

Game Analysis Frameworks

CMSC 19929: Creating Computer Games for Learning

Common Frameworks

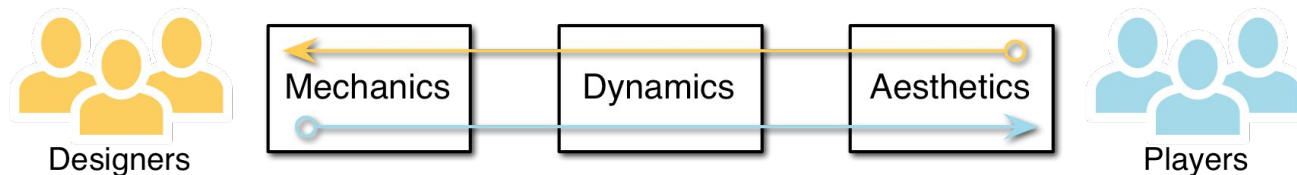
- **MDA: Mechanics, Dynamics, Aesthetics**
- **Formal, Dramatic, and Dynamic Elements**
- **Elemental Tetrad**

MDA

- Proposed at the Game Developers Conference (2001)
- Formalized in "MDA: A Formal Approach to Game Design and Game Research"
 - Robin Hunicke, Marc LeBlanc, Robert Zubek (2004)
- **Most well known framework for game analysis**
- **Three elements:**
 - **Mechanics:** The specific components of the game at the level of data representation and algorithms
 - **Dynamics:** The runtime behavior of the mechanics acting on player inputs and each other's outputs over time
 - **Aesthetics:** The desirable emotional responses evoked in the player when she interacts with the game system

MDA

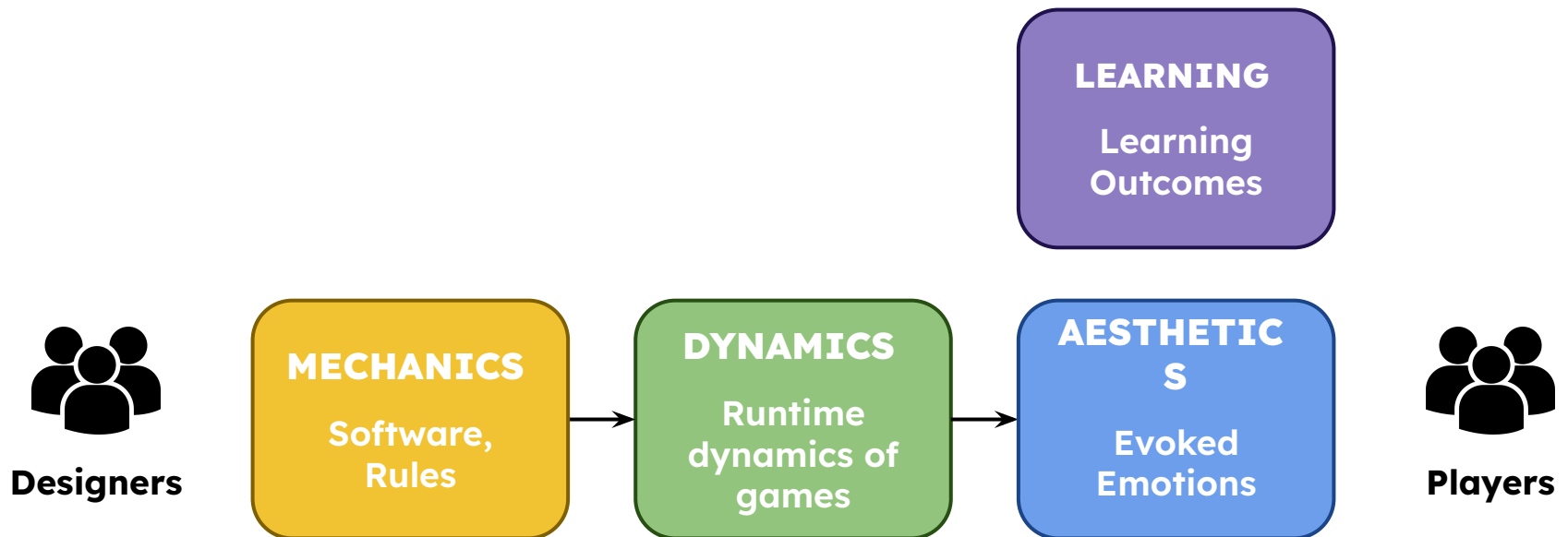
- Designer and players view games from different directions



- Designers **should** first consider the aesthetic feelings that they want players to experience
 - Then consider the dynamic play that will engender these aesthetics
 - Finally create mechanics that will lead to these dynamics
- Players **should** first read the rules of the game (mechanics)
 - These rules lead to dynamic play
 - The dynamics engender aesthetic feelings

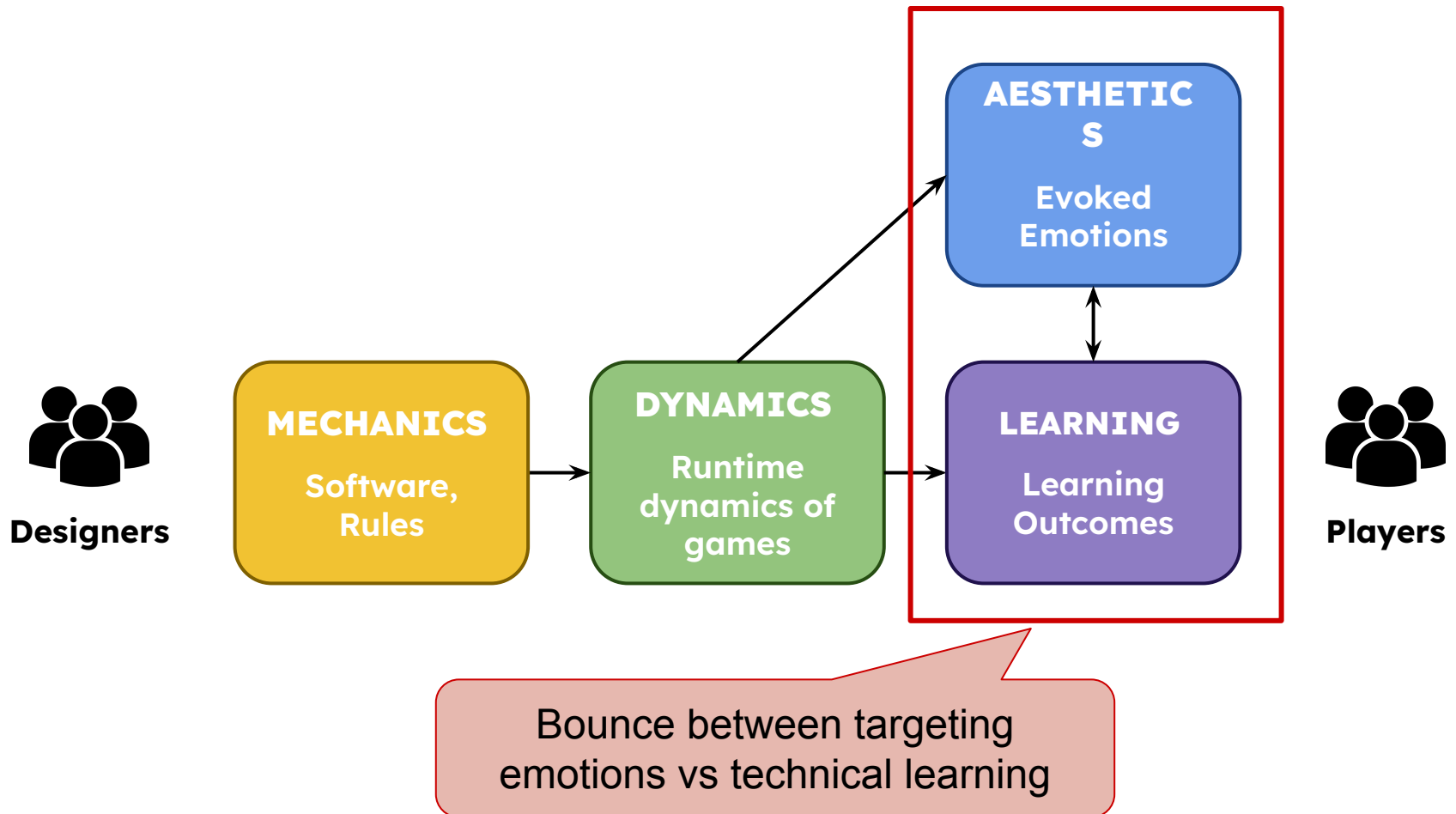
MDA for educational game

What element is missing?

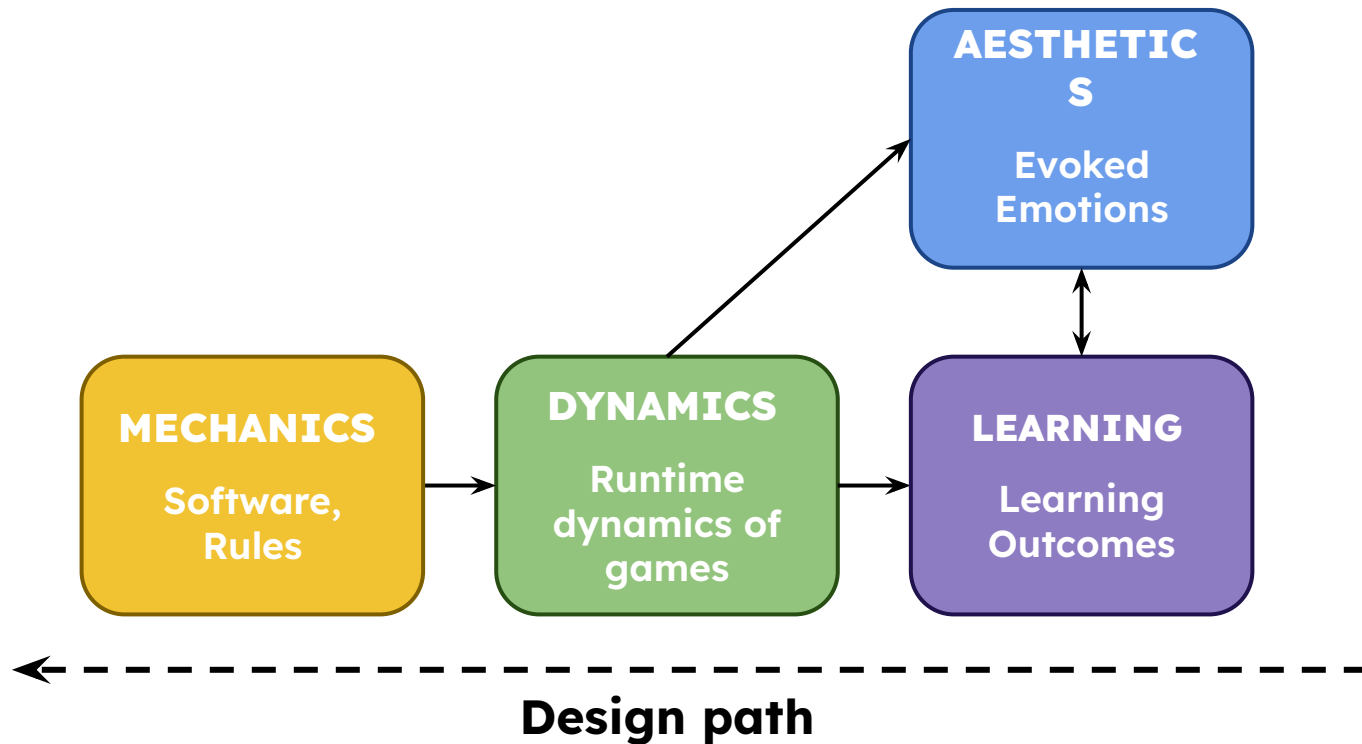


MDA for educational game

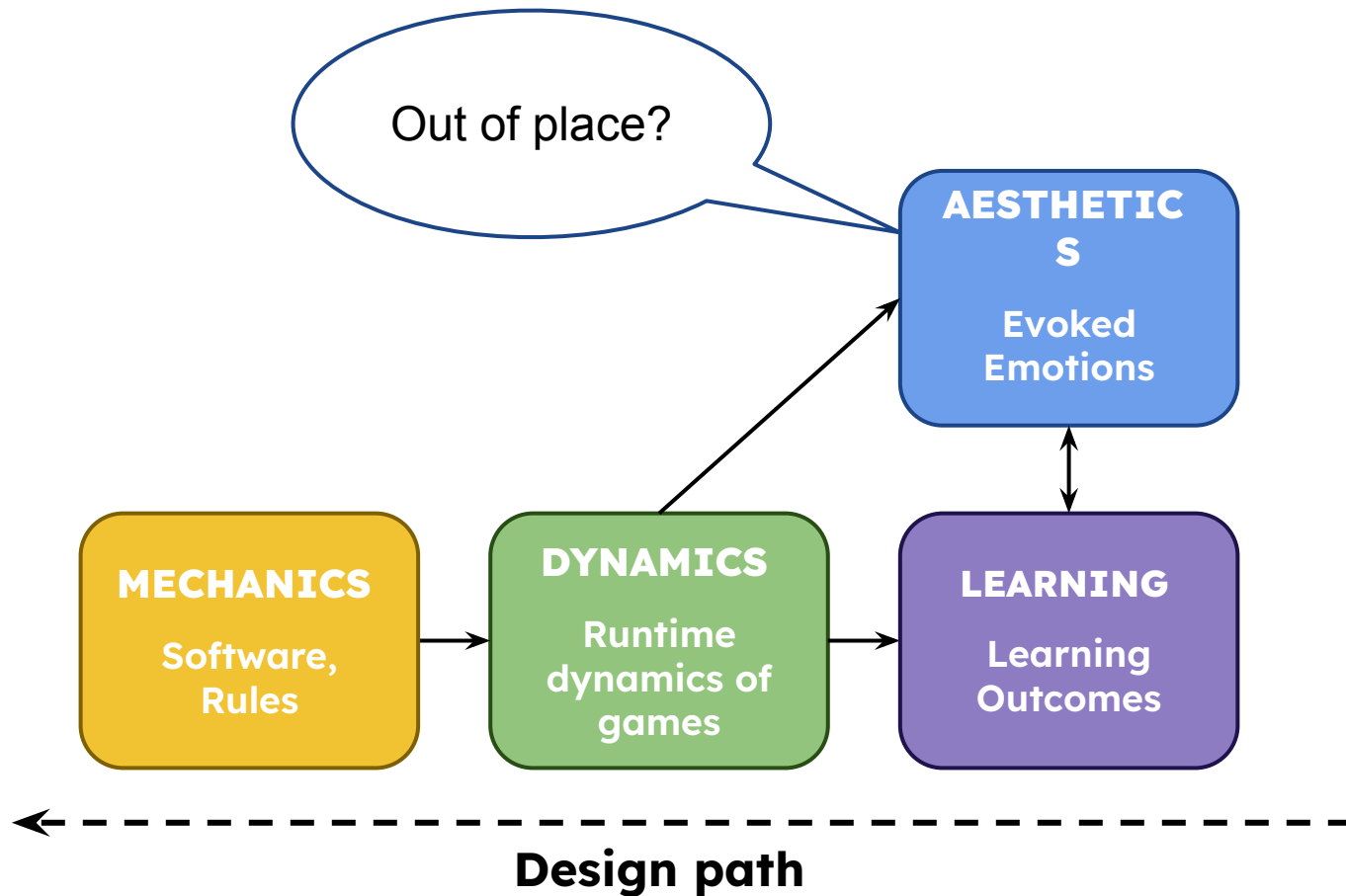
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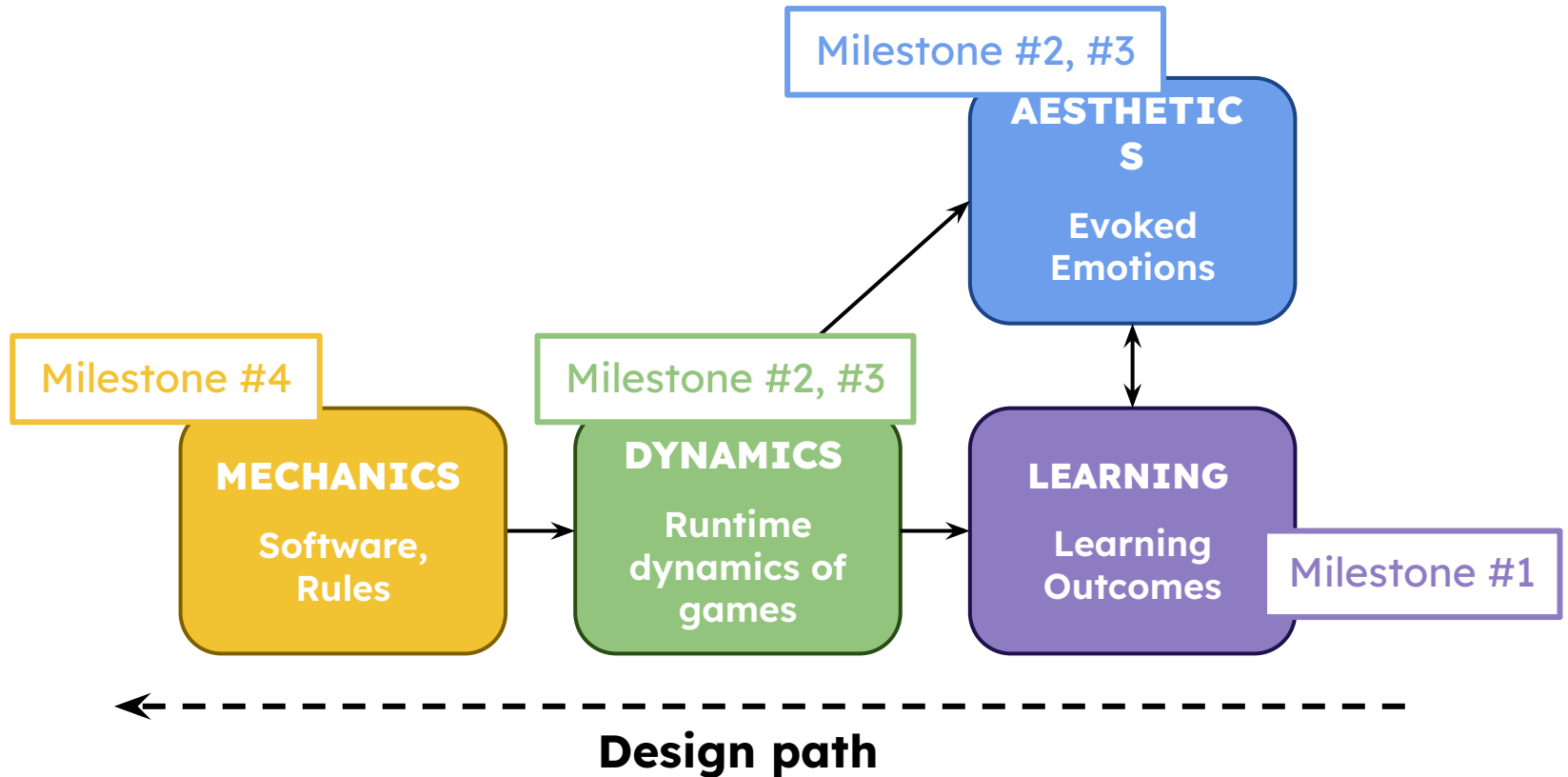
MDA for educational game



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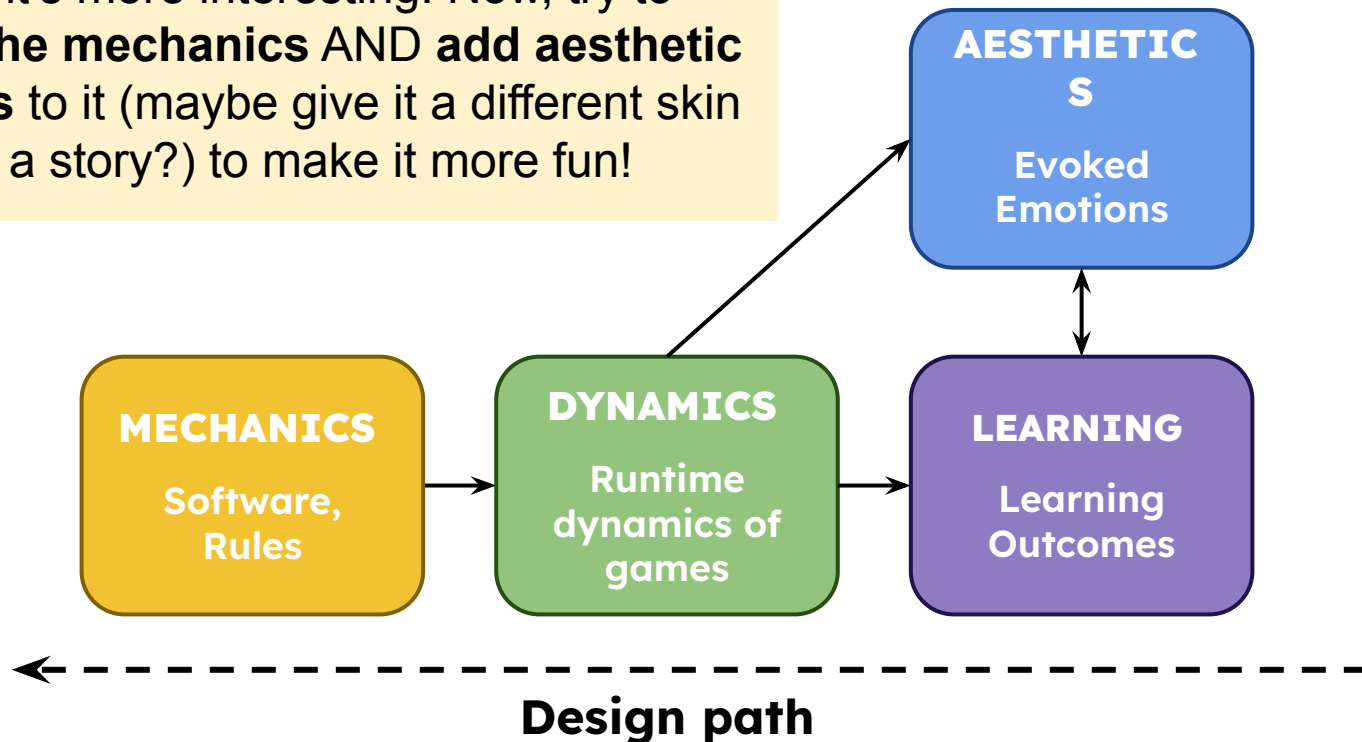
MDA for educational game



MDA for educational game

On the first day of class, we modify the “rules” (mechanics) of the Bartok game to make it’s more interesting! Now, try to **modify the mechanics AND add aesthetic elements** to it (maybe give it a different skin and a story?) to make it more fun!

Group of 3-4 students



Formal, Dramatic, and Dynamic Elements

Proposed by Tracy Fullerton in Game Design Workshop

- **Formal elements:** Structural components that define the game as a playable system (e.g., rules, resources, and boundaries). Without them, a game is essentially unplayable.
- **Dramatic elements:** Narrative elements that provide context, tie the gameplay together, and encourage players to become emotionally invested in the outcome of the game (e.g., premise, characters, backstory).
- **Dynamic elements:** The game in motion. Once players turn the rules into actual gameplay, the game has moved into dynamic elements. Dynamic elements include things like strategy, behavior, and relationships between game entities.

Formal Elements

A game ceases to be a game if the formal elements are removed

Seven formal elements of games

- **1. Player interaction pattern:** How do the players interact?
 - Single-player
 - 1-on-1
 - Team vs team
 - Multilateral (multiple players vs each other)
 - Unilateral (one player versus all the other players)
 - Cooperative play
 - Multiple individual players each working against the same system
- **2. Objective:** What are the players trying to achieve in the game?
When has someone won the game?

Formal Elements

- **3. Rules:** Limit the players' actions by telling them what they may and may not do in the game.
 - Many rules are explicit, but others are implicitly understood
- **4. Procedures:** Actions taken by the players in the game
 - A rule tells the player what to do
 - The procedure dictated by that rule is the actual action of the player
 - Procedures are often defined by the interaction of multiple rules
 - Some procedures are also outside of the rules: Bluffing in Poker
- **5. Resources:** Elements that have value in the game
 - Money
 - Health
 - Items
 - Property

Formal Elements

- **6. Boundaries:** Where does the game end and reality begin?
 - *"A game is a temporary world where the rules of the game apply rather than the rules of the ordinary world" – Johan Huizinga, **Homo Ludens** (1955)*
 - This concept is now known as the **Magic Circle**
 - In a sport like football, the magic circle is defined by the boundaries of the playing field
- **7. Outcome:** How did the game end?
 - Both final and incremental outcomes
 - In Chess, the final outcome is that one player will win, and the other will lose
 - In an RPG, there are several incremental outcomes

Activity: Formal Elements

Get together with your group partners, roughly brainstorm the **seven formal elements** of your game (nothing needs to be set in stone!)

1. Player interaction pattern (e.g., single player, 1 vs 1)
2. Objective (e.g., when does someone know they win?)
3. Rules (well, probably many but try listing a few)
4. Procedures (e.g., some actions taken by the player)
5. Resources (e.g., money, health, items, property, points)
6. Boundaries (e.g., when does the game end?)
7. Outcome (e.g., how did the game end)

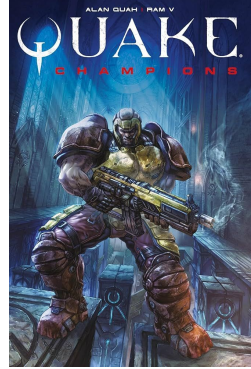
Dramatic Elements

- Make the rules and resources more understandable
- Give players greater emotional investment in the game
- Similar to aesthetic in MDA (but more comprehensive)
- Three dramatic elements

Dramatic Elements

1. **Premise:** The basic story of the game world

- **Monopoly:** The players are real-estate developers trying to get a monopoly on corporate real estate in Atlantic City, New Jersey
- **Donkey Kong:** The player is trying to single-handedly save his girlfriend from a gorilla that has kidnapped her
- *The premise forms the basis around which the rest of the game's narrative is built*



Dramatic Elements

2. Character: The individuals around whom the story revolves

- Vary widely in depth
 - The main character of Quake is nameless and largely undefined
 - Nathan Drake, from the Uncharted games, is as deep and multidimensional as the lead characters in most movies
- In movies, the goal of the director is to encourage the audience to have empathy for the film's protagonist
- In games, the player actually *is* the protagonist character
- Designers must choose whether the protagonist will act as
 - An avatar for the player
 - A role that the player must take on
 - Most common of the two
 - Much simpler to implement.



Dramatic Elements

3. **Story:** The plot of the game

- The narrative that takes place through the course of the game
- Different from 1. Premise (core concept / basic story)
- Story includes the complete narrative including **plot**, **setting**, and **subplots**.

Activity: Dramatic Elements

Round 1: Get together with your group partners and brainstorm the premise for your potential game (write it down somewhere for your record)

Round 2: Get together with another group, take turn to give an “elevator pitch” of your brainstormed premise and ask questions / give each other feedback :)

Dynamic Elements

Occur only when the game is being played

- **Emergence**
 - Simple rules lead to complex and unpredictable behavior
 - One of a game designer's most important jobs is to attempt to understand the emergent implications of the rules in a game.
- **Emergent narrative**
 - Narrative can also be dynamic
 - Narratives can emerge from the gameplay itself
 - One of the central appeals of RPGs
 - Different from the narrative embedded in cut scenes and plot
 - Unique to interactive experiences
- **Playtesting is the *only* way to understand dynamics**
 - Game systems are unpredictable
 - Experienced game designers can make better guesses
 - But, everyone **must** playtest to understand a game

Next week

► Part 1: Classes and Objects ([Han](#))

Coding practice

Mon 7/13

► Part 2: Player Types and Motivation

Open work time: Milestone #2

Guest Lecturer: [Erica Goodwin](#)

Tue 7/14

► Exploring Pygame ([Han](#))

Open work time: Milestone #2 (cont.)

[Assignment Due] Project Milestone #2: Basic Game Design (Tue 7/14)

► Part 1: Inclusive Design

Coding practice

Wed 7/15

► Part 2: Designing Interactive Systems to Support Children's Critical and Reflective Engagement with AI

Open work time: Milestone #3

Guest Lecturer: [Erica Goodwin](#), [Aayushi Dangol](#)

Thu 7/16

► Collapsing Qubits: A Quantum Themed Card Game

Open work time: Milestone #3 Flash Talk

Guest Lecturer: [David Gonzalez-Maldonado](#)

Fri 7/17 (Students) — Flash Talk and Peer Review Workshop

Field Trip: [UChicago Weston Game Lab](#)

[Assignment Due] Project Milestone #3: Final Game Design & MVP Description (Sat 7/18)

Project Grading Clarification

- There is no right or wrong way to design YOUR game
- **My role:**
 - Teach foundational knowledge about learning design and game design
 - Give feedback on your design exercises and milestones
- **Your role:**
 - Integrate what you learn in class to make meaningful and appropriate design decisions
 - Present your milestones in a thoughtful way
- I assume you're the "expert" in the topic you're trying to teach through your game. So I'll not be critical about core learning content of your game, just the presentation of it because you (a good designer) need to successfully convey your ideas to me (an audience - maybe a potential user or investor of your product)

Milestone #1 Grading Criteria

Summary An introduction summarizing your learning content area in 1-2 paragraphs (~250 words).

- You'll get full credit if you summarize all the subsequent parts of this design document.
- Example:

SUMMARY:

Our educational game on sustainable living is tailored to diverse users from 3rd-9th grade (age 8-14) and offers a tiered curriculum that both fosters foundational awareness and inspires real-world actions. The game employs three pedagogical models – constructivism, spiral curriculum, and constructionism – to achieve its educational goals. Specifically, our curriculum ensures (1) learning topics take into account limited pre-existing knowledge of the young audience, (2) later topics build on and deepen previous knowledge, and (3) there are concrete deliverables/actions the users can take as the fruit of their learning.

The game presents three distinct learning levels. The first level, foundational awareness, acquaints users with the core elements of their environment. The second level, everyday practices, provides actionable insights that can be integrated into their daily routines. Finally, the curriculum culminates in community and systemic actions, challenging learners to engage in the broader socio-political contexts of environmentalism and sustainability, empowering them to be a green citizen and an agent of change.

Milestone #1 Grading Criteria

Target User Attributes Create three mythical users. I will take points off if:

- 2+ users have very similar profile
- Missing *“Explain what skills this user lacks that you have that you will need to accommodate when you design your game”*
 - **Bad** answer: *“This player struggles to understand biology concepts so my game will accommodate that.” (not descriptive enough - which biology concepts, which skills she/he lacks that make it hard for her/him to understand biology concepts)*
 - **Good** answer: *“This player has short attention span and lacks reading comprehension skills, so it is very difficult for her/him to read long text or learn from textbooks. My game will accommodate this user by including more visual cues and/or offering optional non-serious game challenges that she/he can choose to play as a “break” from the learning tasks.*

Milestone #1 Grading Criteria

Skills Describe what skills you are going to teach your user.

- Make a list!
- Try grouping them into level of difficulty (if applicable)
- This is the list of “subtopics” within the overarching topic / subject / content are you’re going to teach
- Example:
 - Overarching topic - Sustainable Living

SKILLS

Beginner (Foundational Awareness):

- Resource scarcity
- Ecosphere
 - Biodiversity
 - Pollution
 - Animal welfare

Intermediate (Everyday Practices):

- Upcycling
- Hand-me-down
- Trash sorting
- Energy conservation
- Public transportation
- Chemical alternatives

Milestone #1 Grading Criteria

Learning Trajectory Make a diagram

- Learning goals (text inside all the boxes) can be a mix of skills and knowledge
 - Do NOT make a list of definitions of different science concepts. If your learning content is very academic, you should at least specify what do you want players to be able to do with a definition / piece of knowledge (e.g., articulate Newton's 2nd law, apply Newton's second law to do something, explain a real-world or stimulated scenario using their understanding of Newton's second law they learn)
 - Why can't I just teach a definition? Well, some players can just brute force the learning part of your game by memorizing all those definitions....

Milestone #1 Grading Criteria

Learning Trajectory (cont.)

- MUST describe your methodology (i.e., which theory inspired the shape of your learning trajectory?).
 - You should choose from learning procession, spiral curriculum, pieces of knowledge, constructivism, or a mix of them)
 - You should explain why do you think your choices of theory make sense
 - If you're inspired by any other theories (e.g., ZPD, flow, scaffolding), you should also explain your use of such theories
- MUST include sources you draw the learning goals from (can be an online articles, a textbook, etc. - as long as they're credible / can't be AI-generated or from a TikTok post, etc.)
- MUST specify whether you use the learning goals from your choice of sources as is or whether you modify them (if so, which modifications you made and why)

Milestone #1 Grading Criteria

Overall

- Your design document **MUST** be thoughtful
- If you write something down to just “check all the boxes”, it’s not considered a well-designed product

*Think of your group as a startup team and me as a potential investor.
You should convince me that your game is worth putting 💰💰💰 in*

Important Due Dates

- **Milestone #2:** Basic Game Design (Tue 7/14, 11:59 PM)
- **Flash Talk** (Fri 7/17, in-class during lecture)
- Will release instructions for both assignments on Sunday morning

Those who aim to implement the game for extra credit...

- You're free to use any programming languages you would like to (except for Scratch)
 - You can consider using Scratch to make the game prototype for your final presentation (i.e., "final exam")
- However, course staff doesn't have the bandwidth to provide supporting resources anything outside of what is covered in the course (e.g., debugging Unity code)