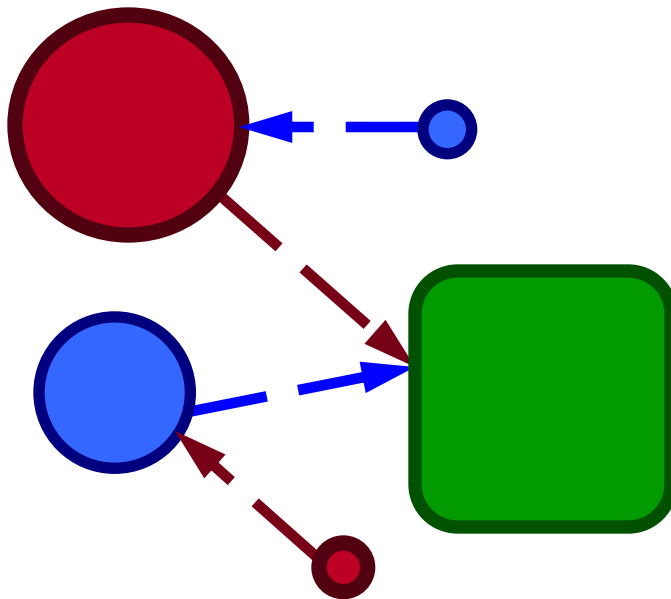


# [Contemporary Video Game Design.]

Challenges in **Visualization**  
**Interaction**  
and **Simulation**



[**Andrew Nealen.**]

Department of Computer Science  
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# [Talk. Origins.]

- 2 years (= 3 classes) of teaching game design
  - **40 graduates**: teams of four students make a game from prototype to final product in 14 weeks
- Collaboration on the Design and Programming of the award winning video game **Osmos** (demo to follow)
- Talks, panels, roundtables and blogs
- Many, many years of “**game analysis**”
  - Yes, I play many (video) games 😊

# [Talk. Motivations in 2D.]



# [Talk. Rules.]

- Please interrupt me if you like
- Even better: interrupt me if you can educate me on a topic
- This talk is a first
  - I am a structural engineer/architect/computer scientist (= computer graphics researcher) by education
- Ideally I will learn from you
  - While making this as entertaining as I can

# [Definition. Games.]

- Games are about **meaningful interaction** with and within a **dynamic formal system**
- Games have **rules**
- Games have **goals**
  - and these goals can be explicit or implicit
  - or even consist entirely of playful sense-pleasure
- Games (can) contain **resources**
- Games are **abstractions**

[Example. **Osmos.**]



This is you.

# [Osmos. Deconstructed.]

- **Interaction:** mouse clicks + mote collisions
- **Dynamic formal system:** “Newtonian” physics
- **Rules:** absorb smaller motes, etc.
- **Goals:** become the biggest + sense pleasure
- **Resources:** mote size. coupled to propulsion mechanic. arguably the key contribution.
- **Abstractions:** gravitational motion, energy conservation, linear momentum, actio = reactio... etc.

# [Meaningful. Play.]

- Player **interaction** should (ideally) be
- **Discernable**
  - Perceive the immediate outcome of player action
  - Sound or visual effect, game state change
- **Integrated**
  - Outcome of action is woven into the game system
  - Long term consequences
  - Actions in earlier stages have far reaching influence

[Rules of Play. Salen and Zimmerman.]



[Digital. Analog.]



# [Digital interaction. **Forms.**]

- Two forms of **interaction in video games**
- **Direct interaction**
  - **Tactile.** Grasping. Pulling. Pushing. Shooting.
- **Indirect interaction**
  - **State change.** An earlier decision/action has far reaching influence on the dynamic simulation
- Contemporary games have problems simulating direct interaction
  - **Instead.** state manipulation through **abstracted** direct interaction

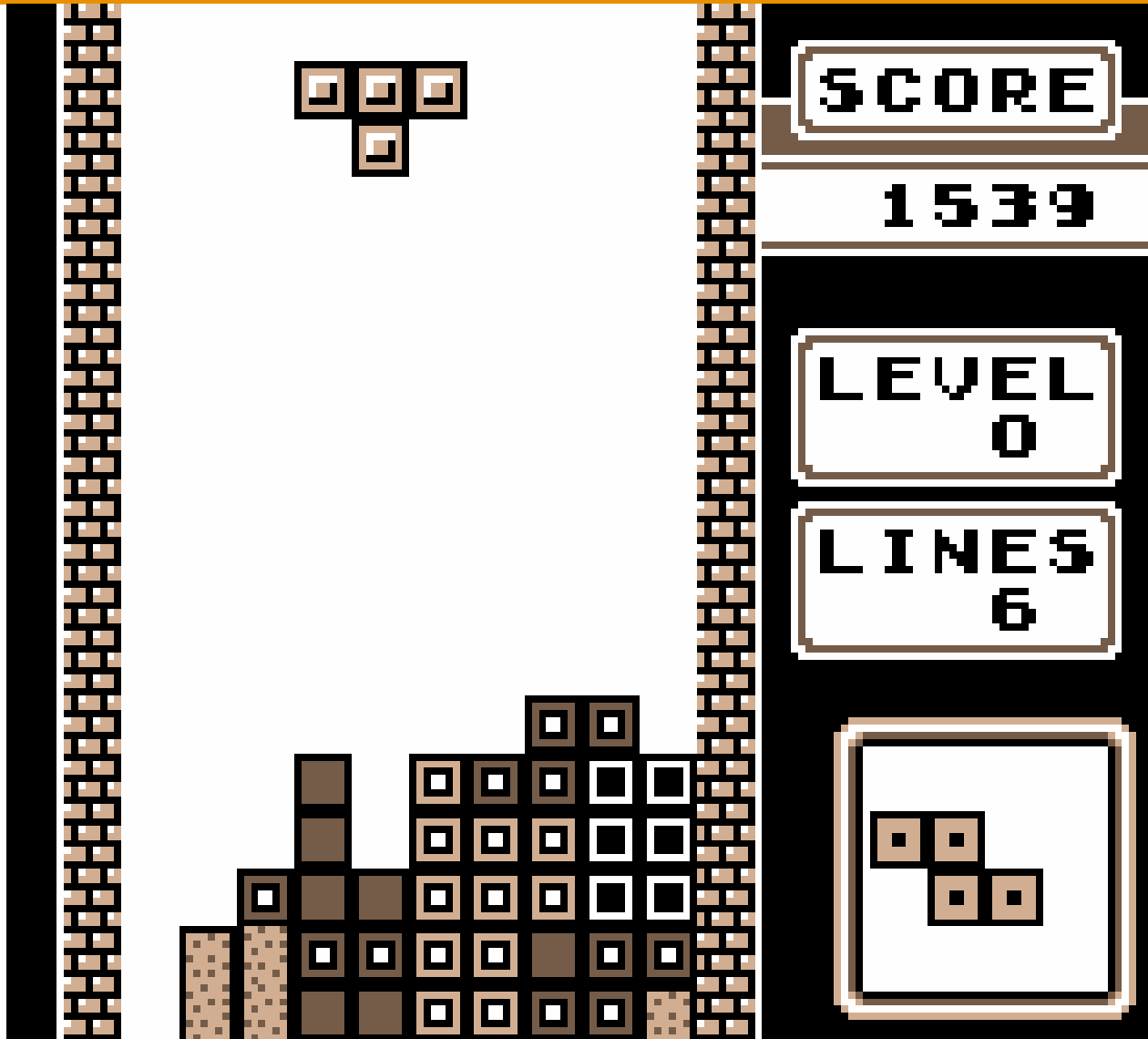
# [Digital interaction. **Abstraction.**]

- Discernable actions  
= **abstracted direct interaction**
  - Collision. Gathering. Motion. Buttons.  
Swinging (Wii).
- Integrated actions  
= **state changes** and long term consequences  
as a result of discernable actions
  - Behaviors. Strategies. Etc.
  - These are generally also simplified/abstracted to  
make the game tractable and learnable

# [Abstraction. **Why?.**]

- Ongoing discussion among game designers
- Controller mappings and tactile feedback
  - **Example.** Motion sensing on Nintendo Wii
- Where this works well.
  - Bowling. Throwing. Minor pulling.
- Where 1:1 mapping breaks
  - Collision. Absence of feedback.
    - Solution.** Abstraction (break 1:1 motion of device)
- Games are **always** abstractions on some levels

# [Input. Reaction. Sensitivity.]



# [Game. Feel.]

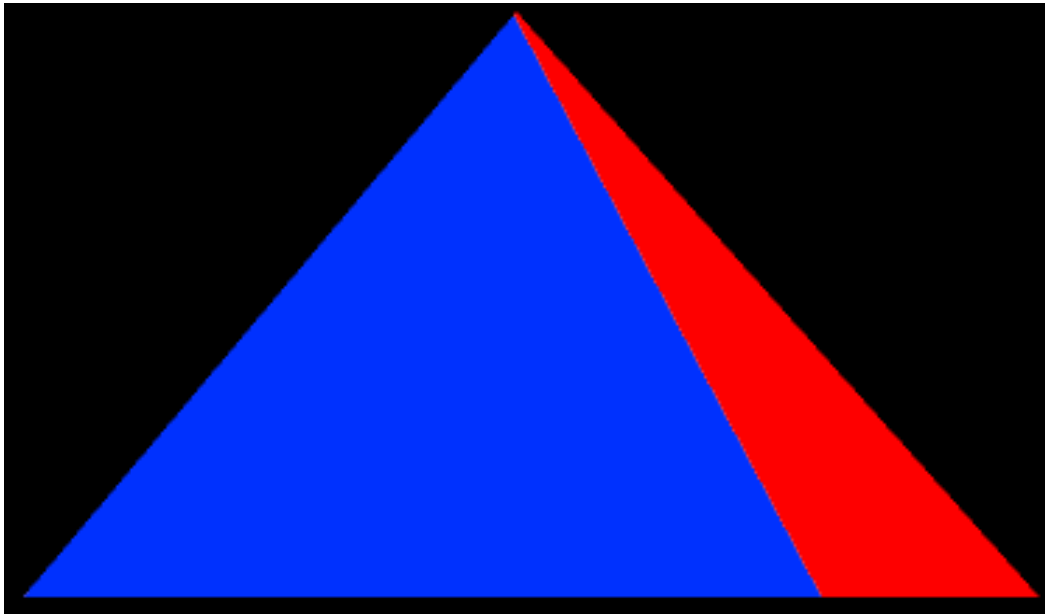
- Tetris input and feedback is **discrete**.
  - Many casual players tend to enjoy this kind of play style tremendously.
- Learning the game controls is near trivial.
  - This is not snowboarding. Playing the piano. Etc.
- Mastering the game is hard and rewarding.
  - Balancing the game is difficult.
  - Iteration and rapid prototyping are valuable tools.

# [Visual. Abstraction.]



# [Visual. Iconography.]

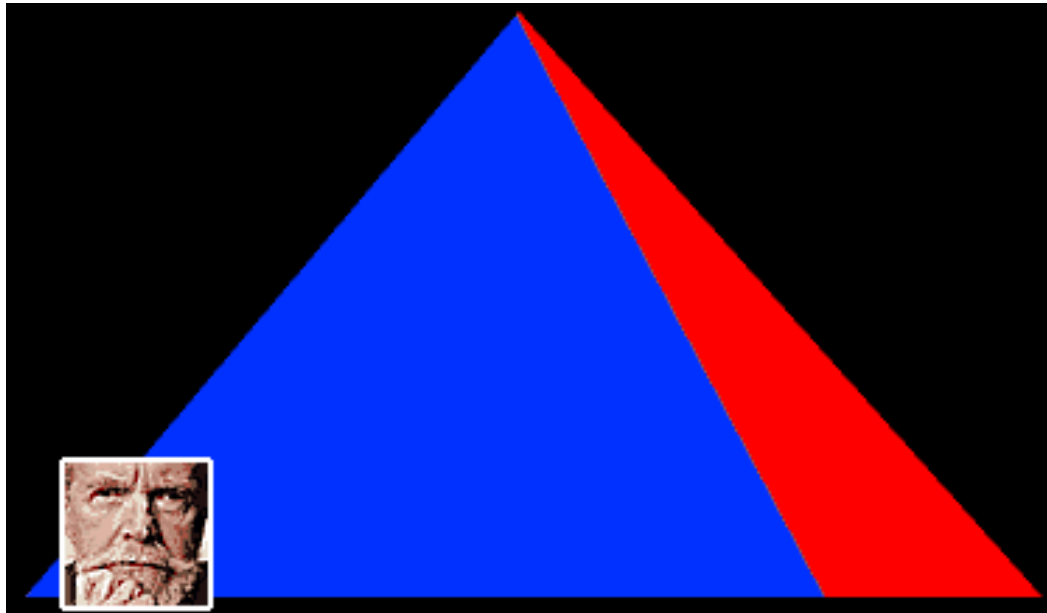
- A map of visual iconography





# [Visual. Iconography.]

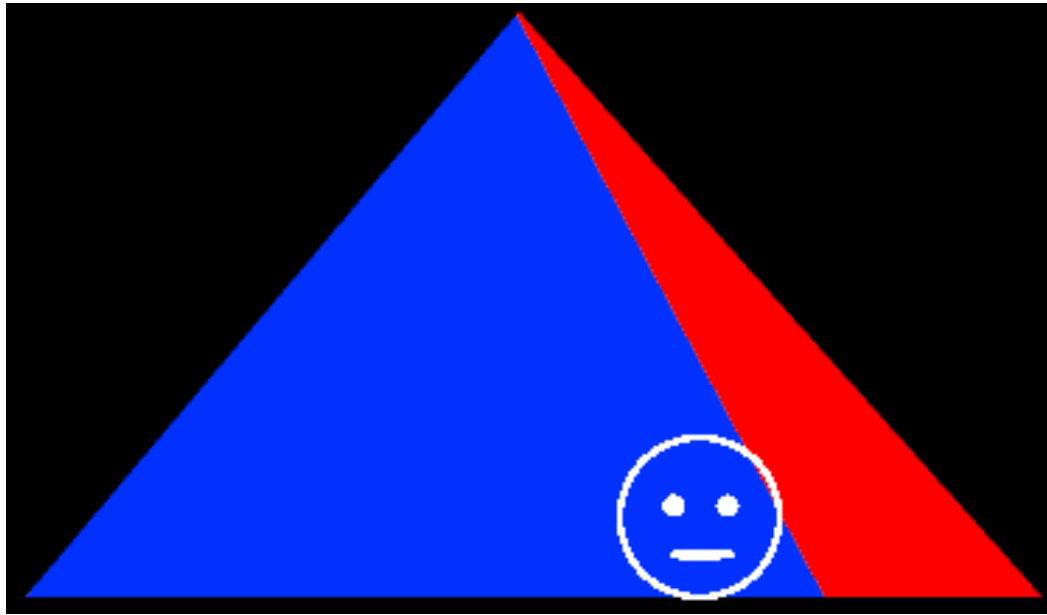
- A map of visual iconography



- Lower left: visual resemblance (e.g. photography)

# [Visual. Iconography.]

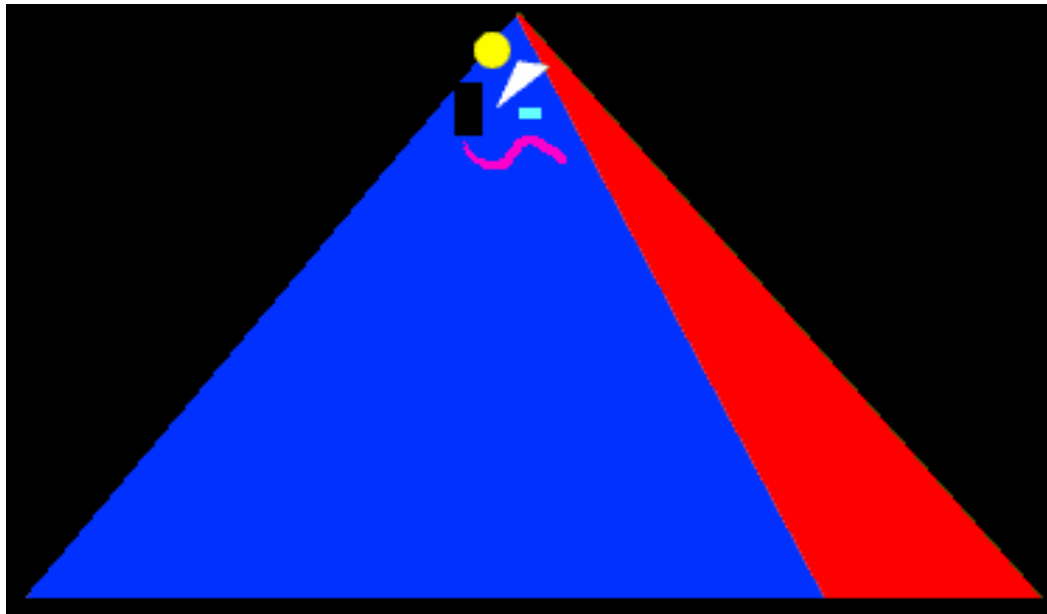
- A map of visual iconography



- Lower right: iconic abstraction (e.g. cartooning)

# [Visual. Iconography.]

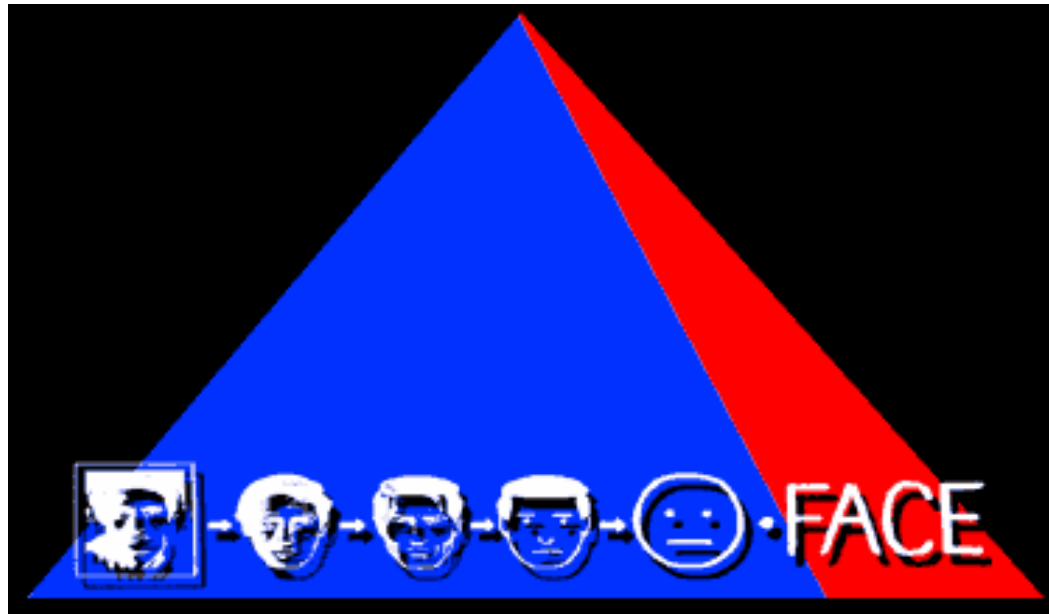
- A map of visual iconography



- Top: picture plane („pure“ abstraction)

# [Visual. Iconography.]

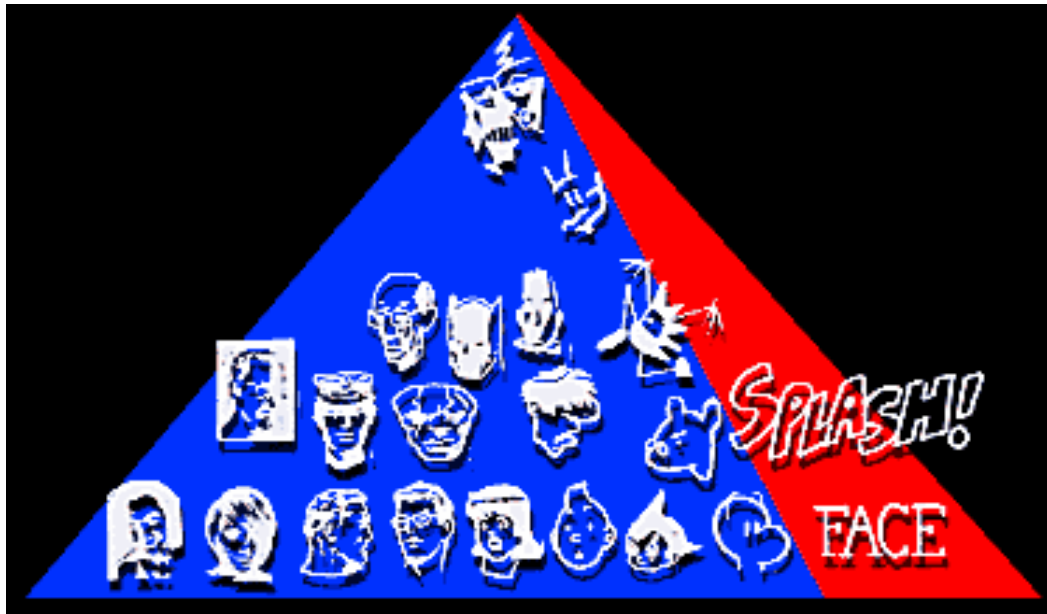
- A map of visual iconography



- Far right: from realism to cartoons... words as the next logical step

# [Visual. Iconography.]

- A map of visual iconography



- Interesting tool for thinking about comics and games as art

# [Game. Context.]

- Areas of game design iconography

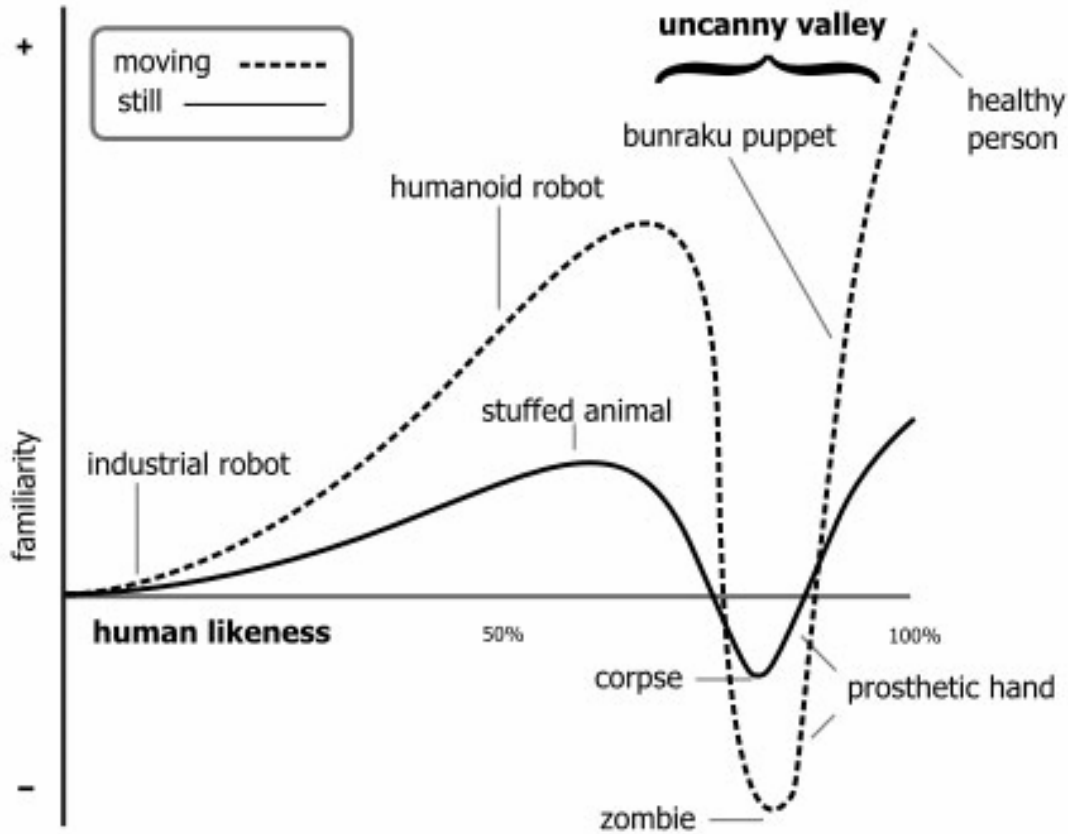


**Potential**  
**Uncanny Valley**

**Final Game**

**Prototype**

# [Uncanny Valley.]



[Bukimi no tani The uncanny valley. Masahiro Mori 1970]

[Uncanny valley. **Solved?.**]





[Uncanny valley. **Solved?.**]



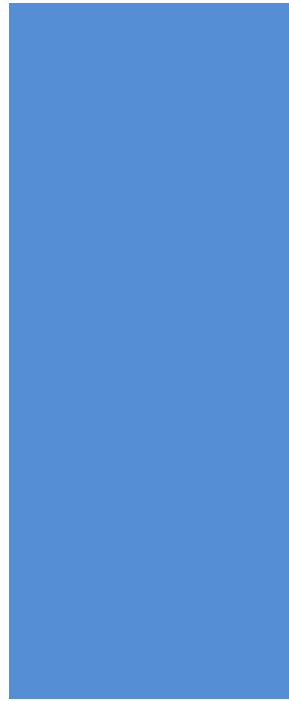
# [Uncanny valley. **State.**]

- Still images are continuously improving
  - Just a matter of time. **Potentially solvable.**
- Problem is exacerbated in human animation
  - Motion capture works for film.  
Infeasible for physical interaction in games.
  - Much research effort. **Potentially solvable.**
- **But what about digital interaction?**

# [Digital. Development.]



[Rendering.]



[Animation.]

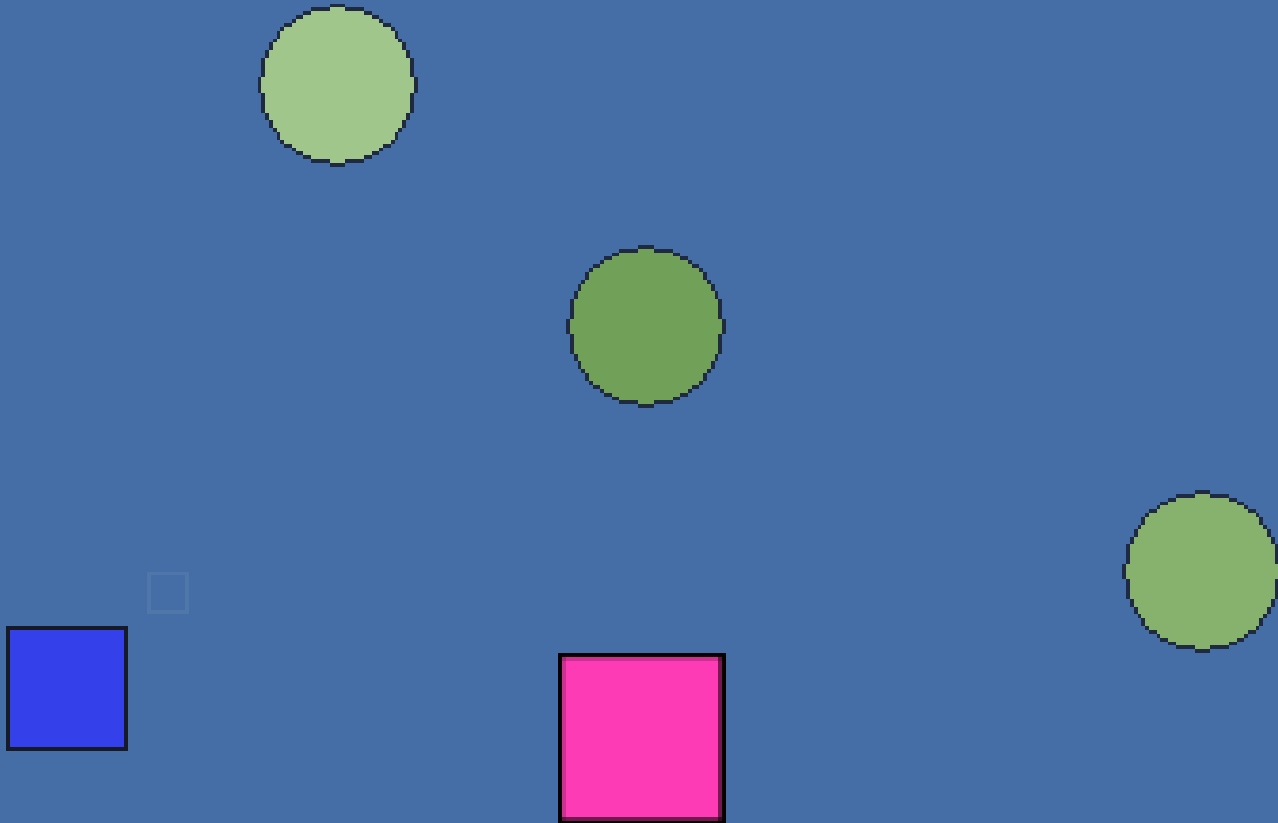


[Interaction.]

# [Uncanny valley. **Interaction.**]

- Currently, meaningful interaction in **photorealistic environments** is quasi non-existent.
- Limited to. Destruction. Shooting. Etc.
- Notable example. **Exploration.**
  - Sense-pleasure as a goal is possible.  
Explicit interaction goals other than the most primitive kind are generally **absent**.
- Other Direct interactions ?  
Indirect interactions/simulations ?

# [Visual. Interaction. **Abstraction.**]



[Simulation. Reality. Abstraction.]

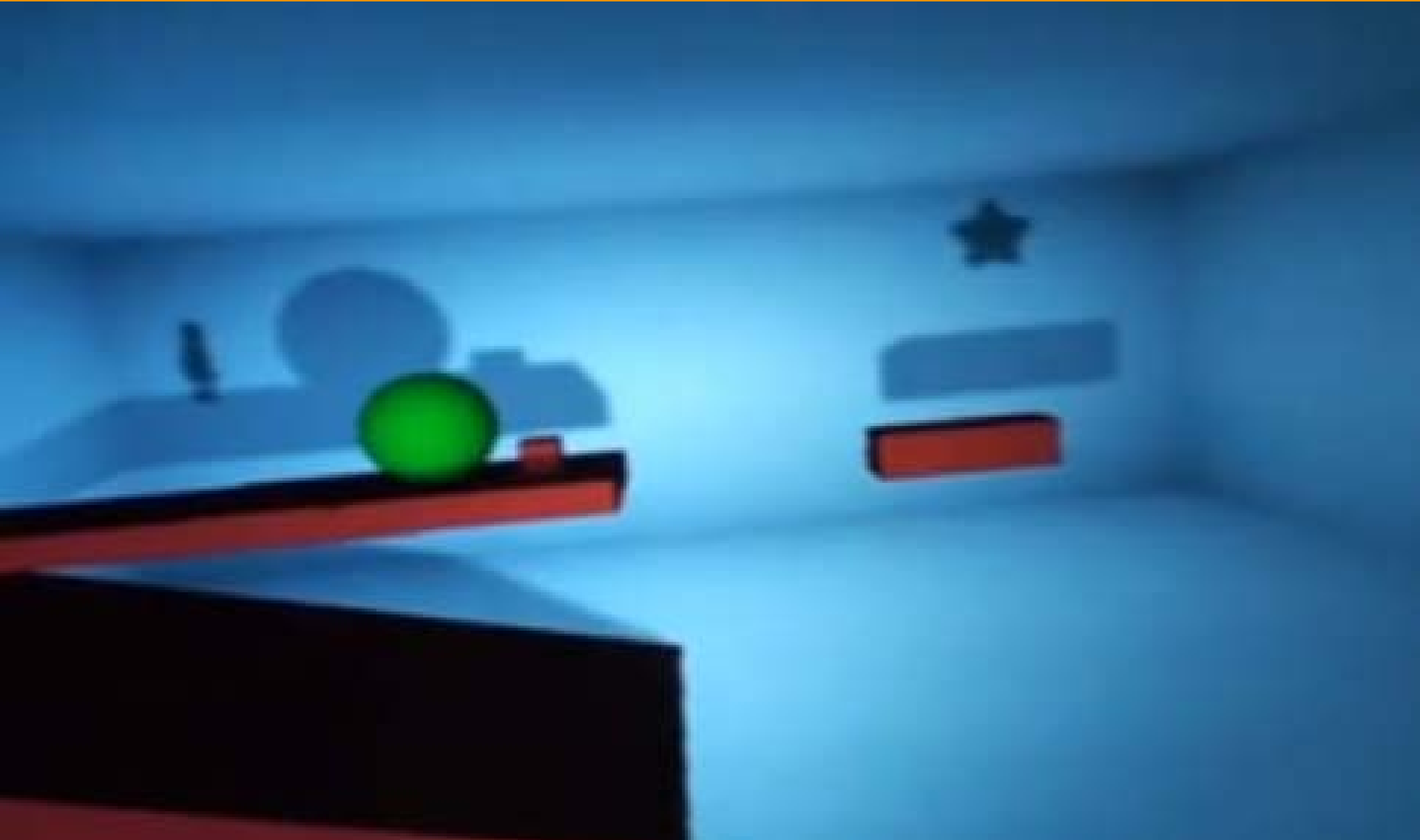


[Gravitation. Jason Rohrer]

# [Engineering. Abstraction.]



# [2D to 3D. Abstraction.]



[Shadow Physics. Steve Swink and Scott Anderson]



# [2D Game. Play.]

- Success of 2D low DOF games often and mostly attributed to nostalgia.
  - Surely this helps. But...
- Reduced DOFs, **Abstraction** and simplicity of control equally important
- If the game does not **feel** right it will not succeed
  - Control. Feedback. State changes. Simulation.

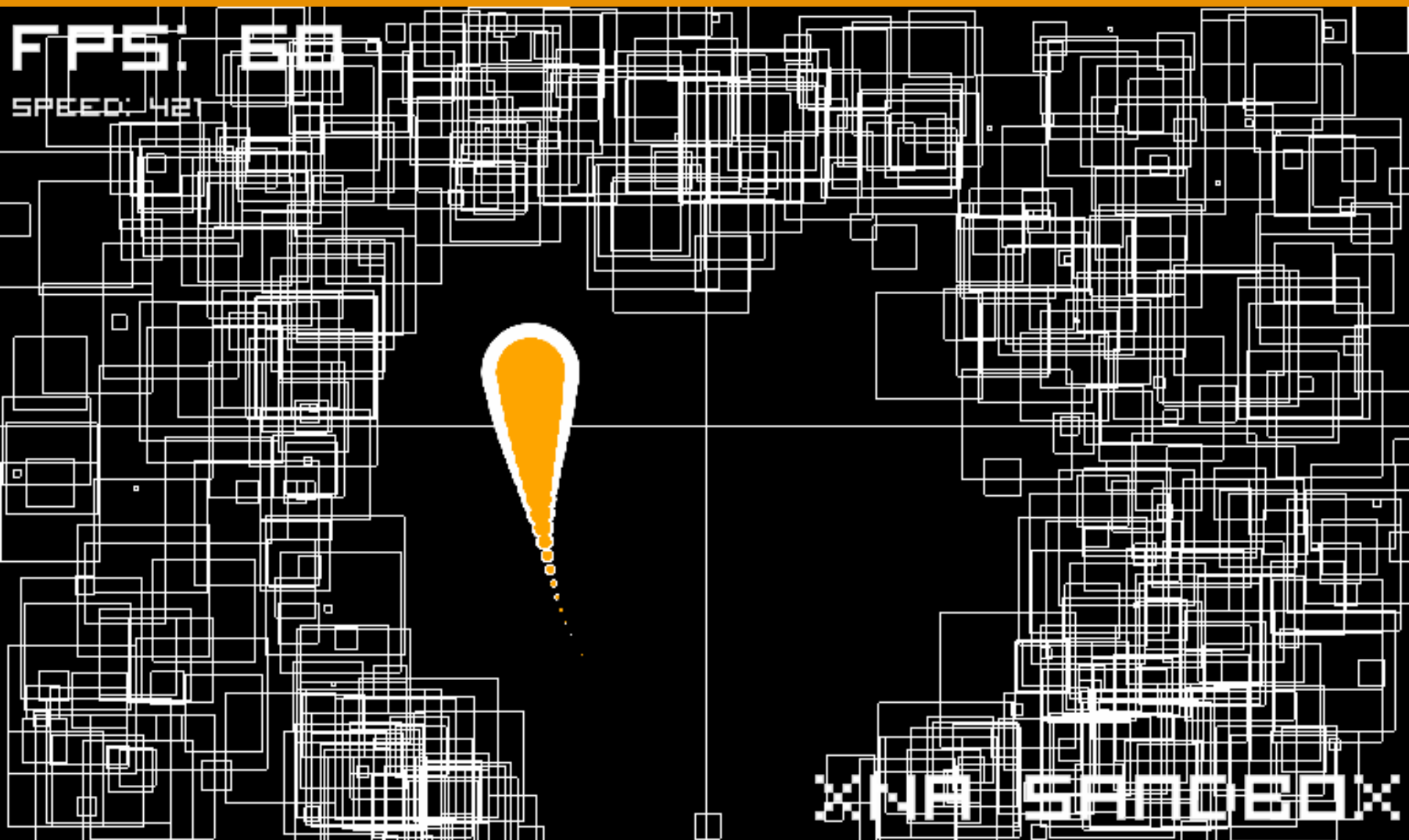
# [Games. Strengths.]

- **Platforms.**
  - Convey meaning. Messages. Ideas. Ideals.
  - Individuals. Authors. Renaissance people.
- **Abstraction of and interaction with and within**
  - Concepts. Systems. Worlds.
- **Low degrees of freedom input. Large possibility space.**
  - Design is hard. Be challenged. Persevere.

# [Games. Ideas.]

- Data mining
  - Use games as vehicles to explore human behavior. To improve game systems and interfaces.
  - As tools to help guide research. **ESP Game.**
- Research into game controls + response
  - How many and which degrees of freedom.
  - How many redundant feedback systems.
  - How to meld sense pleasure and explicit goals.

[Visual feedback. Eye candy?.]



# [Interdisciplinary. Science. Art.]

- Computer science
- Art
- Cognitive science
  - Intelligence and adaption of game systems.
- Perceptual science
  - Quantify audiovisual feedback mechanisms.
- English / Composition / Drama
  - Digital composition. Digital narrative. Semiotics.

# [Games. Outlook.]

- More interesting **visualizations**. Non photorealistic renderings. Icons. **Semiotics**.
- More **rich interactions**. Interfaces. Mappings.
  - Use time as an additional degree of freedom.
  - Not only binary/analog input devices
- Use of games as **educational tools**.
- New exploratory and **participatory art forms**.
- Adaptive games. **Adaptive rule sets**.

[Thank. **You!**.]



This is you.