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AI Based Game Design

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Game Research Seminar,
DSV 2021-01-20

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AI Based Game Design

is the practice of creating games where the AI is an intrinsic part of the game design, intertwined in the game mechanics.

What do you mean by AI?

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When we talk about AI (artificial intelligence) in games we approach it not only as a set of techniques, such as BDI architectures or path planners, but from a more philosophical perspective:

the AI in AI based game design refers to when computational processes are designed and implemented to create the impression of something that acts with intentionality.

This ‘something’ can be an agent, such as a non-player character, but it can also be a process that creates content for the game, such as quests, or new levels in a game.

(Direct quote from the FAQ I wrote in 2011)

What do you mean by game design?

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Game design is a subset of game development, the often iterative process of designing the core mechanics of a game. The `core' of a game is what the game play is about.

(Direct quote from the FAQ I wrote in 2011)

How does AI-Based Game Design relate to Expressive AI?

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AI-Based Game Design exists within the domain of Expressive AI, which is an interdisciplinary research agenda where AI-based art and entertainment link together game studies, design practice and technical research.

AI-Based Game Design pushes forward the Expressive AI agenda; by tightly coupling game design and AI, it has the capability of increasing the expressivity of the system.

Direct quote from the FAQ I wrote in 2011. EAI refers to:

Mateas, M. 2003. Expressive AI: Games and Artificial Intelligence. DiGRA (2003).

Why do we need to talk about AI-Based Game Design? (Our* argument from 2011)

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AI-Based game design presents a methodology that supports exploring uncharted territories of the game design space.

In the space of of AI based game design, established AI technologies are used for innovative game design, and the needs emerging from game designs push forward the innovation of AI technologies.

A commonly held view regarding AI and games is that it is enough to create the impression of intelligence, the "smoke and mirrors", by choosing the right cues that makes players use their mental models of a representation, relying on players' immersion and imagination. We do not argue against this, however, we do not see this as a reason to not create something which is something beyond smoke and mirrors.

Direct quote from the FAQ I wrote in 2011.

*Josh McCoy, Anne Sullivan, Gillian Smith and me, Mirjam P Eladhari

Outset Philosophy

First, we approached AI in games from a philosophical perspective. Our main sources for inspiration were

- Dennet's perspective on Intentionality - abstract away the complexity and instead reason about the intentions and goals of that system.
- Agre on how players assign intentionality by using words "beyond the mathematical structures"
- Sengers' perspective on how player construct meaning by create narratives

Agre, P.E. 1997. *Computation and Human Experience* (Learning in Doing: Social, Cognitive and Computational Perspectives). Cambridge University Press.
Dennet, D. 1987. The Intentional Stance. MIT Press.
Sengers, P., 2000. Narrative Intelligence. In: K. Dautenhahn, ed. Human Cognition and Social Agent Technology, Advances in Consciousness Series. John Benjamins Publishing Company.

Case studies

- In order to better understand the relationship between AI and game design we*, looked at our own game prototypes that all use some kind of AI as part of the core game mechanics.
  - Mismanor and GrailGM,
  - Prom Week and Comme il Faut
  - Rathenn and Launchpad,
  - The Mind Module, the Pataphysic Institute, and Mind Music)

*that is me, Mirjam P Eladhari, and Josh McCoy, Anne Sullivan and Gillian Smith

- We reflected on how we worked with our AI systems and the game design of the prototypes where they are used.
- We wrote a technical report.
  AI-Based Game Design: Enabling New Playable Experiences, Mirjam P. Eladhari, Anne Sullivan, Gillian Smith, Josh McCoy, University of California Santa Cruz, December 2011

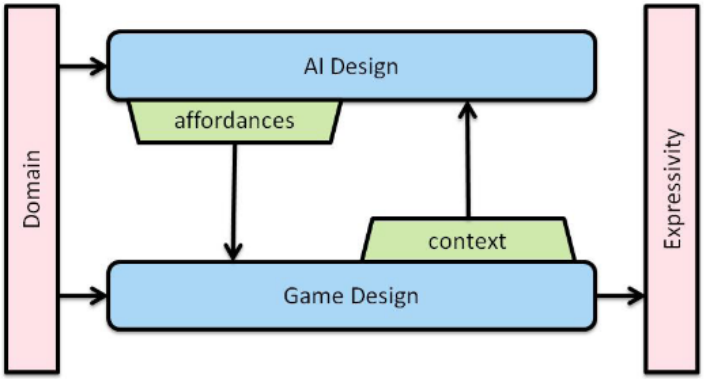

Figure 1. This diagram illustrates the process of AI-based game design. The AI system affords certain mechanics and aesthetics for the game design, while the game design provides the context in which the AI operates. Domain information, such as theories.

We could see that our process, in the different projects was revolving around how several knowledge domains and techniques (both AI and other) was used. The affordances of the AI and the context given by the design: iterations.

Why do we need to talk about AI-Based Game Design? (Our argument from 2011)

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This argument resonated with the research community

Direct quote from the FAQ I wrote in 2011.

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Artificial and Computational Intelligence in Games: AI-Driven Game Design

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Michael Cook (University of London, GB)
Mike Preuß (Universität Münster, DE)
Pieter Spronck (Tilburg University, NL)

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Co-authored publications related to AIGD

2011

AI-Based Game Design: Enabling New Playable Experiences Mirjam P. Eladhari, Anne Sullivan, Gillian Smith, Josh McCoy, Technical Report: USCS-SOE-11-27, University of California Santa Cruz, December 2011

2015

AI-Based Game Design Patterns, Treanor, M., Zook, A., Eladhari, M.P., Togelius, J., Smith, G., Cook, M., Thompson, T., Magerko, M., Levine, J., Smith, A. Proceedings of the 2015 Conference on the Foundations of Digital Games (FDG 2015). Monterey, CA, June 22-25, 2015.

AI-Based Games: Contrabot and What Did You Do? Cook, M., Eladhari, M.P., Smith, A., Smith, G., Thompson, T., Togelius, J. and Zook, A. Playable Demo Track, Proceedings of the 2015 Conference on the Foundations of Digital Games (FDG 2015). Monterey, CA, June 22-25, 2015.

2016

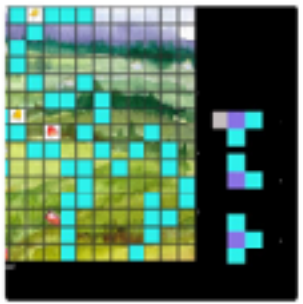
PCG-Based Game Design Patterns, Cook,M., Eladhari, M., Nealen, A., Treanor, M., Boxerman, E., Jaffe, A., Sottosanti, P., Swink, S. CoRR abs/1610.03138 (2016)

2019

TOG: An Innovation Centric Approach to teaching Computational Expression and Game Design, Eladhari, M.P., Teaching Games: Pedagogical Approaches - DiGRA 2019 Pre-Conference Workshop (TGPA:DiGRA2019) August 6 2019, Kyoto, Japan.

2015 AI BASED GAME DESIGN PATTERNS

This paper proposes a model for designing games around Artificial Intelligence (AI). AI-based games put AI in the foreground of the player experience rather than in a supporting role as is often the case in many commercial games. We analyze the use of AI in a number of existing games and identify design patterns for AI in games. We propose a generative ideation technique to combine a design pattern with an AI technique or capacity to make new AI-based games. Finally, we demonstrate this technique through two examples of AI-based game prototypes created using these patterns.



Foregrounding

AI-Based Game Design Patterns, Treanor, M., Zook, A., Eladhari, M.P., Togelius, J., Smith, G., Cook, M., Thompson, T., Magerko, M., Levine, J., Smith, A. Proceedings of the 2015 Conference on the Foundations of D
Monterey, CA, June 22-25, 2015.

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AIGD in teaching

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Course: Computational Expression

- Masters' level course, 5 ECTS.
- Given at the Institute of Digital Games at the University of Malta
- Majority of students were programmers.
- Students had prior game design knowledge

- Text seminars
- Workshops
- Guest lectures
- Game prototyping
- Reflection

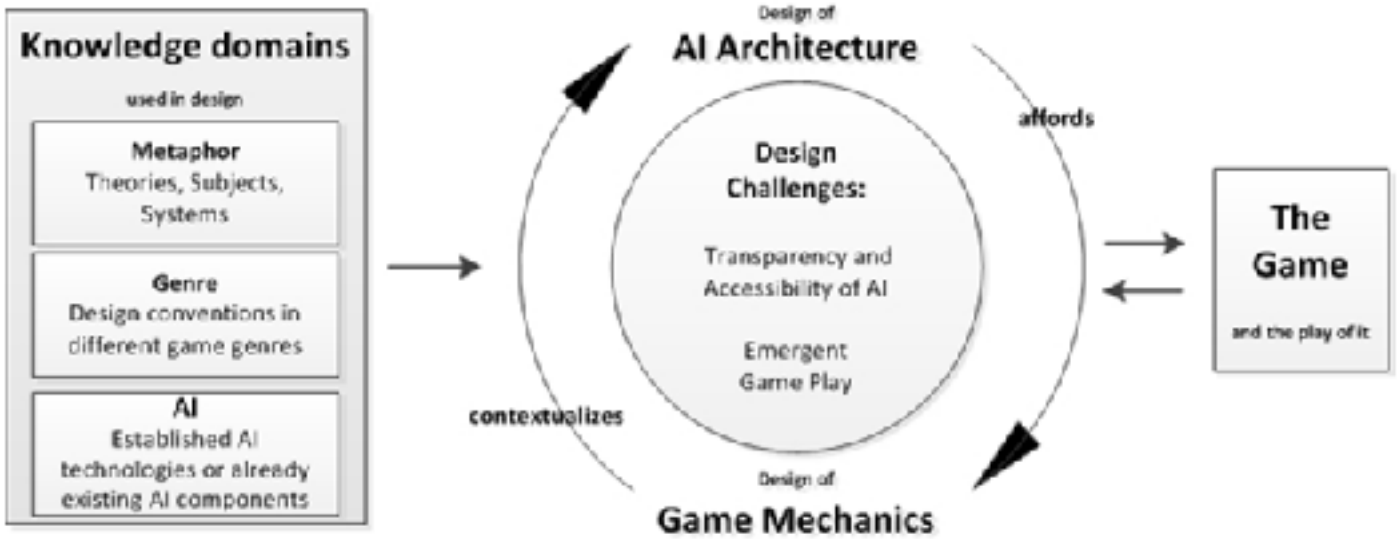


Fig 1 The process of designing AI-based games.

PALETTE – THE SEMINAR TOPICS

- Computational Expression, Software studies and platform studies

- The relation between Game Design and Artificial Intelligence, AI Based game design

- Approaches and technologies for Interactive Narrative

- Characters, Characterisation and Agents in computer games

- Procedurally Generated Content and data mining

- Biofeedback as player modelling and/or game interface

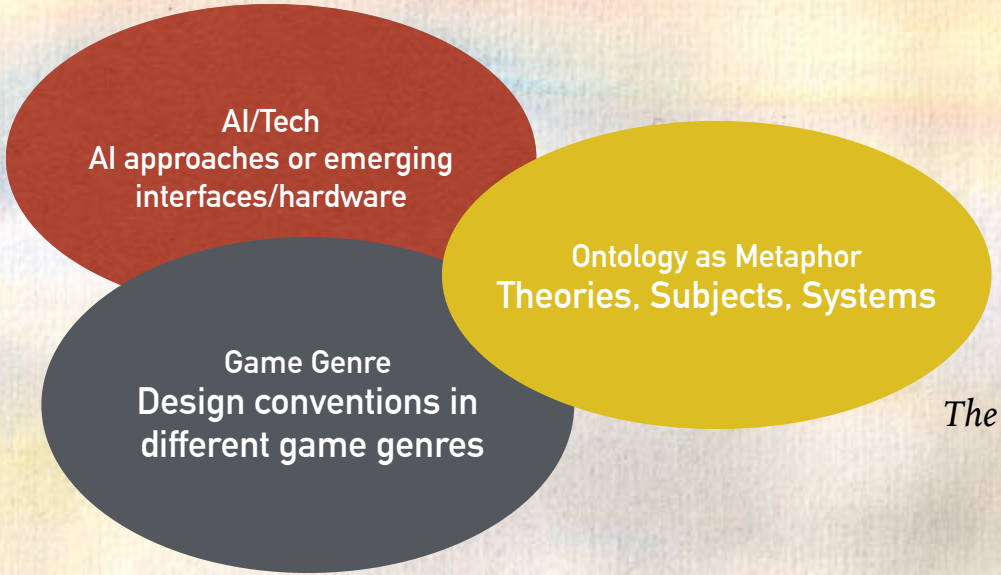
- Interface technologies beyond the personal computer (XR; CAVEs, Augmented Reality, Pervasive, Console stereoscopic camera systems etc.)

- Computational Creativity

- Artificial Life

TASK: (KEPT IN MIND DURING KNOWLEDGE GATHERING PHASE)

Make a playable prototype using a central AI or technology, using a rich metaphor as inspiration for the game mechanics, while being aware of any genre conventions used (or not).



The Triad

➤ Groups who put a strong **focus on the Ontology** (metaphor, the knowledge domain), in addition to the AI/tech, generally created **the more interesting and innovative designs.**

➤ Combination of project work and classic seminar defense style teaching allowed both concrete prototypes and reflection.

➤ Outcomes for students:

- ➤ games for portfolios
- ➤ seeds for research papers
- ➤ seeds for thesis topics
- ➤ proof of concepts:feasibility for thesis work or game-to-market
- ➤ (more) realistic views on dev effort for custom AI
- ➤ expanded palette for innovation and development in future career

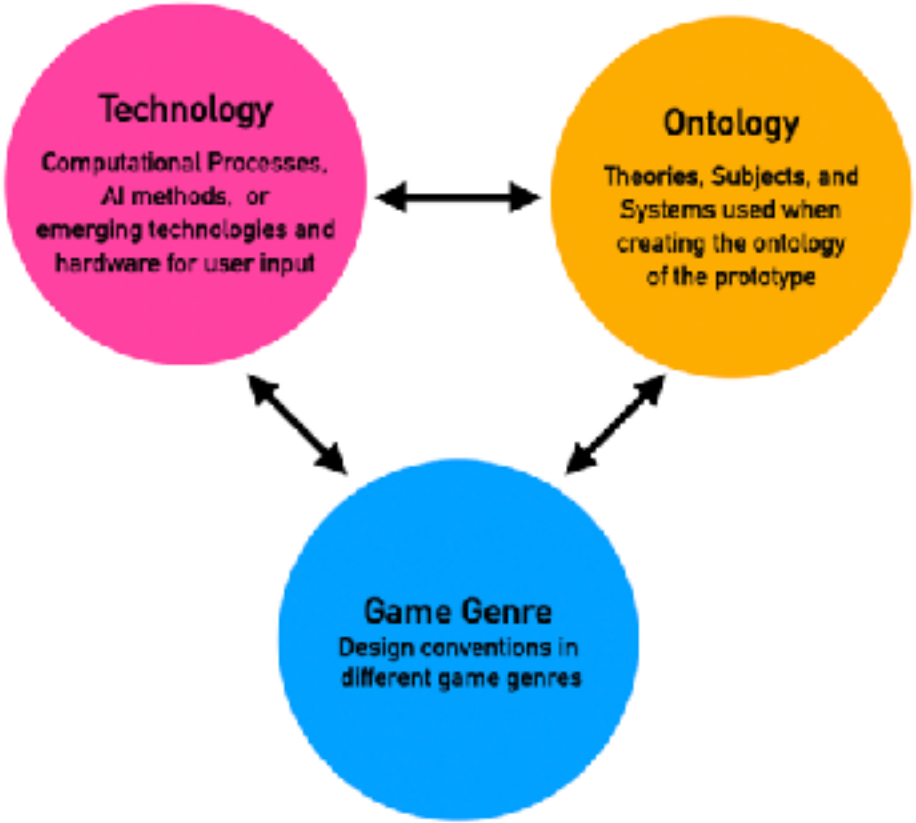


Figure 1: The TOG model

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TOG: An Innovation Centric Approach to teaching Computational Expression and Game Design, Eladhari, M.P., Teaching Games: Pedagogical Approaches - DiGRA 2019 Pre-Conference Workshop (TGPA:DiGRA2019) August 6 2019, Kyoto, Japan.

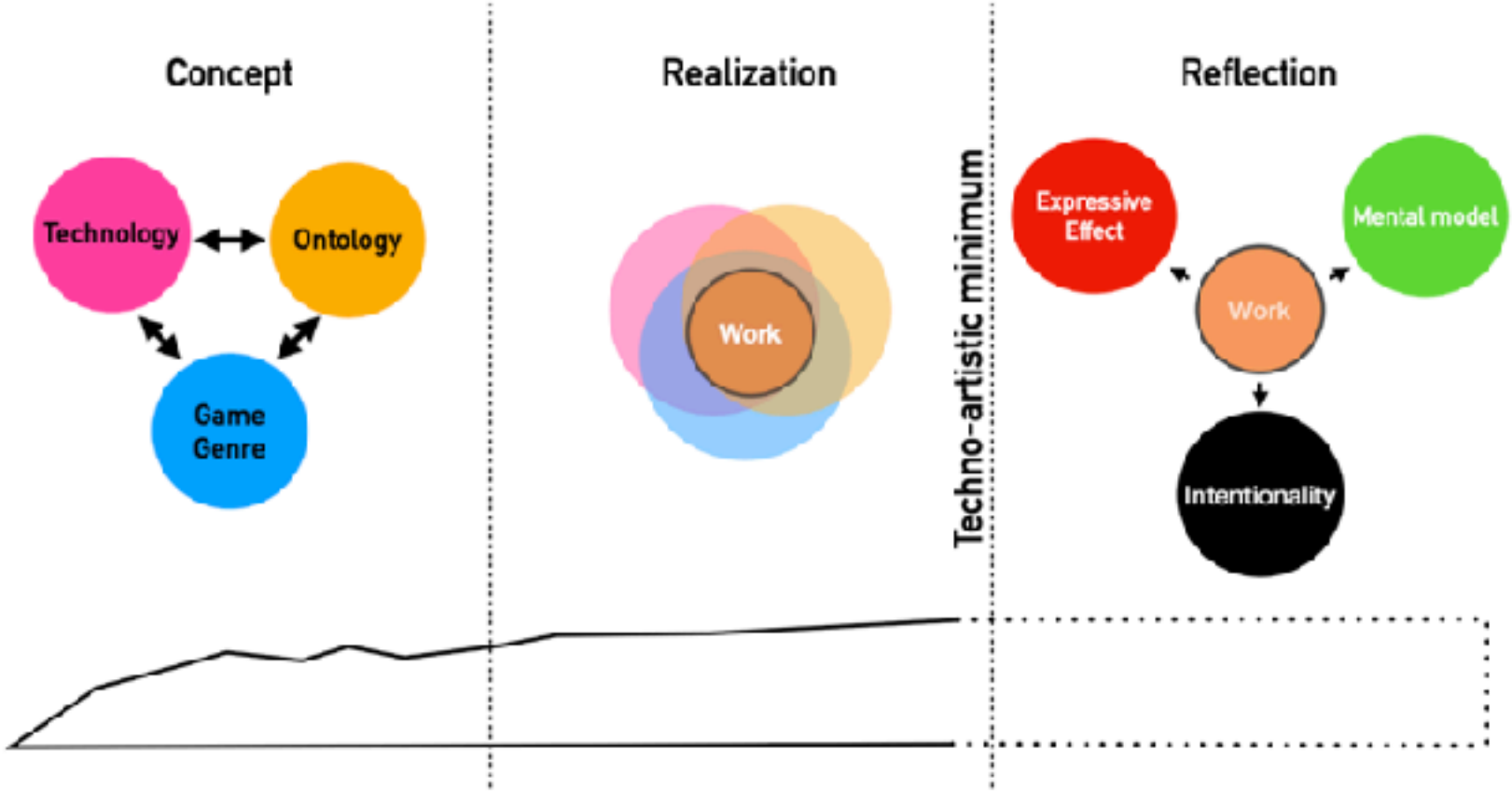

Figure 2: Tog model and implementation phases