
E-Learning A.I. for Simulations and Serious Games in Image Interpretation

Keywords:

adaptivity; learning analytics; simulations; serious games

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AGENDA

- Challenges in Image Interpretation, Why adapt?
- E-Learning A.I.
- Interoperable E-Learning A.I. (ELAI)
- Application example for Image Interpretation, Serious Game "Lost Earth 2307"
- Summary & Outlook

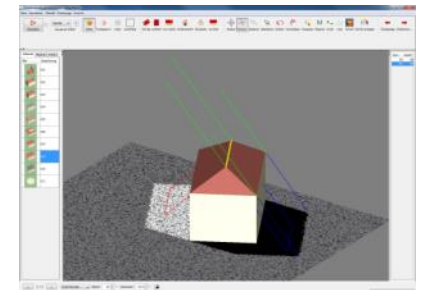
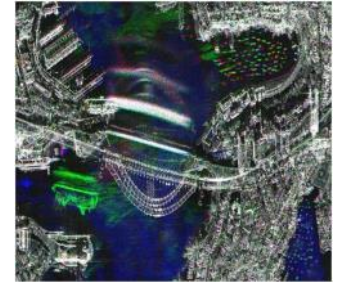
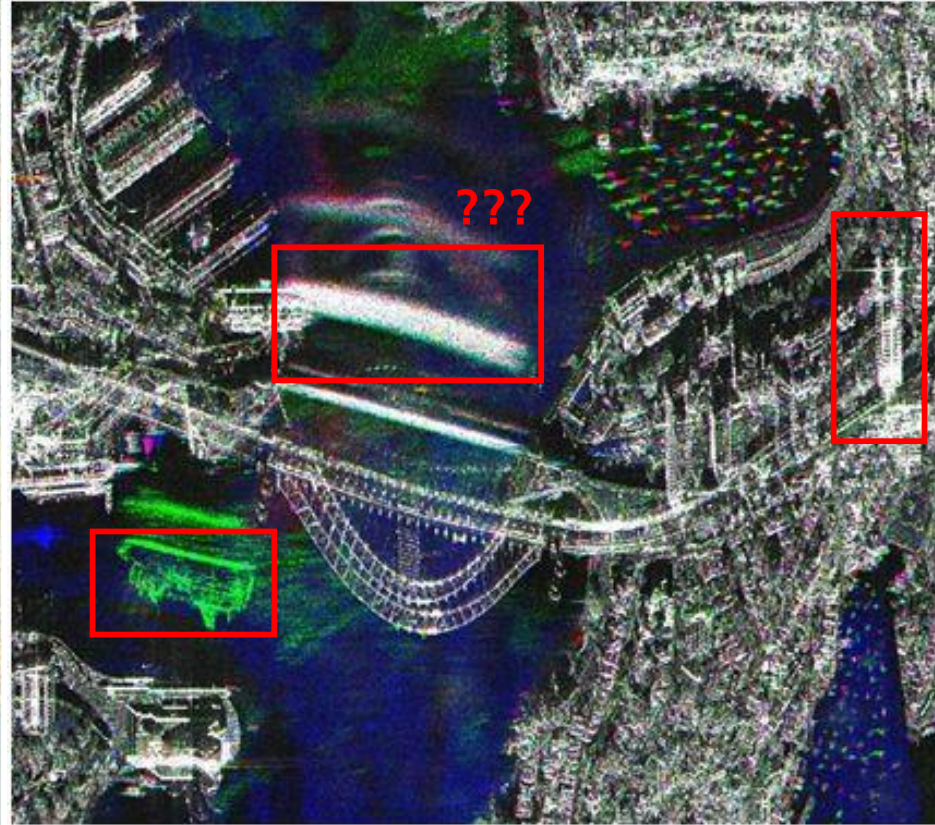


Image Interpretation – Radar, Challenges, Need for Learning & Training



Optical Image – Source: Google

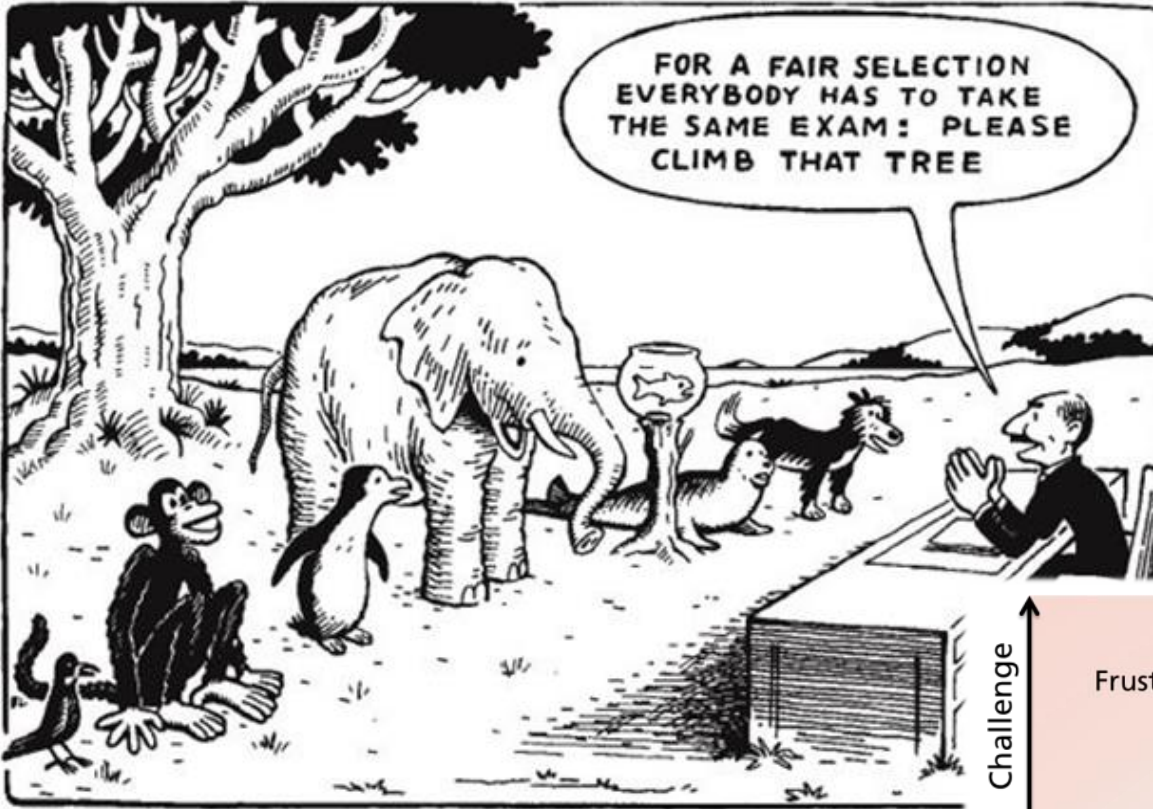
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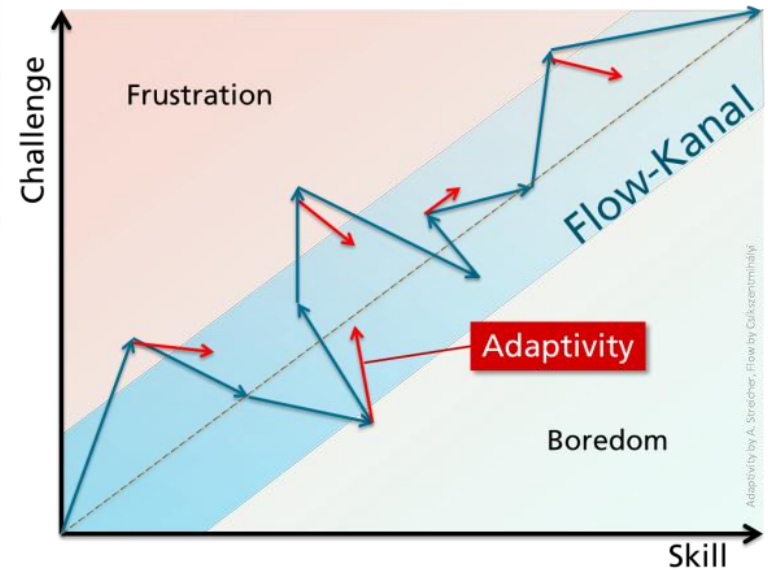
TerraSAR-X Image – Source: Infoterra

Radar
(SAR)

Why Adaptivity for Learning?

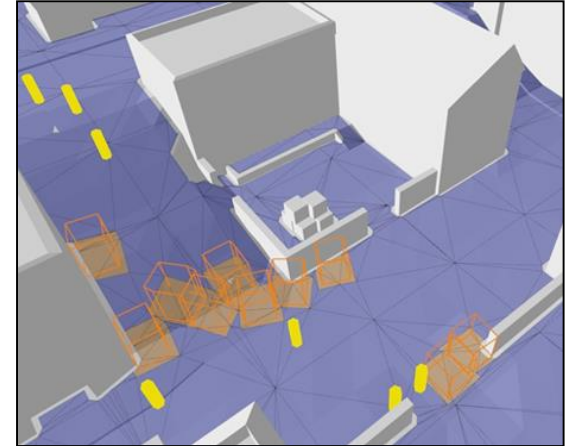


Adaptivity → Flow → Immersion
→ Greater Learning Effects

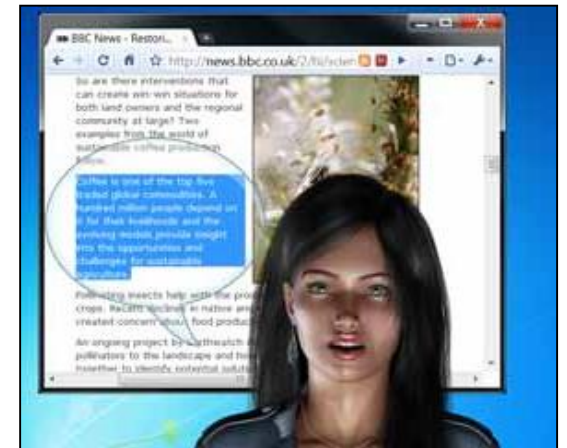


A.I. in Games

- Today: mostly just path planning
- In high-rated games focus is on graphics, real A.I. development seems to stagnate
- We need E-Learning + A.I. *for games* !
- Use existing technologies from other domains, e.g.
 - Intelligent Virtual Agents
 - Cognitive Architectures
 - Intelligent Tutoring Systems
 - Didactic models
 - ...

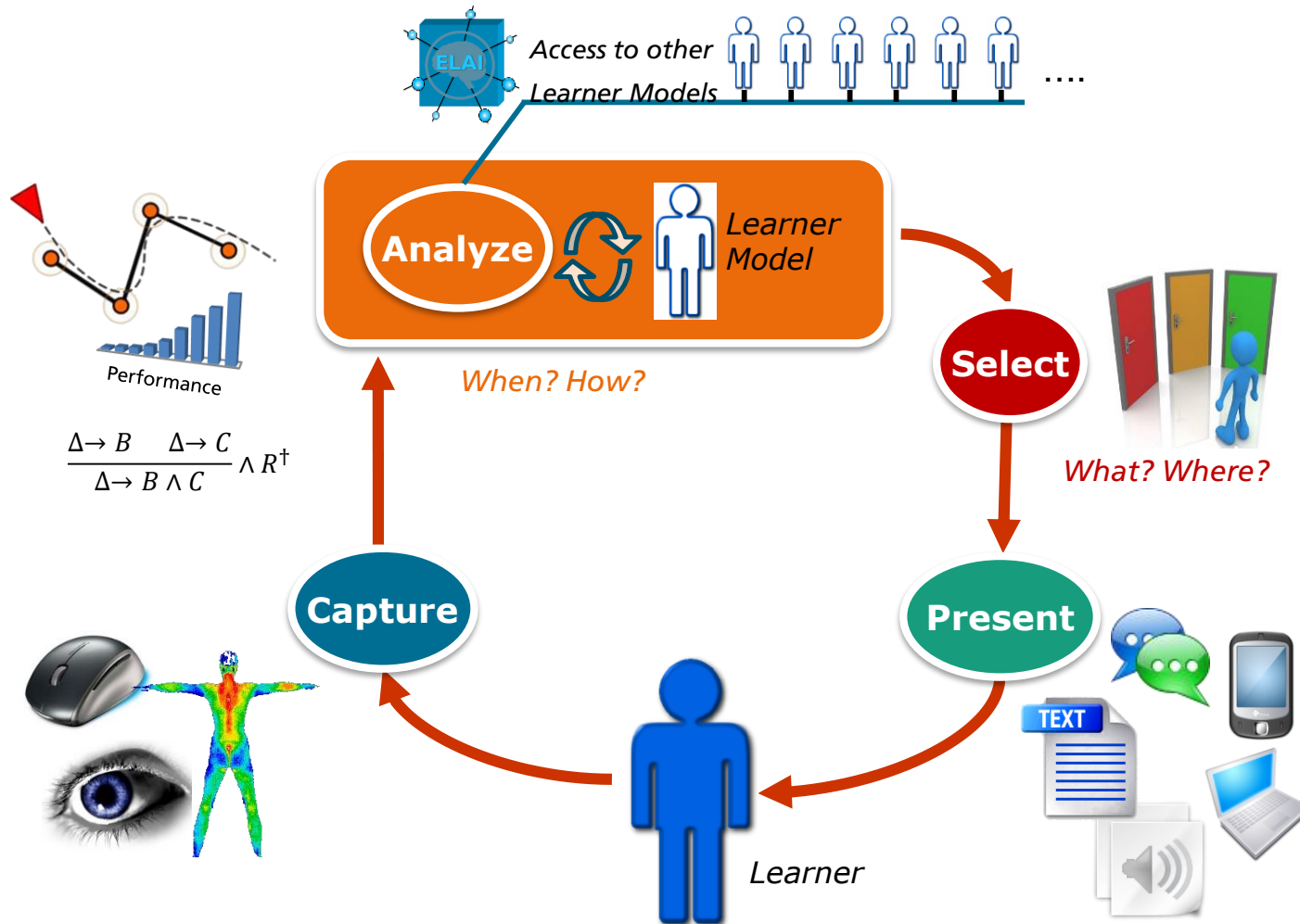


gameware.autodesk.com

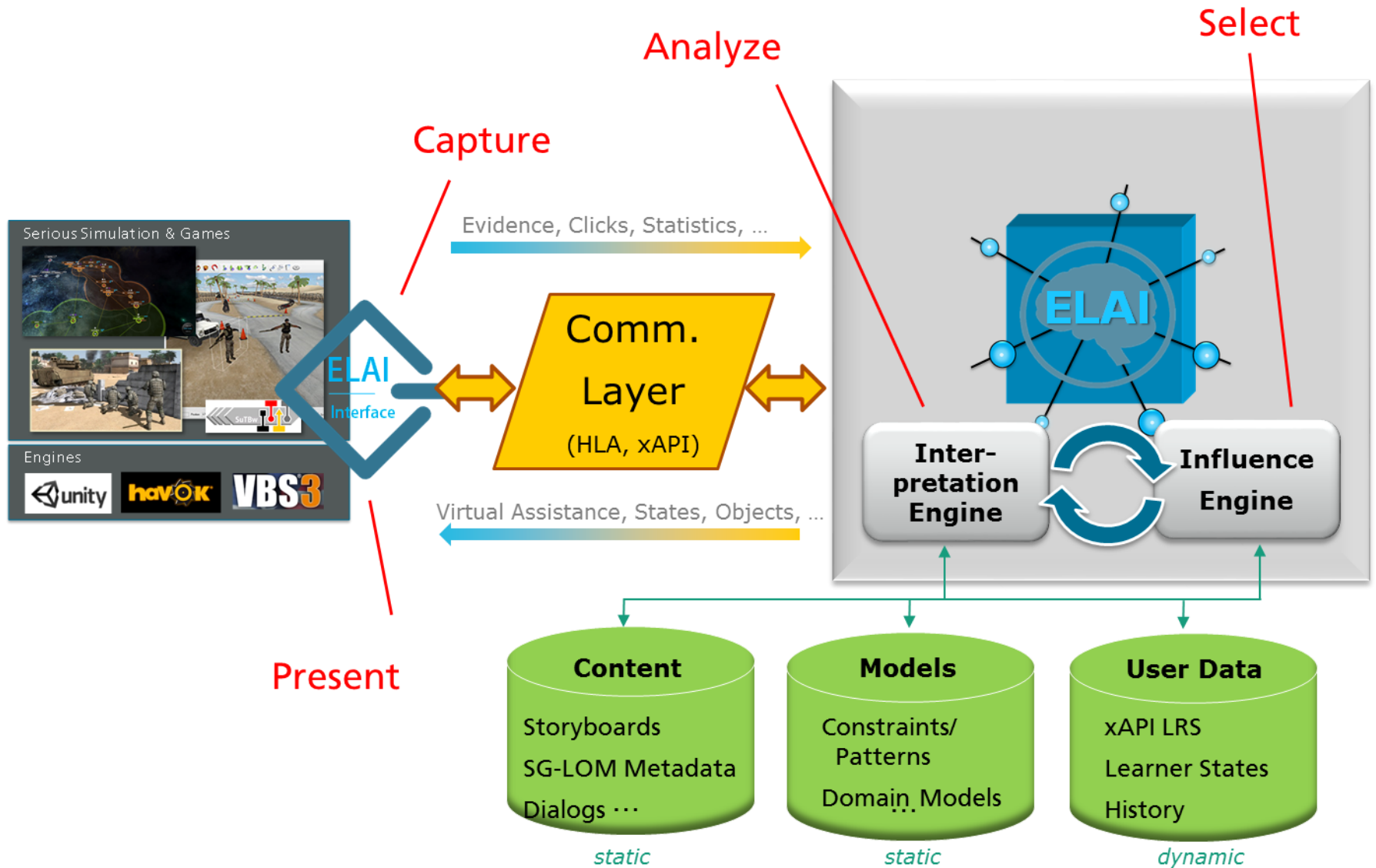


www.web3.lu

Adaptivity Cycle

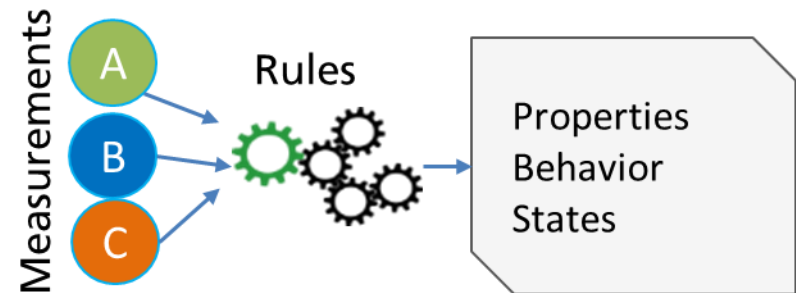
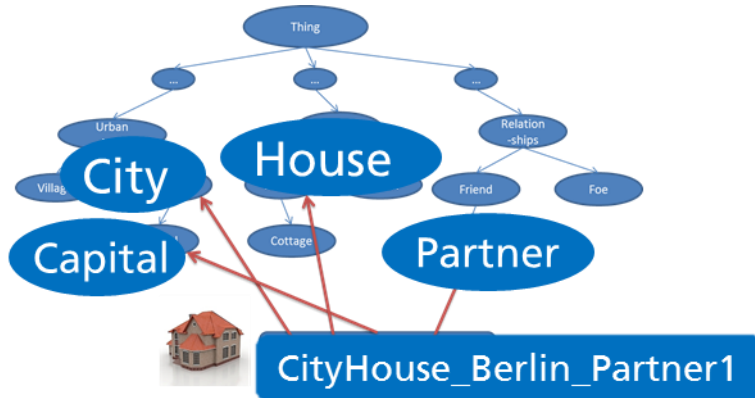


Our Solution: Interoperability & E-Learning A.I. (ELAI)



E-Learning A.I. – Examples

Purpose	A.I. Technology
Automatic Scene Understanding	Computer Vision: Object Recognition, OCR, etc. Semantic Text Analysis and Ontologies, e.g. Cyc
Context-Adaptive Recommendations	Intelligent Virtual Agents Semantic Retrieval, Ontologies Natural Language Processing/Generation
Intelligent User/Learner Models	Semantic interoperability, e.g. <i>RDF</i> Cognitive Architectures, e.g. <i>ACT-R</i> Didactic Factors with transformation rules
Dynamic Difficulty Adaptation	Adaptive Learning Paths by dynamic state automata/machines Model-driven Image Processing



Serious Game for Aerial & Satellite Image Interpretation: *Lost Earth 2307*

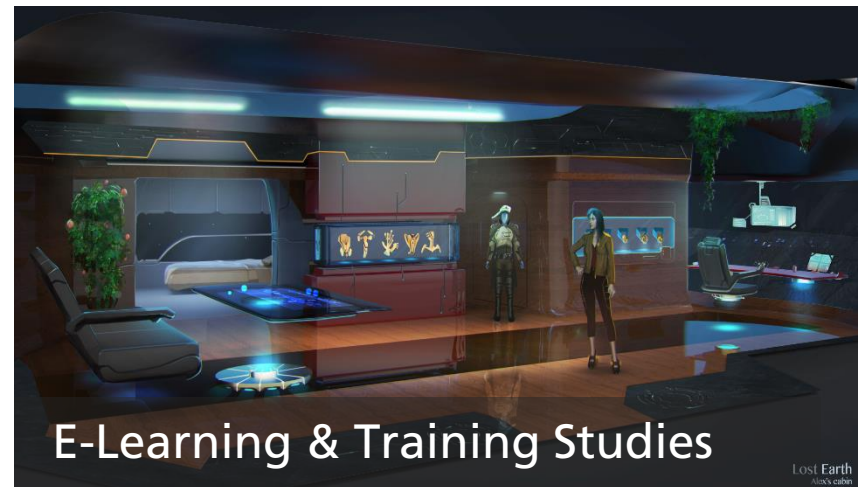
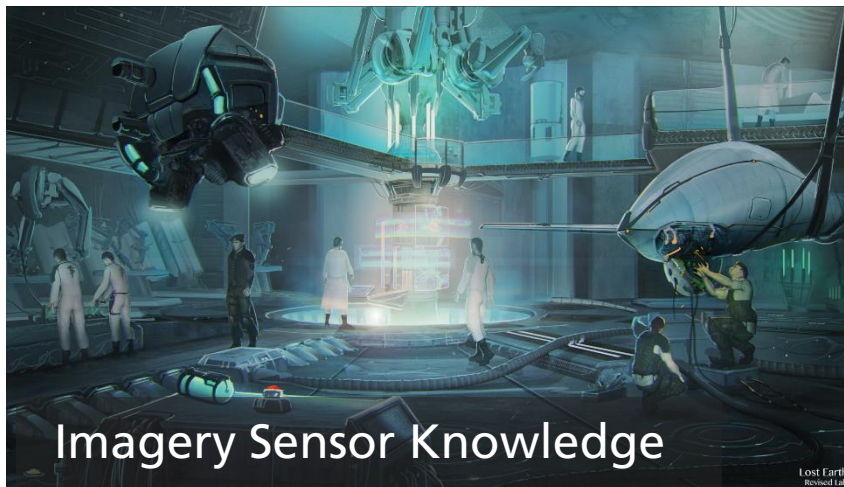
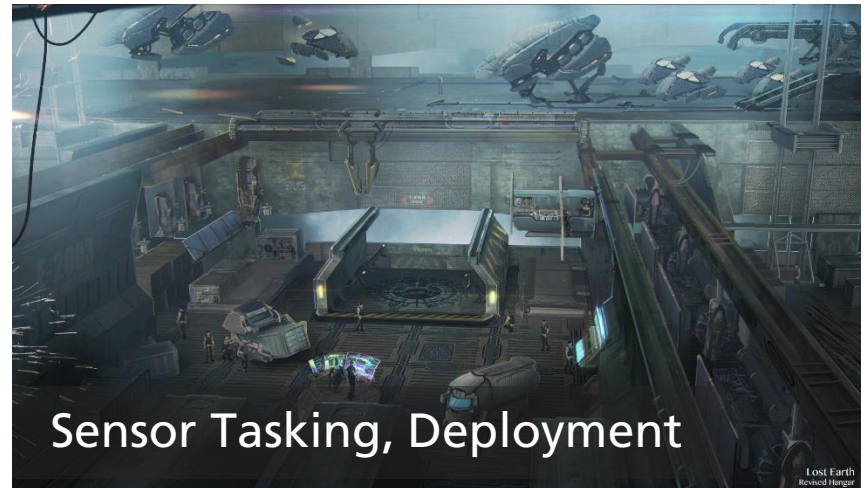


Learning Objectives:

- Interpretation of E/O, IR, Radar; Knowledge about pro/contra of specific imagery sensors
- Knowledge on sensor tasking, RecceCycle, dissemination, reporting

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Serious Game for Aerial & Satellite Image Interpretation: *Lost Earth 2307*



ELAI for Lost Earth – Adaptive Paths: Dynamic Modification of Game's State Automata

(e.g. facultative paths become mandatory)

The screenshot displays the VIland software interface, which is used for mission planning and reporting. The interface is divided into several panels:

- Image control:** Shows a satellite-style image of a landscape with a bridge and a dam. A green box highlights a specific area of interest.
- Briefing:** Contains a portrait of Isaac Kasparow and a text message: "Our troops are heading for the high dam you just located. Along their way is a bridge and we want to know if we can pass over it or if these fanatics destroyed or sabotaged the bridge in any way. I need you to task a sensor and to report type an status. Of special interest is the servability. Please be so kind and add the respective reference point on the image according to the STANAG. And there are any vehicles, please annotate them on the image." Below this, the objectives are listed: "Task sensor", "Annotate RP and vehicles if any", and "Report Purpose Code: C 1,2 (CAT 12 - BRIDGES AND TUNNELS)".
- Hints:** Provides instructions on how to use the toolset, including how to select the "Annotations" tab, how to use the "RP" button, and how to click on the image to place a reference point.
- Reporting Guide:** Shows a tree view of reporting categories, with "CAT 12 - BRIDGES AND TUNNELS" selected. The categories are: 1. LOCATION AND TYPE, 2. STATUS, 3. EQUIPMENT AND ACTIVITY, 4. DEFENCE, and 5. FACILITIES / DESCRIPTION.
- Tasking:** Contains a form for entering tasking information, including classification, format, report number, purpose code, and location/target details.
- INTERNAL COORDINATION:** Shows a form for entering internal coordination information, including from/to, info, originator serial number, type of sensor, technique, map series sheet number, target location, target description, purpose of request, photo scale, no. prints/plots/rpts, and delivery address.

ELAI for Lost Earth – Dynamic Difficulty Adjustment (DDA) by Dynamic Image Modifications

(e.g. dynamic, computer generated clouds)



Eye Tracking to Determine Attention, → Flow



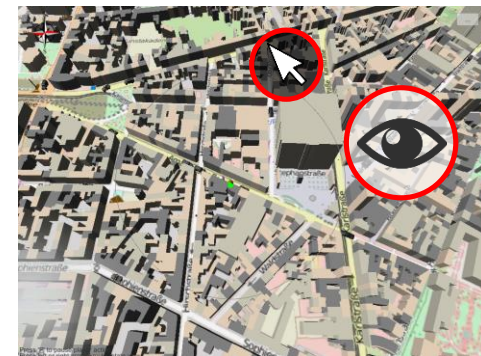
Expert



Δ ideal path: 0.01

*Quickly notices target
Keeps looking at target after
first fixation*

Novice



Δ ideal path: 0.89 ▲

*Looks around aimlessly
Moves in wrong direction*

Summary & Outlook

- Adaptive knowledge transfer → Competence-oriented training
- Interoperable tutor agent → Multiple users + multiple systems
- Externalized A.I. framework (ELAI)
 - Interoperability by design
 - Follows adaptive cycle
 - Uses A.I. technologies, e.g. intelligent user models, automatic scene understanding
- Application in real serious game for image interpretation

Outlook:

- Interlinking with more Serious Games and Simulations, or LMS
- Integration of more (sophisticated) A.I., e.g. Cognitive Architectures

*Thanks for your
attention! Questions?
Comments?*



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