(Day 2)

CMSC 33231 - Diana Franklin

Readings for Today

Efficiency of Learning from Proof Blocks vs Writing Proofs
https://dl.acm.org/doi/10.1145/3545945.3569797

Using Foundational CS1 Curricula for Middle School & Early High School Computer Programming Education
https://dl.acm.org/doi/10.1145/3545945.3569877

But first!!!! Let's learn a little theory

Goals for today

Familiarize ourselves with multiple theories that drive CS Ed research

Learn how those theories are used in research

Discuss good presentation design

Discuss the two papers in relation to the levels of research design

Be critical / opinionated (but obviously still respectful) -

We want to explore possible (reasonable) interpretations, not just say what we 100% believe

Affordances Boggle

I give you a raw material(s)

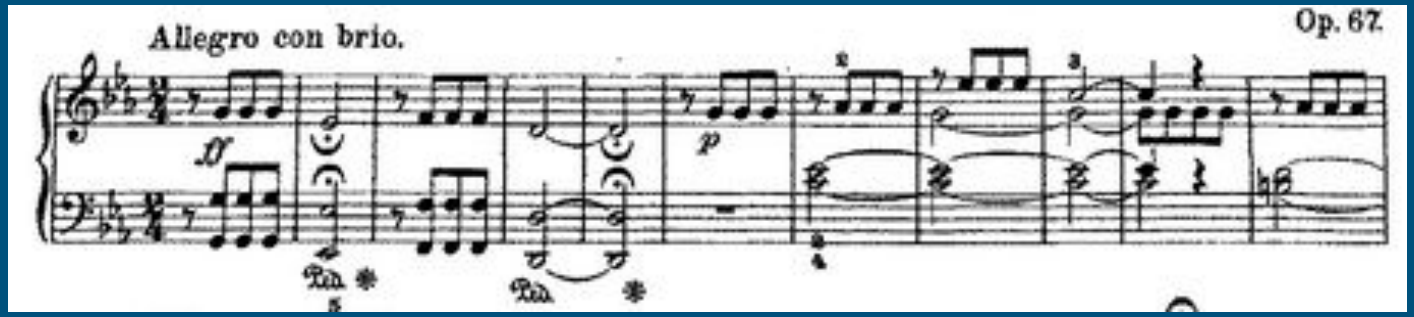
You think of all of the things you can make with that material (with little else)

Scoring:

- For each idea, 1 point for each opponent who did not think of it
- I will group ideas into a higher-level concept if very detailed

Leaves

Blind Spots:
Novices vs Experts



https://www.youtube.com/watch?v=_4IRMYuE1hI

Guitar Hero Musical Notation

Affordances

Visible: A comfy chair for some

False: Too deep for short people

Hidden: A stool with right incentive

Design fails for females / minorities

- Non-wheelchair-accessible rooms / buildings / etc.
- Facial recognition misidentifying people with darker skin
- Central A/C set to temperatures comfortable to men, freezing for women
- Seat belt designs for pregnant women?
- Several short females got killed by air bags when they first became standard
- Gym equipment is too high for some people
- Questionairres about families assume you have a mother and a father - genders, single parents, grandparents, etc., are outliers
-

Design fails for females / minorities

- Air bags
  - Crash test dummies were adult male sized
  - Killed children and small females in passenger seat
  - Killed small female drivers from steering wheel airbag
- Ill-fitting PPE (masks too large and won't seal)
- Body armor doesn't account for female chests
- Facial recognition software (minorities falsely accused)
- Department "unisex" sweatshirts last year - this year they got W & M sizes
- Voice recognition software (recognizes male voices, California American English accent)
- https://www.theguardian.com/lifeandstyle/2019/feb/23/truth-world-built-for-men-car-crashes

Guess the Probability Game

I will have a program with a certain probability that it will report 0 or 1

Possibilities are: 0, 10, 20, 30, 40, 50, 60, 70, 80, 90 100

Each person gets one guess

1st correct guess gets 10 pts

2nd correct guess gets 5 pts

Incorrect guess gets -5 pts

What technical material does this game expose?

What do we learn about learning?

If you are careful about the mechanics, students have to really think about the technical material and what it means

More engaging

What do we learn about learning?

More active, less passive during game

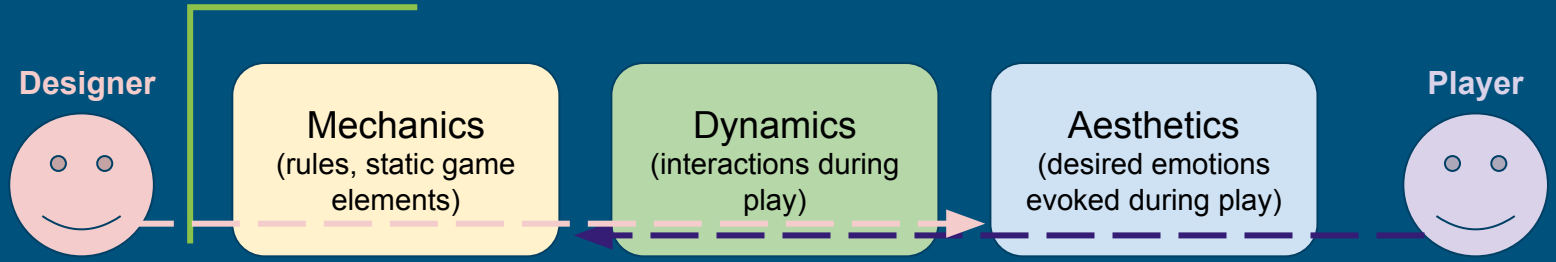
Might learn more when I’m engaged

May not get the actual learning goal unless made explicit

Gamification

1. Use the **incentives** in games to encourage students to complete learning tasks
2. Apply motivation theory and game theory to education

MDA



Elements:

Mechanics: The game itself - rules, game elements, etc.
Dynamics: The ways in which the mechanics cause interactions during gameplay
Aesthetics: The resulting emotions that the player feels from the interactions

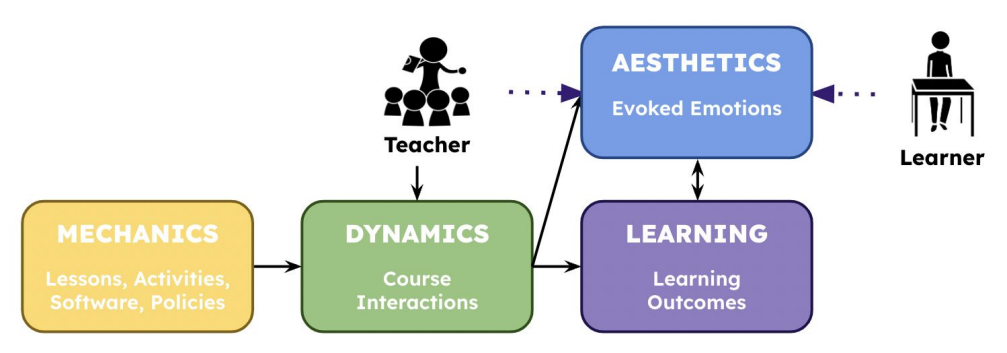
The **designer** creates *mechanics*, which in turn cause dynamics

But the **player** feels the *aesthetics* first, which are caused by dynamics & mechanics

The designer should identify emotions, then identify the dynamics that would cause those emotions, and finally design mechanics.

Therefore, a designer should design right to left.

MDAL



Elements:

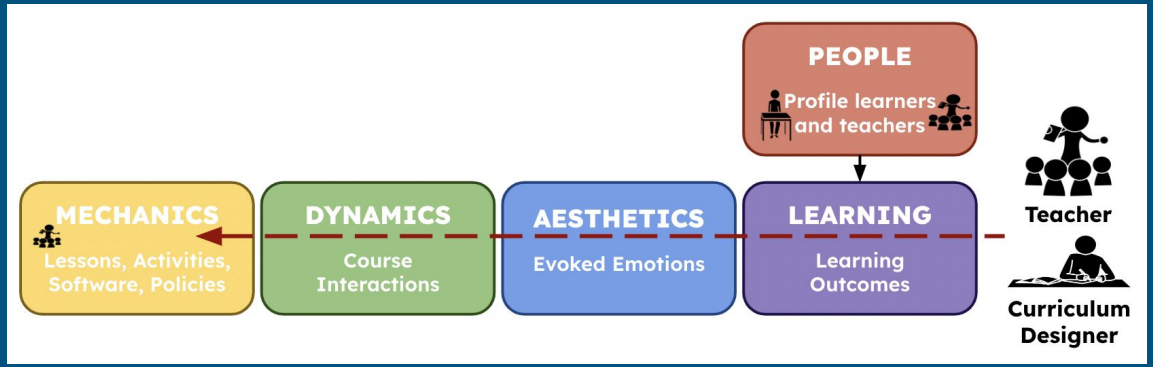
Mechanics: Lessons, activities, software, policies
Dynamics: The ways in which the mechanics cause interactions during class
Aesthetics: The resulting emotions that the player feels from the interactions
Learning: The resulting learning that occurs as a result of the interactions

The **designer** creates *mechanics*, which in turn cause dynamics

The **learner** feels the *aesthetics* first, which are caused by dynamics & mechanics

The **teacher** feels the *aesthetics*, but also controls many of the dynamics

MDAL



The designer profile learners, decide on learning goals, identify emotions, then identify the dynamics that would result in the combination of the desired learning goals emotions, and finally design mechanics.
Therefore, a designer should design right to left.

Presentation: Proof Blocks

Attributes of a good set of slides (according to Diana)

Motivation at the very beginning

Images to add to the motivation

Add titles to the slides

Related work: added pictures and explained the relationship between related work and our work

Wait on details until you've set up the problem well

Include all pertinent research study design details

The slide order is important!

Attributes of a good delivery

Not reading the slides verbatim, but expand on them (use images when possible)

Loud enough for everyone to hear

Look at the audience, not hte slides

Not a monotone voice

Proof Blocks

Discuss papers

- What was their idea?
- How did they analyze it?
- **What do you think about it? Do you think it would have worked for you? (why or why not)**

In groups, you answer the following question

- In what ways did the paper use CS Ed theory?
- What are the limitations in the research design?
- What are next research steps?

Foundation CS1 in middle / high school

In-class Activities

Discuss papers

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SOLO Taxonomy: 5 levels

Prestructural: little to no understanding of the topic

Unistructural: understanding of a single aspect of the topic

Multistructural: understanding of several aspects of the task but each aspect is represented independently

Relational: understanding of several aspects of the task and how they are related

Extended Abstract: understanding of the aspects can be generalized beyond the context of the question