament assets
  - Defense Modeling and Simulation Organization (DMSO)
- Component Overview
  - Simulation Environment– Unreal Tournament
  - 3 individually developed Human Behavior Models (HBMs)
    - Soar: serves as the central behavior generation component
    - AI.Implant: Path-planning and navigation middleware
    - Performance Moderator Functions: Emotional and physiological effect's modeling
  - Customized Unreal Tournament assets and scripts
    - ICT
    - Quicksilver Software, Inc.

HBM Architecture



Army Ranger Subordinates

SoarBots

SGIO

Civilians/ combatants

AIIBots

AII Data Manager

COM

Civilians

PMFBots

PMF Data Manager

Native functions

Native functions

Native functions

UScript/C++ Interface

SoarInterface

AIIInterface

PMFInterface

Unreal Tournament– Why?

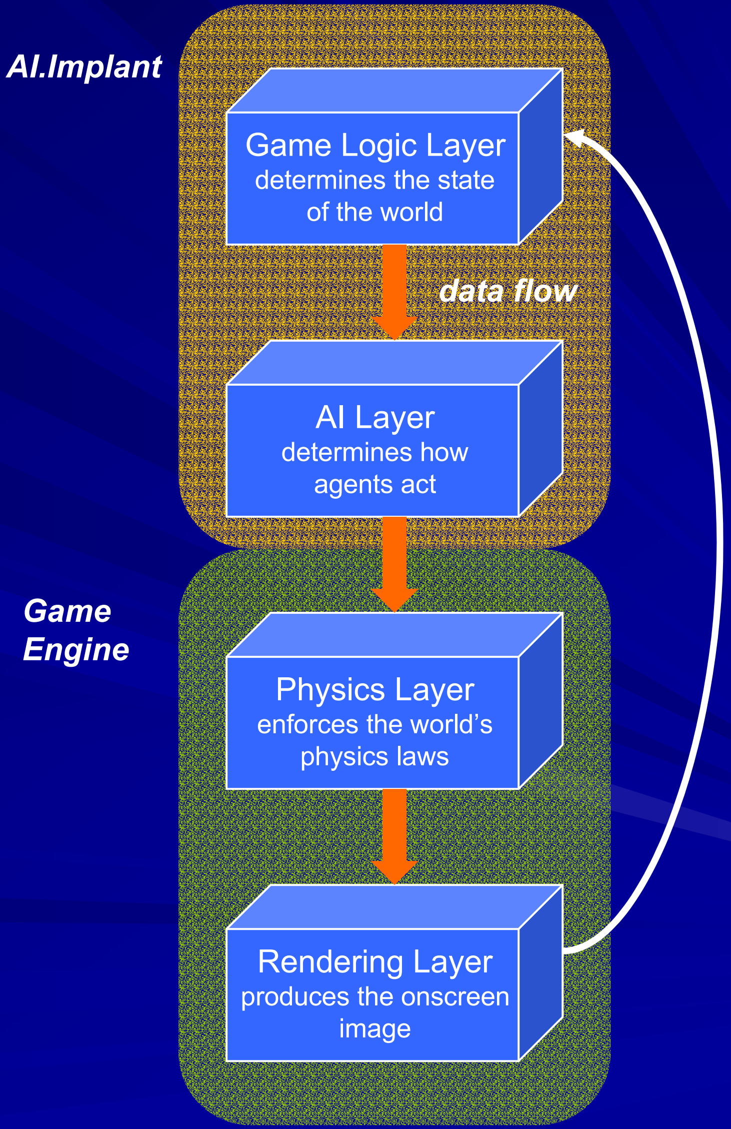
- Highly modularized and replaceable
- A C++ interface based on an object model that is similar to Microsoft Foundation Classes (MFC)
- Supports dynamic loading of DLLs and scripts on demand
- Robust debugging environment, with Visual C++ debugger support
- An UnrealScript interface based on an object model that is similar to Java

Soar

- Utilizes existing Agent MOUTBots– added follow and tactical scanning operators
  - Manages subordinate bot navigation, communication, and attack behaviors
- Nuggets
  - Straightforward operator/production additions
  - SGIO
  - n-level behavior modeling
- Coal
  - Difficult to debug
  - Communication between Soar and the Game Engine

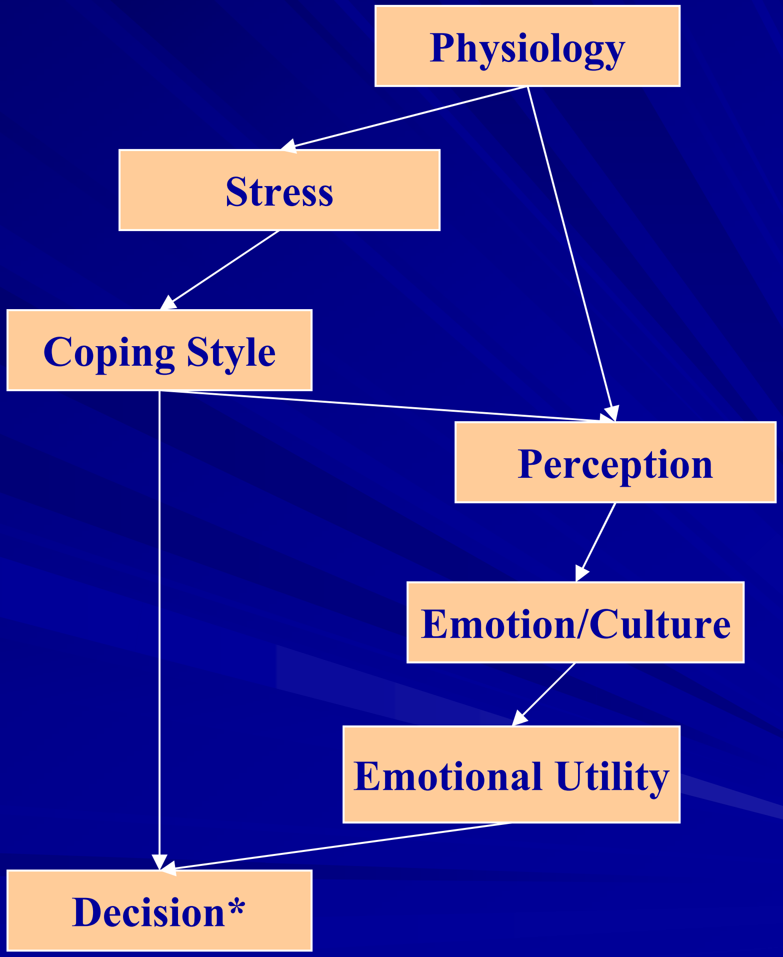
AI.Implant

- Overview
  - Autonomous character creation and management– allows developers to build and control Game AI more easily
    - Group/targeted behaviors
    - Basic navigation and path planning
  - SDK– C++ middleware residing from the Game Logic Layer (state of the simulation) to the Physics layer
- Nuggets
  - Simple development of complex AI controls
  - Developer extendibility of existing behaviors
  - Relatively simulation-independent
  - Straightforward SDK that contains a suite of C++ APIs
- Coal
  - Limited set of included behaviors
  - Isolated APIs
  - No platform cross-compatibility
  - Documentation


AI.Implant
Game Logic Layer
determines the state of the world
data flow
AI Layer
determines how agents act
Game Engine
Physics Layer
enforces the world's physics laws
Rendering Layer
produces the onscreen image

Performance Moderator Functions (PMFs)

- Reflects physiological and emotional states of simulation-controlled players
- Nuggets
  - Modular system that is simulation-independent
  - Models multiple "coping styles" within one architecture
  - Multiple levels of CGF customization
  - Reusable, rapidly composable entities
- Coal
  - Lacks a central AI system to control other aspects of character intelligence, movement, and behavior



Conclusion

- HBMs can enhance current simulation capabilities by modeling fairly complex human behaviors and emotions catered to a specific discipline or genre (i.e. military tactics)
- Overall Nuggets
  - Able to qualitatively evaluate how different behavior models interact with one another simultaneously
  - Unreal I Game Engine provides a relatively seamless integration of external components
  - Relatively robust communication mechanisms of HBMs
- Overall Coal
  - Too tightly integrated with simulation
  - Game Engine and asynchronous HBMs don’t always exchange data correctly

Demonstration

- Custom-developed Mogadishu level, animations and character models
  - Based off *Black Hawk Down* scenario
- 3 subordinate SoarBots (Army Rangers)
- 2-5 AI.Implant Bots (civilians, militia)
- 1 PMF Bot

PMFServ
Penn

Rapidly Deployable, PMF-Based
Human Behavior Modeling

SOAR

Unreal Tournament

AI·implant™

Questions?