Personalisation: ELEKTRA Case Study

Owen.Conlan@scss.tcd.ie
Personalisation Primer

• Personalisation should not...
  • Frustrate the user
  • Hide information from a user
  • Treat the user as a static variable!

• Personalisation should...
  • Alleviate Cognitive Overload
  • Enhance Motivation
  • Promote Metacognition, specifically Reflection

• Personalisation should also...
  • Tailor the experience to each user’s specific needs
  • Evolve as the user evolves
  • Be non-invasive
Personalisation Ingredients and Recipes
Digital Educational Games

• Personalised Technology Enhanced Learning meets Video Games
  • Traditional eLearning suffers from high drop-out rates
  • Games can be highly motivating and engaging
  • Create new worlds to experiment and play in
Building Digital Educational Games is Easy?
Ah yes, but what if they have my looks and your brains?

With your brains and my looks we could produce remarkable children.
Game + eLearning ≠
Motivational and Fun Learning Experience
Potential of Digital Educational Games

Digital
- Amazing Worlds
- Personalisable
- Explorative
- Open Ended

Game
- Visual
- Fun
- Motivational
- Flow

Educational
- Cognition
- Meta-cognition
- Self-regulation

CS7IS5 - Personalisation: ELEKTRA Case Study
Current DEGs

- Commercial Success
- Some Educational Benefit

- Science Education
- Separation of Learning and Gaming

- Effective Learning Shown
- Large Uptake

- Interactive Emotional Drama
- Rich Narrative
ELEKTRA - Enhanced Learning Experience and Knowledge Transfer

- FP6 Call 4 STREP
- Kick-Off
  - 1st February 2006
- Duration
  - 24 months
- 9 Participants in 6 countries
- Overall Budget €3m (€2.5m EC contribution)
  - ~€450,000 for TCD

- Non-invasive Personalisation in a 3D Immersive Educational Game
  - Physics/Optics Curriculum
  - Aimed at 12-15 year olds
  - Story-driven Adventure
  - Multidisciplinary
  - Pedagogy, Cognitive Psychology, Computer Science, 3D Game Developers, Neuroscience, Educational Publishers
  - 4-Stage approach to non-invasive personalisation
Research Challenges

• Current Adaptive Digital Educational Games
  • Embed the adaptive logic in the game making them difficult to alter/improve
  • Offer limited personalisation
  • Do not offer metacognitive support

• Challenges
  • Separate Personalisation from the Game
    • Ensure the learner does not notice!
  • Perform implicit modelling of the learner’s needs
  • Offer seamless personalisation(s)
    • Coherent with the game experience
ELEKTRA

- End Users are quite homogeneous!
- Domain Experts
- Game Designers
- Pedagogues

- Highly Interactive
- Highly Dynamic
- Must be seamless

- Explorative
- Experimentation

- NPC Guidance
- Environment Guidance
- Meta-cognition

User

Content*

Context

Strategy

CS7155 - Personalisation: ELEKTRA Case Study
ELEKTRA and Narrative

- **Concepts**
  - Physics (Optics/Magnetism) domain model (Knowledge Space Theory)

- **Objectives**
  - Educational (Cognitive): Master the concepts in the domain model
  - Meta-Cognitive: Acquire Confidence and Prudence skills
  - Motivation: Become immersed in the game experience

- **Strategy**
  - Cognitive, Meta-cognitive, Affect/Motivation supports

- **Contextual Models**
  - Implicitly constructed model of user (based on interactions with environment)

- **Reconciliation**
  - Based on user model progress according to domain model; Meta-cognition; Affect

- **Binding**
  - Adaptation Elements (usually triggering NPC Behaviour)
ELEKTRA – What it looks like!

- Game: Adventure
- Digital: FPS/3D
- Educational: Physics - Optics/Magnetism
Screenshot from ELEKTRA
Separation of Concerns

Game Engine

Learning Engine

Modified Nebula 2

Adaptive Engine 3

Specific - General
Non-invasive Adaptation

Game Engine

Inference

Context Accumulation

(1) Interpret

(2) Accumulate

(3) Constrain

(4) Recommend

Adaptation Selection

Adaptation Constraint

Statistical Modelling

Inference Rules

Learner Model

Adaptation History

Game State

Personalisation Rules

Learner Model

Appropriateness Constraint

Game Constraint

Adaptive Elements
ELEKTRA - Personalisation

• The Gaming Engine sends *Events* to the Learning Engine

• The Learning Engine decides on the most appropriate Adaptation

• The Learning Engine sends a *Adaptive Intervention*, in the form of Adaptive Elements, to the Gaming Engine

• This process is cyclical and real-time (approx. 10-25 msec)
Personalisation Axes

• Hinting
  • Knowledge-based
  
  “Wood is not influenced by magnetism!”

• Feedback
  • Cognitive
  • Instant Meta-Cognitive
  • Tendency Meta-Cognitive
  • NPC Confidence/Prudence (Meta-Reflective)
  • Affective/Motivational

“...and moreover you were convinced about your answer”

“...each time you give a correct answer, you seem to be certain of it, this is exactly what I expect from you!”

“Yes. It isn’t easy, and I’m not sure that I would do any better in your position, but you must persevere.”
ELEKTRA – Benefits of Personalisation

• Adapt the game and learning to the learner’s
  • Needs
  • Preferences
  • Abilities

• Improved learning performance
  • Knowledge Gain
  • Self Regulation
  • Meta-Cognitive Awareness
ELEKTRA – Successes and Limitations

• Successes
  • Immersive Gameplay
    Players enjoyed it
  • Integrated Education
    Actually enhanced learning!
  • Non-invasive Modelling
  • Non-invasive Personalisations

• Limitations
  • Costly
    Richly detailed 3D environment; NPC Dialog and Modelling
  • Limited Modularity
    Detailed non-adaptive storyline
Immersive Gameplay + Integrated Education + Compelling Story = Motivational and Fun Learning Experience
Summary

• **Motivation** is essential

• **Micro-adaptivity** shows great potential in personalising highly visual environments
  • 4 Stage Non-invasive Approach
  • Need to harmonize this with the Multi-model Approach

• **Macro-adaptivity** is possibly more complex
  • Negotiation between the Learning and Narrative Engines would be required
    • We’ll talk about 80Days later

• **Meta-cognition** is desirable
What we covered today

Case Study: ELEKTRA
Questions?
Owen.Conlan@scss.tcd.ie