

Interoperable Adaptivity and Learning Analytics for Serious Games in Image Interpretation

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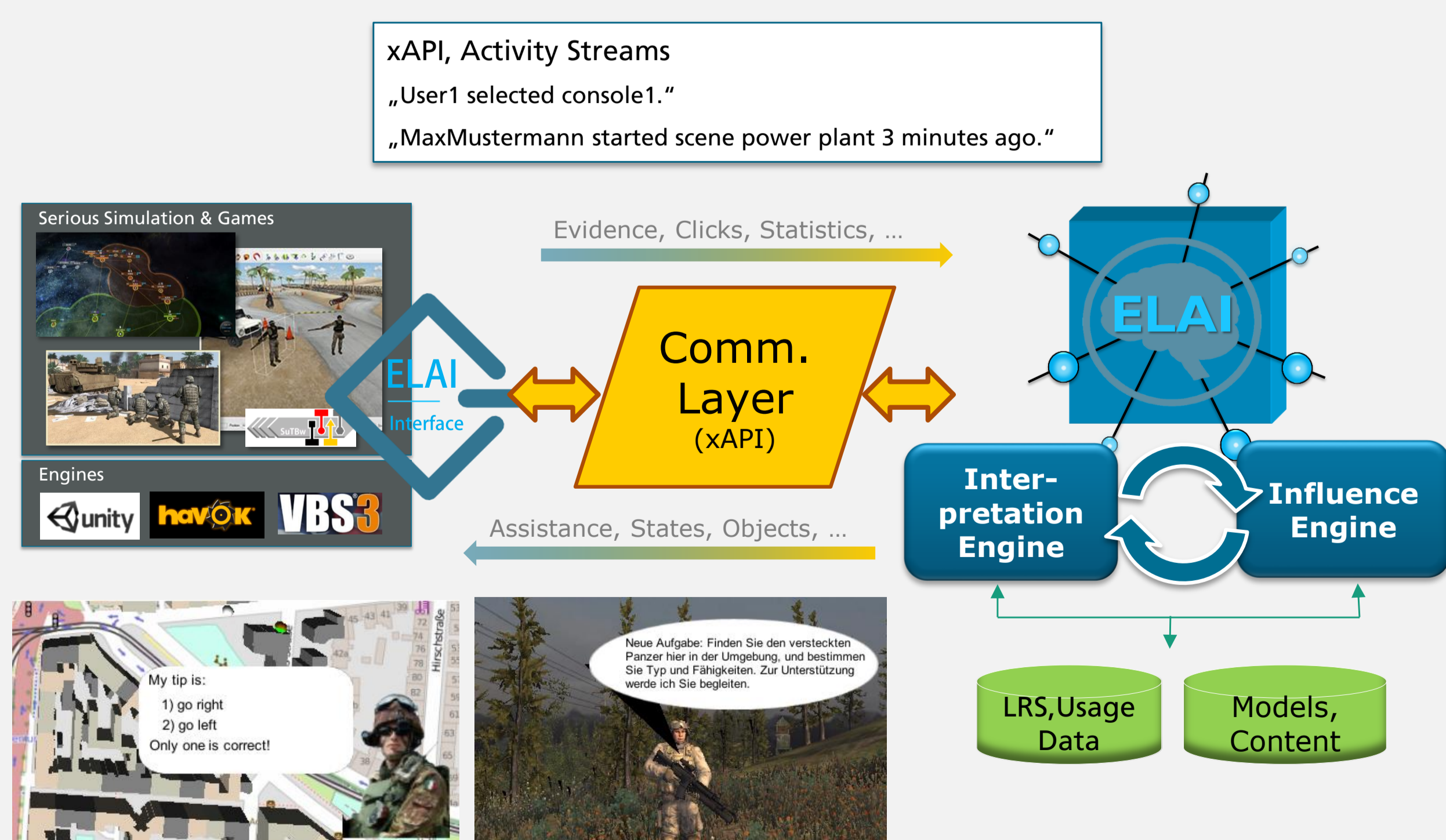
Introduction & Objectives

- Adaptive Serious Games for education and training
- Artificial Intelligence (A.I.) for automatic adaptation
- Increase of learning outcome in aerial and satellite image interpretation; increase motivation (Flow)
- Interoperability for multi-/cross-system applications

Solution Approach & Concept

- Decentralized software architecture and externalized adaptivity logic ("E-Learning A.I.", ELAI)
- Minimal-invasive, bi-directional game engine adapter
 - Usage data collection (xAPI) → Learning Analytics
 - Genre-specific adaptation strategies → Adaptivity
- Usage of interoperability standards, e.g. xAPI, HLA
- Applicable to heterogeneous application scenarios and different game engines

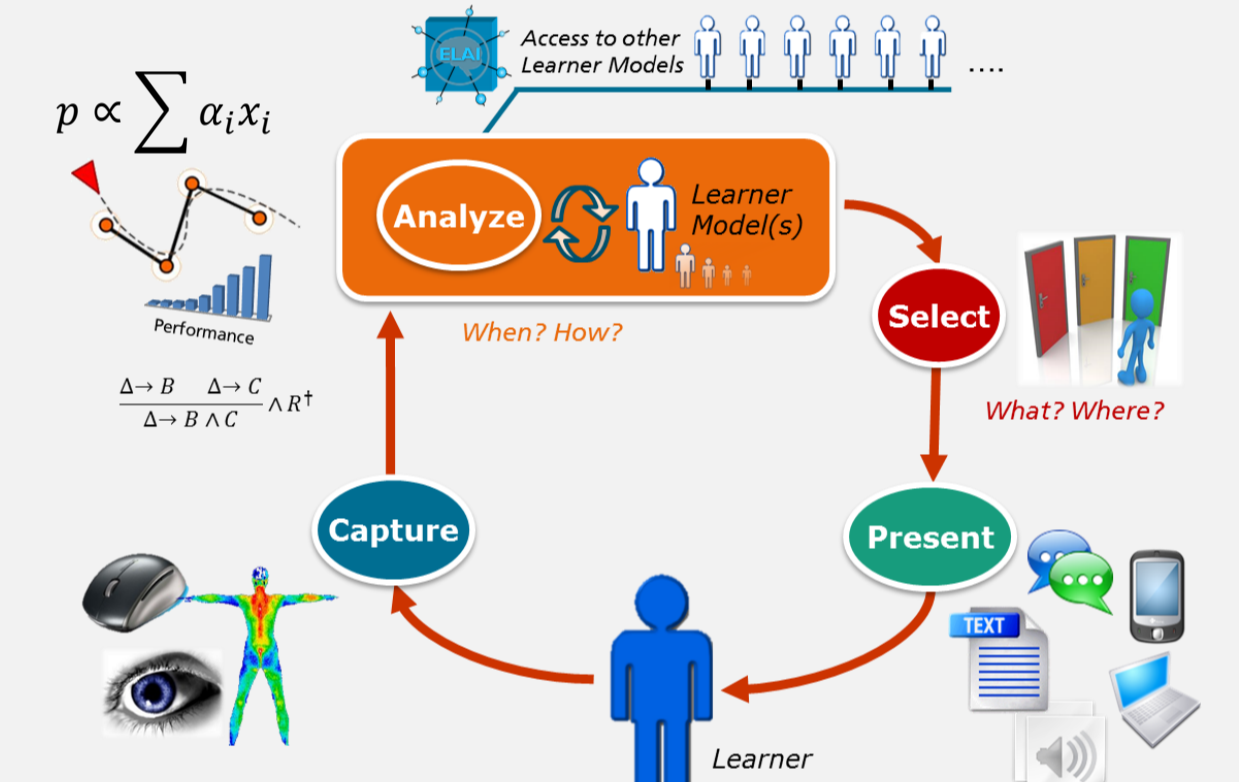
ELAI Architecture



ELAI: Interoperable, externalized e-learning adaptivity for game-engines based applications

ELAI Controller, Tutoring Agent, Adaptivity

- Interpretation Engine** to determine learner states
 - Rule-based heuristics (*Didactic Factors*), i.e., assessing learner states and performance scores
 - Learner classification based on clustering (k-means)
- Influence Engine**: different adaptation strategies using Intelligent Virtual Agents (IVA), Adap. Learning Paths, etc.
- ELAI Tutoring System for Learning Analytics and manual adaptation control, e.g., adjustment of IVA helping level



Application Prototype

- Unity-based seek-and-find mapping game with ELAI-Adapter
- Dynamic Difficulty Adjustment (DDA) for dynamic image modifications, e.g., artificially generated clouding



Related Work

- ALIGN architecture for adaptive serious games
- RAGE: Realizing an Applied Gaming Eco-System
- Total Learning Architecture (TLA), ADL.gov, xAPI

Summary

- Adaptivity for serious games and computer simulations
- Concept successfully applied to Unity-based games
- Decentralized software architecture enables easy integration of other games and simulations (future work)

