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Game Design and Development
as Project-Based Learning

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1. Overview of PBL and game development

Project-based learning (PBL)

- An active learning methodology (“learning by doing”)
- Students tackle a real-life, open-ended problem
- Teamwork over an extended period of time
- Facilitates various skills:
 - Problem-solving and application of knowledge
 - Communication and role-taking
 - Planning and time management
 - Self-reliance and autonomy
- Examples of PBL in your practice?

Game-based learning and game development

- Game-based learning (GBL) refers to using play and games in an educational setting, e.g.:
 - Playing games to raise students' motivation
 - Using learning games to deliver educational content
 - Evaluating students' competences through their in-game performance
 - Having students **make their own games** on a particular subject or issue

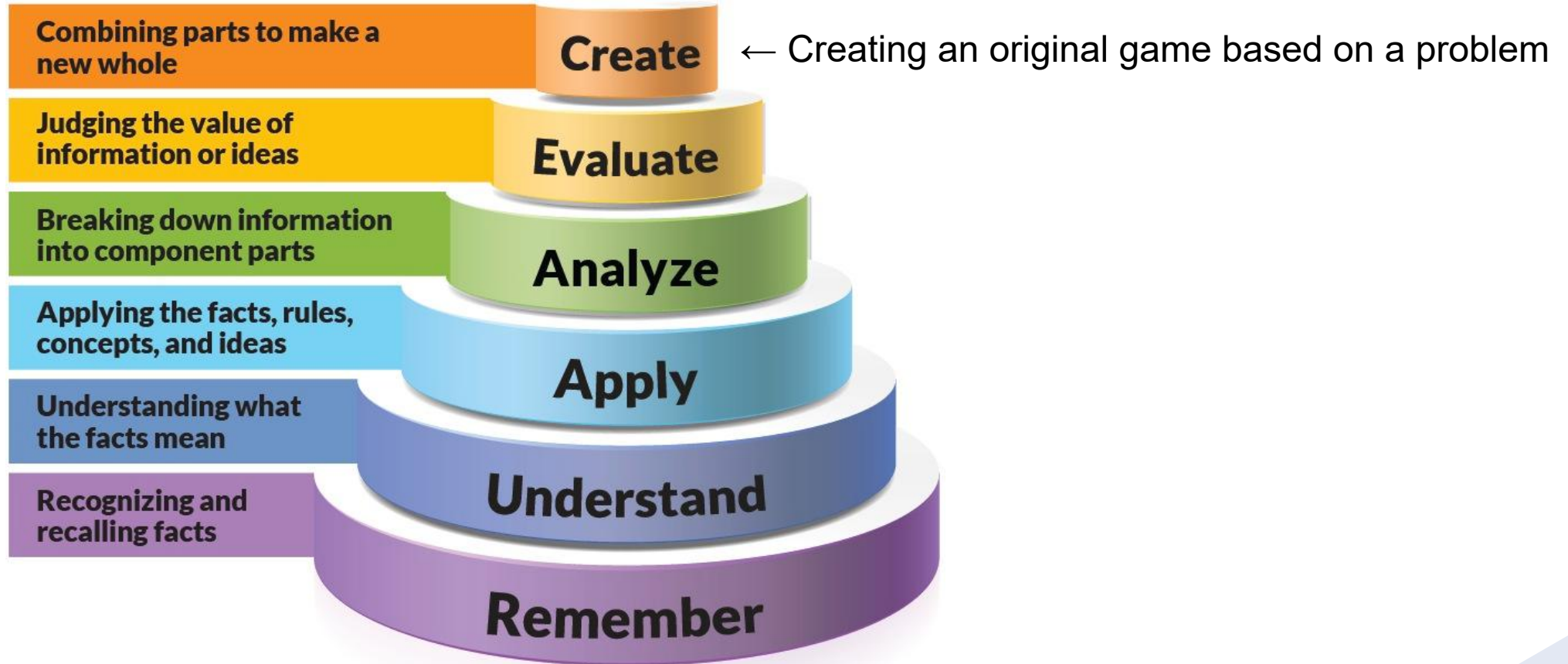
Ke, F. (2014). *An implementation of design-based learning through creating educational computer games: A case study on mathematics learning during design and computing.*

NB! Game development ≠ game design ≠ art design

- **Game development**, broadly, refers to the entire process of creating a game. In a narrow sense, “development” can refer to just the programming aspect of it.
- **Game design** is creating the logic of the game (rules, challenges, player interactions).
- **Art design** refers to creating the audiovisual assets used in the game: character models, level environments, UI, etc.



GBL and game design: Bloom's taxonomy



Churches, A. (2008). *Bloom's taxonomy blooms digitally*.
<https://tips.uark.edu/using-blooms-taxonomy/>

PBL and game design: commonalities

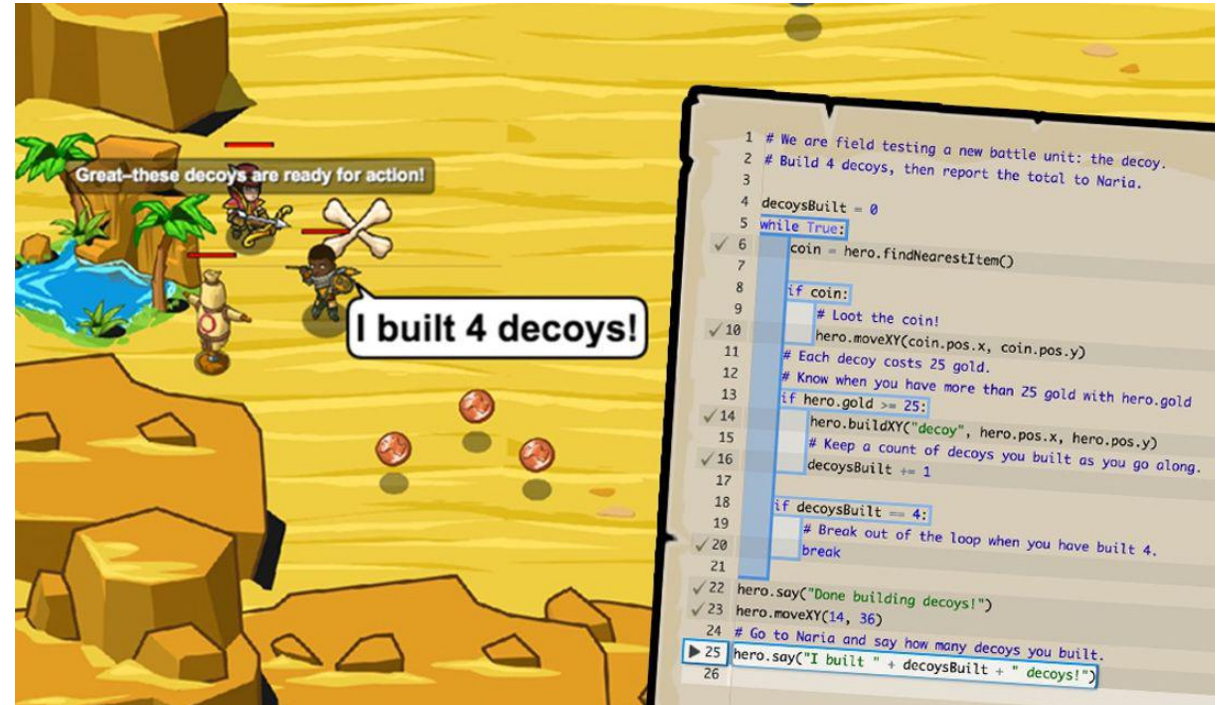
- Heterogeneous team with clear role division
- Defined final goal: tangible *end product*
- Effective communication is crucial
- Requires both team- and self-management
- Limited time frame, schedule to follow

Three levels of learning in PBL/game development

- **Technical/practical skills:** game development, graphics and user interface design, etc.
- **Soft skills:** communication, conflict resolution, project management, etc.
- **Modeling the content:** transforming the educational content into a playable form
 - Games are models of real-life or imaginary processes
 - They are governed by rules
 - Game designers must create rules that represent the learning content
 - This facilitates a deeper understanding of the content

Example: coding games

- Coding games such as *Code Combat* or *Code Monkey* teach programming by asking players to type in code to make progress in the game
- But designing and developing an original coding game can be an effective (if challenging) way to understand particular concepts relating to programming even better.

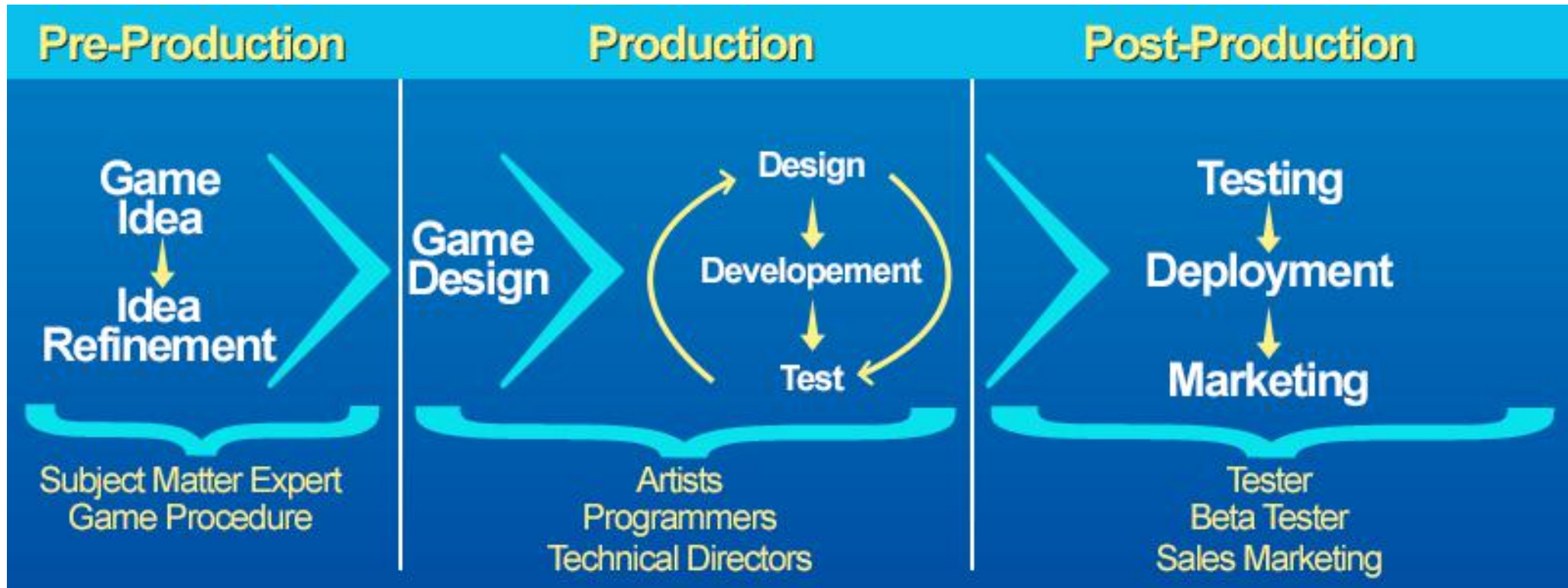


2. Game design and the development process

Team roles & skills in game creation

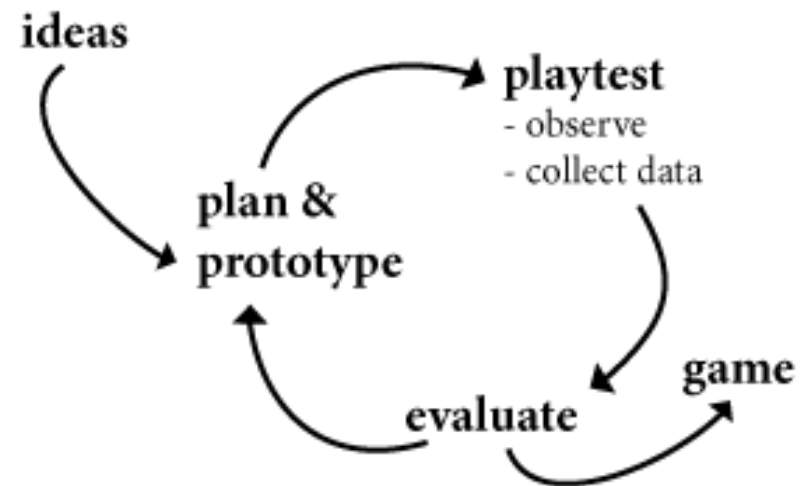
- **Project manager (producer)** : assign responsibilities, tasks, and deadlines; ensure progress and team communication
- **Game designer**: create the game logic
- **Game developer**: create the software code powering the game, based on the game logic
- **Artist**: create the visual assets used the game
- Also **writer/narrative designer, sound designer, composer, QA and testing specialist, community manager, marketing expert, educator/instructional designer, etc.**

Game development process



Game development: iterative design

- Because **balance** is crucial and delicate in games, it usually takes time to fine-tune it to meet players' demands
- The complexity of the software also can lead to a significant number of bugs, so **software testing** is essential
- This is why games are often developed **iteratively**, until they reach **maturity**



Example: Computer Games (4 ECTS BSc course)

- Session 1: Overview of game design
- Session 2: Idea pitching and selection. Team formation
- Sessions 3-10: Designing the game rules, mechanics, characters and story, assets, etc.
- Sessions 11-12: Creating a prototype
- Session 13: Playtesting and feedback
- Session 14: Presenting revised versions of the games



Game design document (GDD)

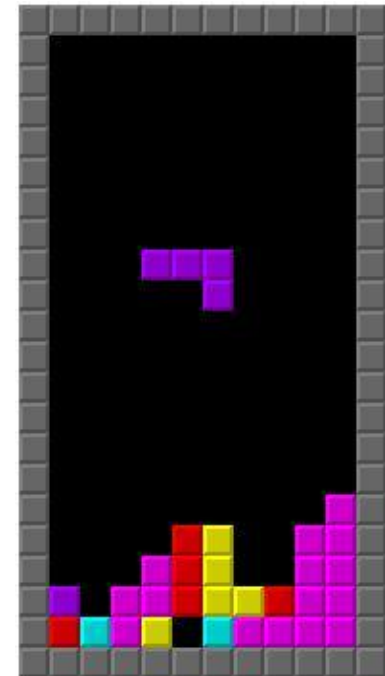
- To ensure a shared understanding of the development process between team members, a **game design document** is needed. It usually outlines:
 - Basic concept
 - Target audience
 - Player roles
 - Genre, rules and gameplay
 - Game environment and level design
 - Visual style; sound and music design
 - User interface and control scheme
 - Platform(s) and technical specifications
 - Distribution model, license and marketing strategies

(Some) game genres

- **Action games**
 - First-person shooter
 - Shmup (shoot-em-up)
 - Platformer
 - Brawler (beat-em-up)
- **Adventure games**
 - Point-and-click
 - Interactive fiction
- **Simulation, management**
 - Sports games
 - Vehicle simulation
 - Business simulation
 - Life simulation
 - Pet game
- **Strategy games**
 - Real-time strategy
 - Turn-based strategy
- **Puzzle games**
 - Physics game
 - Reveal-the-picture
- **Role-playing games**
 - Hack and slash
 - Dungeons & Dragons
 - Roguelike
- **Crossover**
 - Action-adventure
 - Role-playing strategy
 - Sports RPG

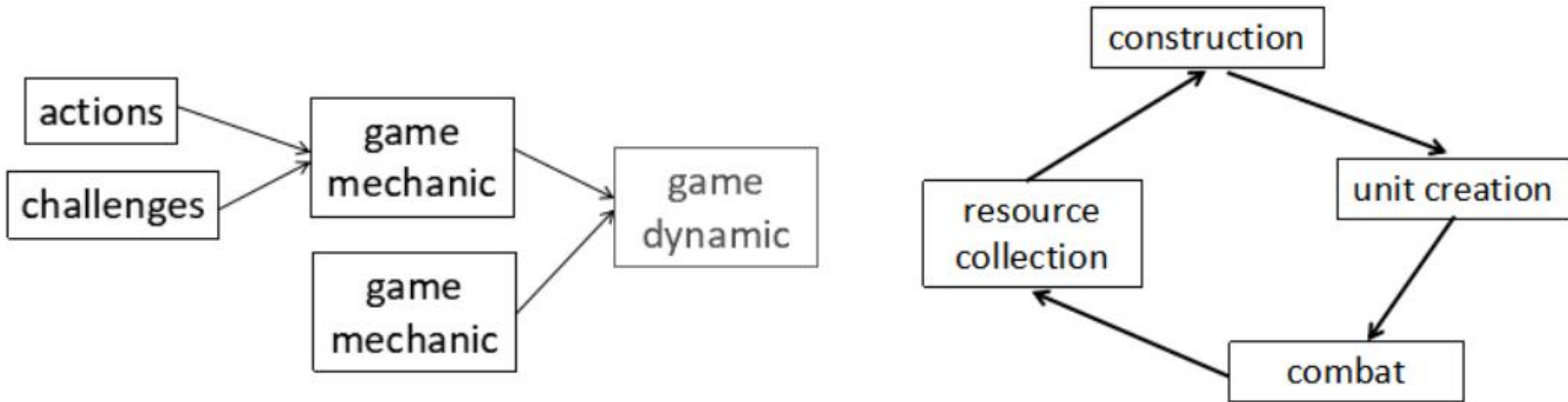
Game mechanics

- **Game mechanics** guide how how the player interacts with the game and its rules:
 - What basic set of actions can playing the game be brought down to?
 - How do these actions affect the flow of the game?
- E.g. *Tetris*:
 - **Rotate** falling geometric shapes
 - Arrange them in a **horizontal line** without gaps
 - **Speed up** the fall



Game dynamics

- **Game dynamics** are emergent player behaviors, or patterns of actions that arise out of a combination of various game mechanics in a particular game context.



MDA: a framework for game design

- **MDA** is a framework for game design that was proposed by R.Hunicke, M.LeBlanc & R.Zubeck.
- MDA stands for **Mechanics, Dynamics, and Aesthetics**.
- **Aesthetics** is used very broadly and refers to the player's feelings and perception of the game:

sensation

game as sense-pleasure

fantasy

game as make-believe

narrative

game as drama

challenge

game as obstacle course

fellowship

game as social framework

discovery

game as uncharted territory

expression

game as self-discovery

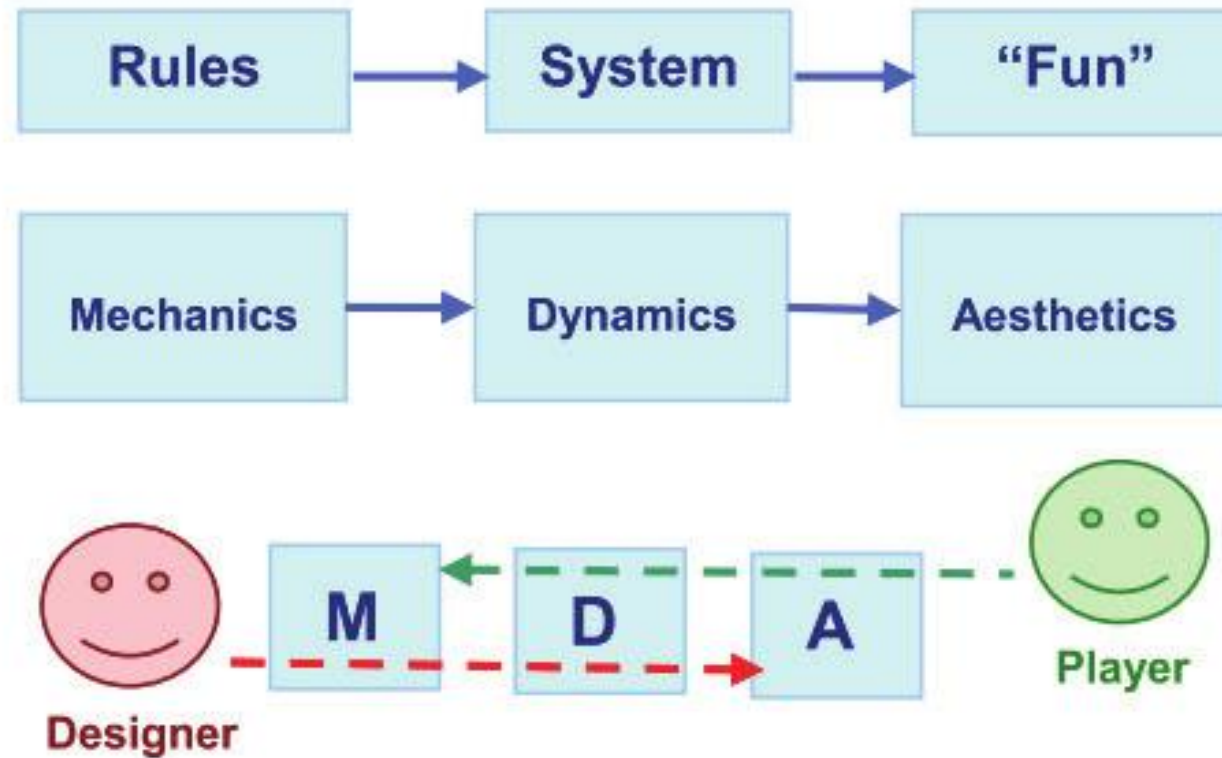
submission

game as pastime

competition

game as arena

MDA: a framework for game design



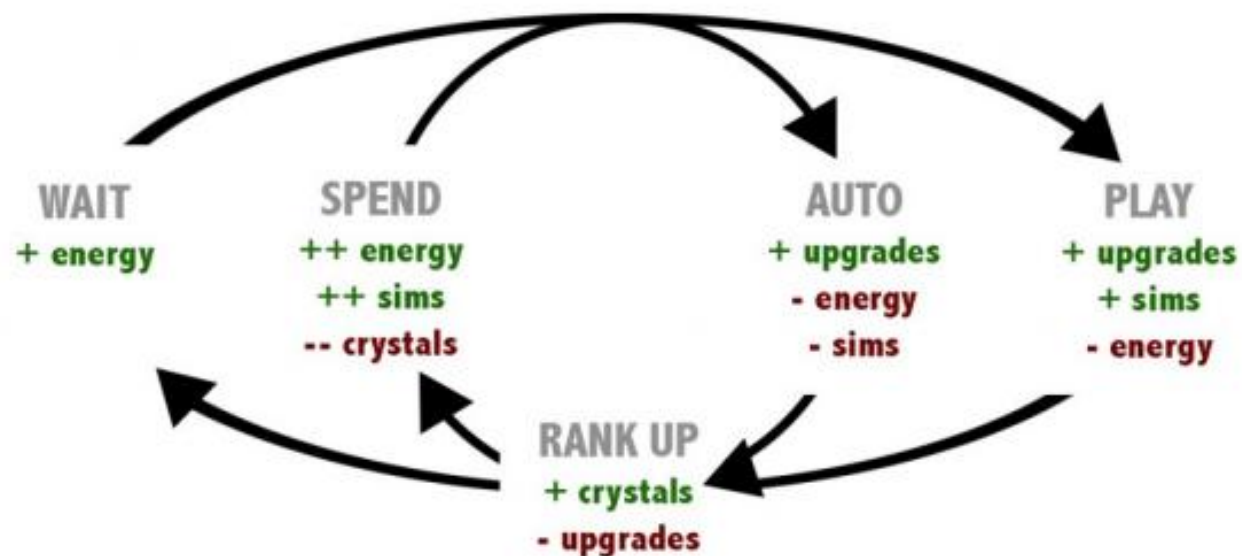
MDA example: RecycleIt!

- MSc project by Esin Kalay
- Aims to raise environmental awareness
- Recycling game:
resource management
+ connect 4 puzzle



Core loop and game economy

- Games can also be thought of as **economies** of resources flowing between players: points, gold, minerals, health, etc.
- This can be visualized as a loop of transactions (**core loop**)



Game economy example: EcoHouse

- A management game developed by Computer Science BSc students
- First created as a spreadsheet:

A	B	C	D	E	F	G	H
Category	Option	Price	Energy production / loss per year	Electricity consumption / production per year	Comfort Level	Environmental Friendliness	Selected
Heating system	Old - Wood log oven	0	12000	0	0	0	1
Heating system	Electric Boiler and radiators	1000	12000	-12000	10	-10	0
Heating system	Wood Oven	2000	12000	0	1	0	0
Heating system	Oil Boiler and radiators	3000	12000	-100	10	-9	0
Heating system	Gas Boiler and radiators	4000	12000	-100	10	-9	0
Heating system	Pellet Boiler and radiators	5000	12000	-150	7	-3	0
Heating system	Air Heat Pump	6000	12000	-3000	7	-3	0
Heating system	Ground Heat Pump and radiators	7000	12000	-3000	10	-3	0
Heating system	Solar panels 1 (water) and radiators	8000	12000	-100	10	0	0
Electricity source	None - circuit	0		0	0	-10	1
Electricity source	Solar panels 2 (electricity)	9000		4000	10	0	0
Electricity source	Wind turbine	10000		4000	10	0	0
Windows	Old - Wooden frames, 2 layers of glass	0	-3000		0	0	1
Windows	Option 1? - U value 1.25	1000	-1500		4	0	0
Windows	Option 2? - U value 1.00	2000	-1000		6	-2	0
Windows	Option 3? U value 0.75	3000	-500		8	-4	0
Windows	Option 4? U value 0.50	4000	0		10	-6	0
Windows	Option 5? U value 0.25						
Roof	Old - Slate (et: eterniit)	0			0	-10	1



3. Discussion

PBL at Tallinn University: LIFE projects

- Compulsory subject (6 ECTS) for all students
- One or two semesters
- Interdisciplinary, team-based project
- Ideas submitted by students or faculty
- Can focus on any societal or educational issues
- <https://elu.tlu.ee>



LIFE project example: Facts Don't Check Themselves



- Digital game to promote information literacy:
 - Raise awareness of “fake news”
 - Fact checking methods
 - etc.
- Interdisciplinary team
- Game design by students:
Fake the Fact
- Finished product, but mixed results in terms of student experience

Limitations of PBL?

- Differing levels of motivation
- Different skills
- Communication and management issues
- Unclear role division
- Too much/little autonomy
- Lack of meta-cognitive awareness
- No follow-ups / subsequent development
- ?

Sillaots, M. & Fiadotau, M. (2018). *Using Project-Based Learning to Teach Learning Game Design: The Example of LIFE Project*