the gamedesigninitiative at cornell university

# Gameplay Modeling

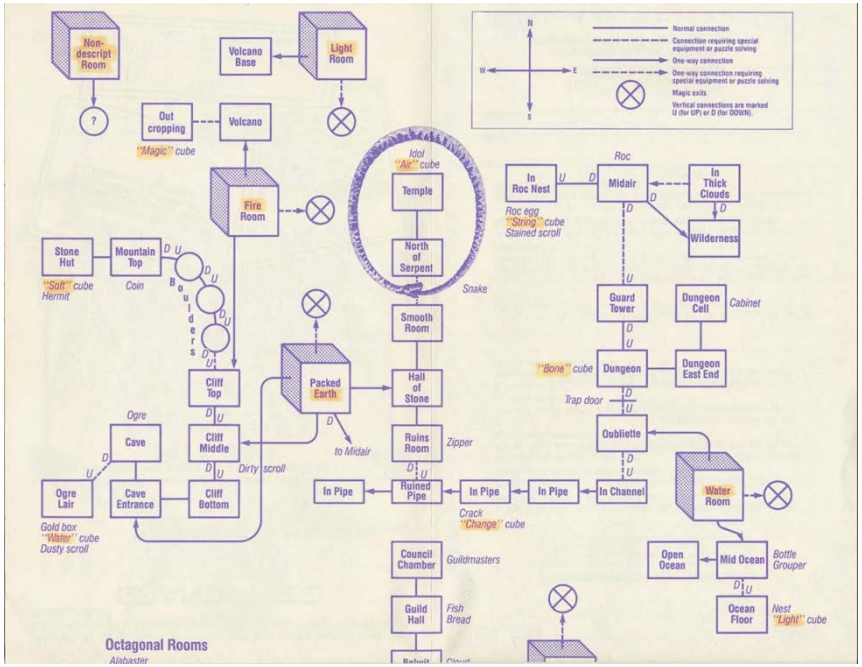
# **Next Week:** Nondigital Prototype

- No software involved at all
  - Board game
  - Card game
  - Something different?

- Goal is to **model gameplay**
  - How? Nondigital/digital is very different
  - Model will be far removed from final result
  - What can we hope to learn from this?

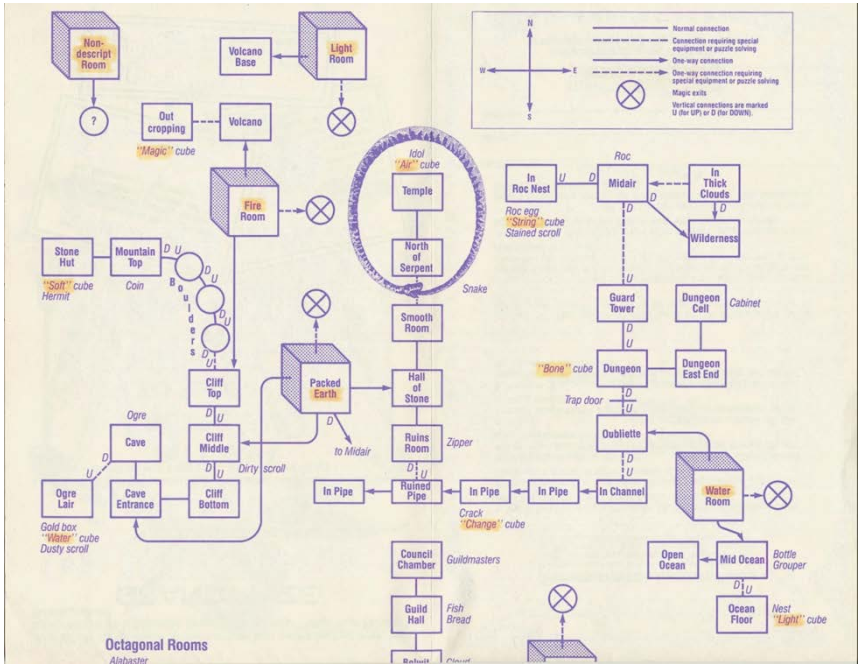
# Understanding Game Progression

- Level design about *progress*
  - Sense of closeness to goal
  - Choice of "paths" to goal (**dilemma challenge**)
  - Path choice can relate to play style and/or difficult
- Easier to design if *discrete*
  - Flow-chart out progression
  - Edges are mechanic(s)
- But game state values are **continuous** (sort of)



# Discrete Progression

- Design is **discretization**
  - Impose flow chart on state
  - Each box is an equivalence class of game states
- **Spatial Discretization**
  - Contiguous zones
  - **Example**: past a doorway
- **Resource Discretization**
  - Range of resource values
  - **Example**: build threshold



# Discretizing Spacial Locality

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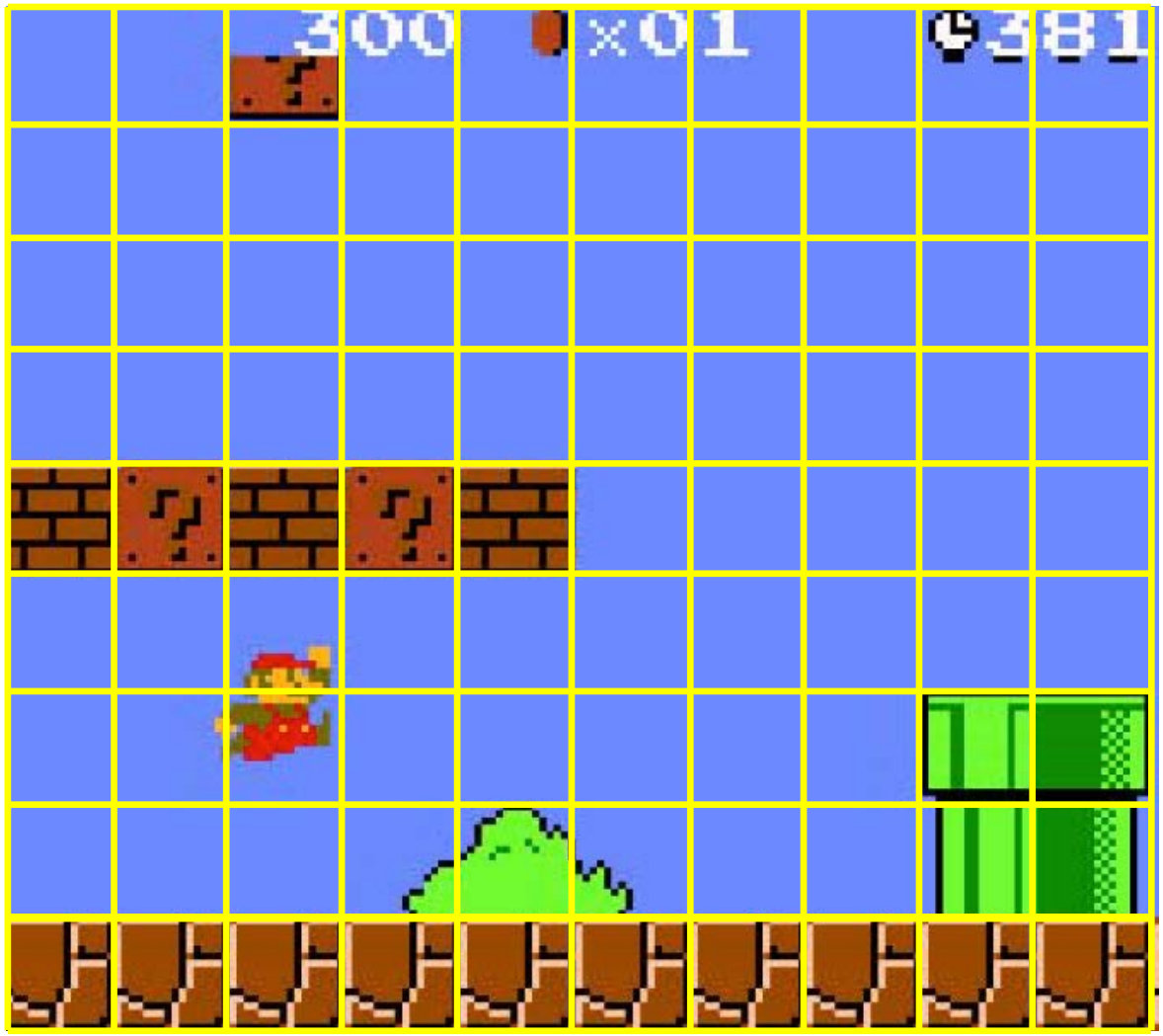

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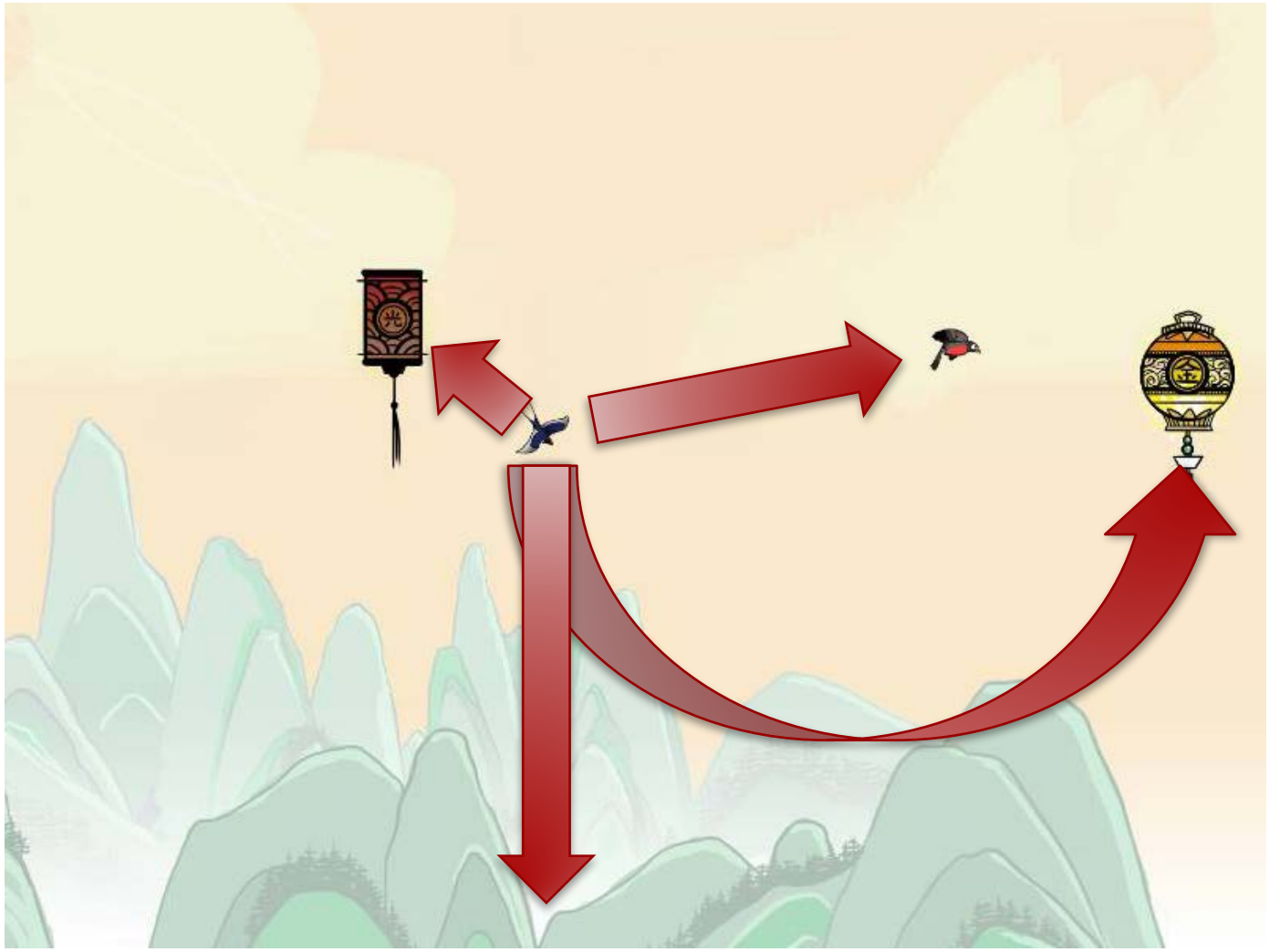

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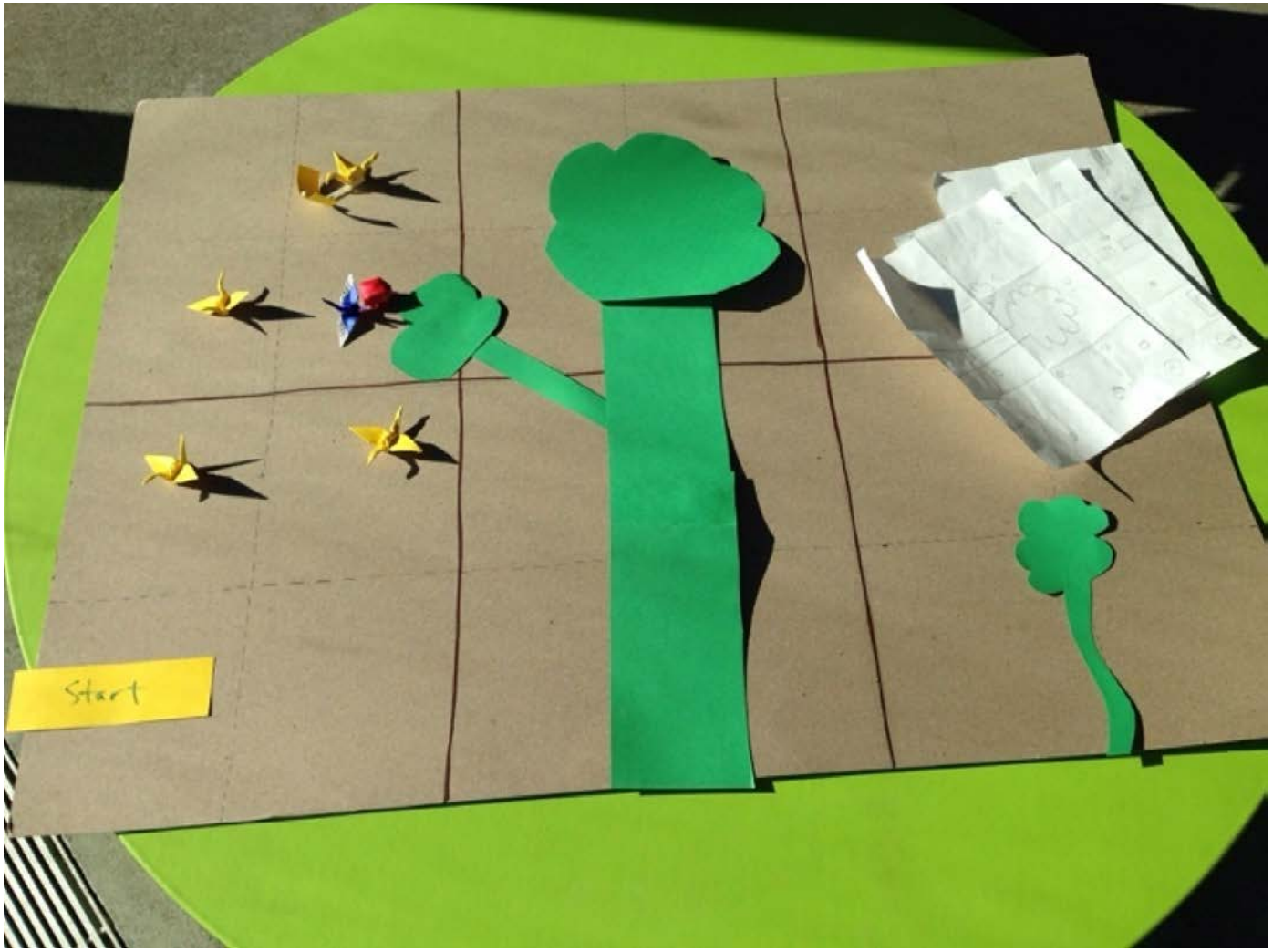
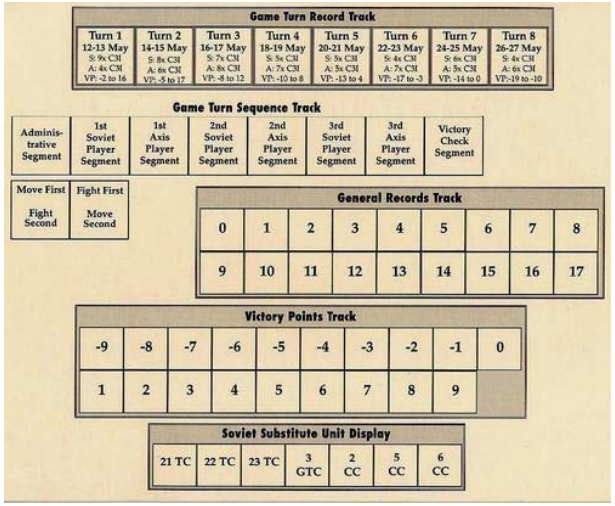


# Nature of Discretization

- State must be **unambiguous**
  - Must be an accurate, precise way to determine state
  - **Example**: string to measure distance in a wargame
- Actions must be **significant**
  - May correspond to several animation frames
  - **Example**: movement and attack in single turn
- Mechanics must have **compact interactions**
  - Avoid mechanics that depend on iterated interactions
  - **Example**: physics is *iterative* and hard to discretize

# Discretization and Turns

- Discretization requires *turns*
  - Represent a unit of action
  - When done, game "at rest"
- Turns can be **multistep**
  - Multiple actions in a turn
  - Evironmental interactions
- Turns can **alternate**
  - between other players
  - with a gamemaster
  - not at all (one player?)



# A Single Turn in *Squad Leader*

1. **Rally Phase**
   - Damaged units heal/repair
2. **Prep Fire Phase**
   - Choose units to attack/fire
   - Cannot act in later phases
3. **Movement Phase**
   - Move units about the board
4. **Defensive Fire Phase**
   - Opponent (not you) acts
   - Fires on units that moved
5. **Advancing Fire Phase**
   - Moved units may now fire
   - Combat strength is reduced
6. **Rout Phase**
   - Damage units go for cover
7. **Advance Phase**
   - Move every unit one hex
8. **Close Combat phase**
   - Find enemies on your hexes
   - Units engage in combat

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**Phase**

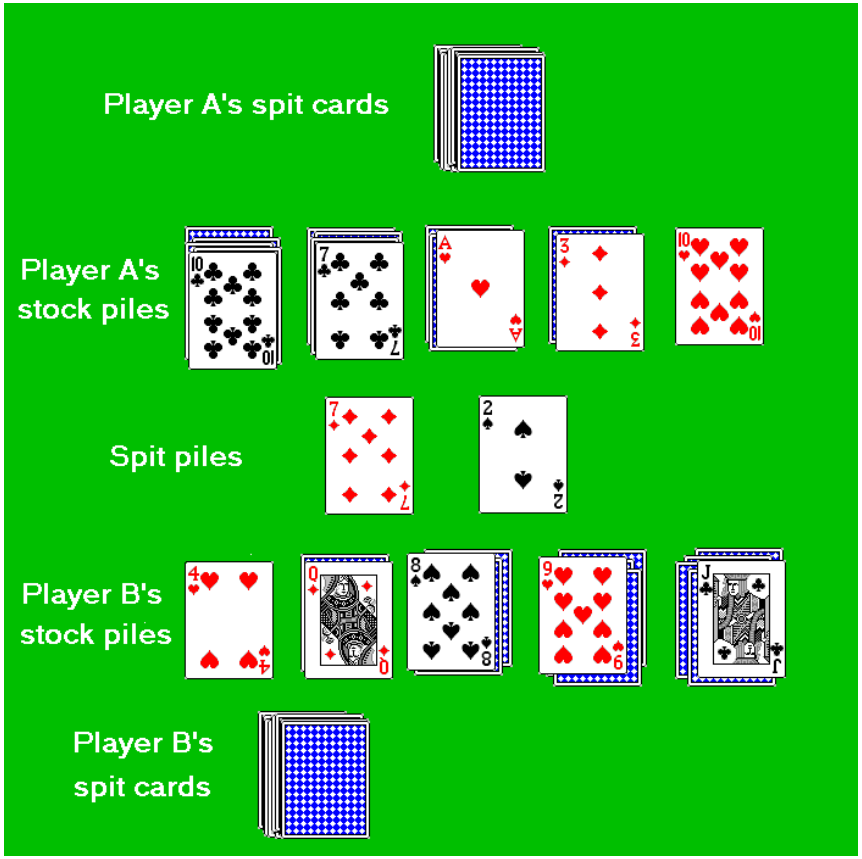
- ery unit one hex

8. **Close Combat phase**
   - Find enemies on your hexes
   - Units engage in combat

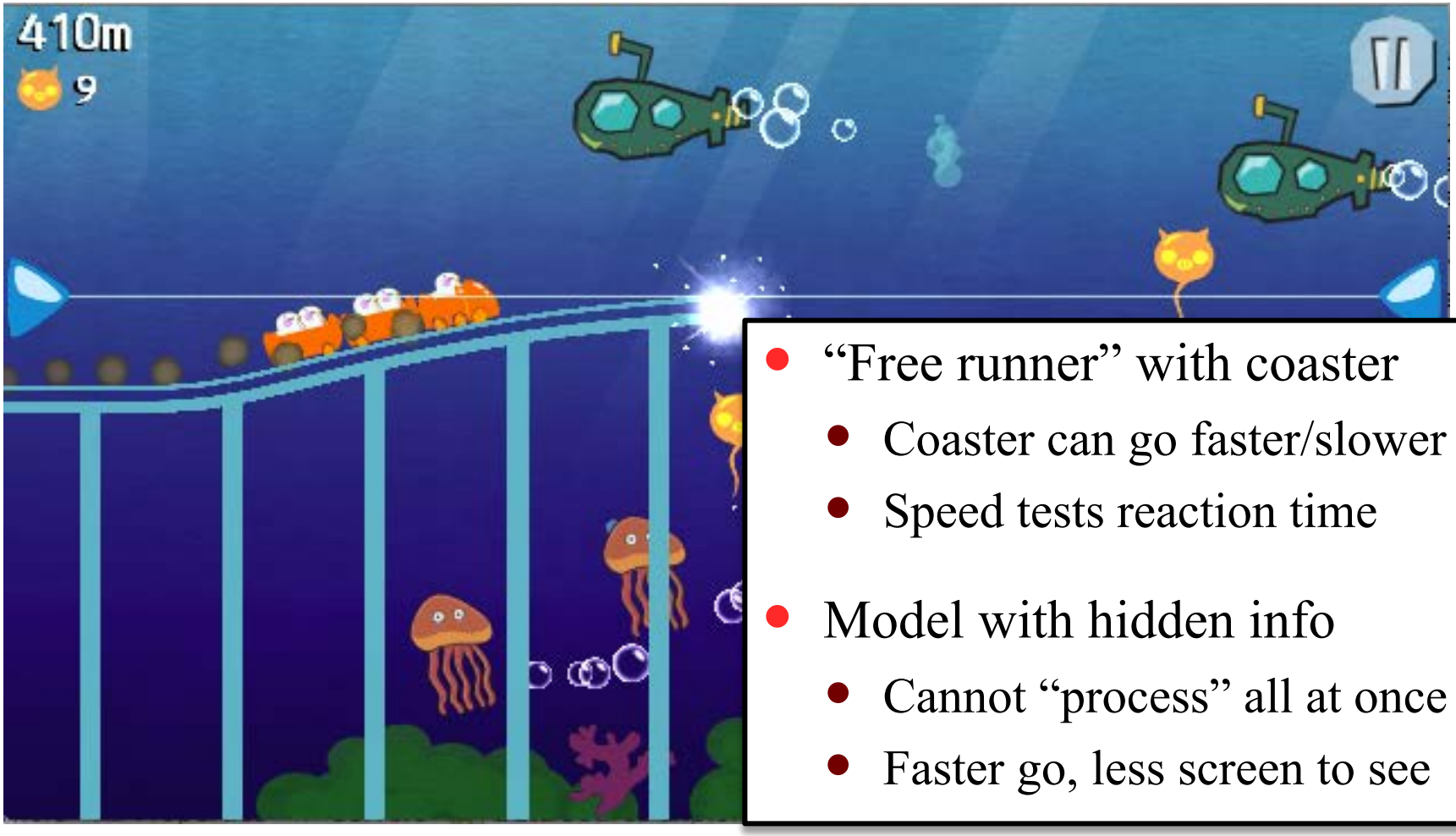
Simulates (real-time) player *reaction time*

# Discretization and Reaction Time

- Allow opponent to **interrupt**
  - Action that reacts to yours
  - Played after you act, but before action takes an effect
  - Core mechanic in *Magic:TG*
- Make play **asynchronous**
  - Players still have turns
  - But take turns as fast as can
  - Conflicts resolved via speed
  - Often need a referee for aid

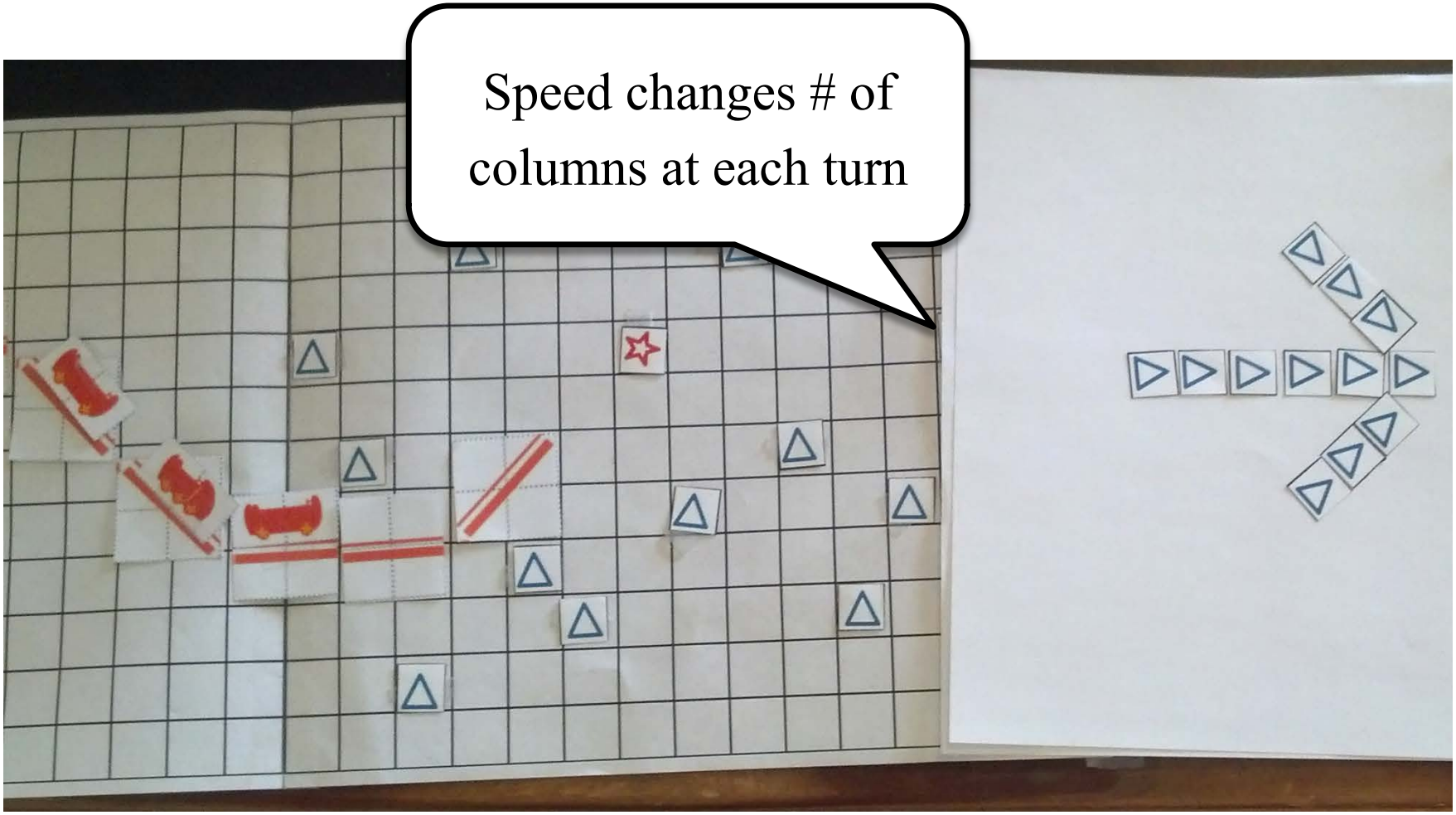


# Case Study: *Runaway Rails*




- "Free runner" with coaster
  - Coaster can go faster/slower
  - Speed tests reaction time
- Model with hidden info
  - Cannot "process" all at once
  - Faster go, less screen to see

# Reaction Time as Hidden Information

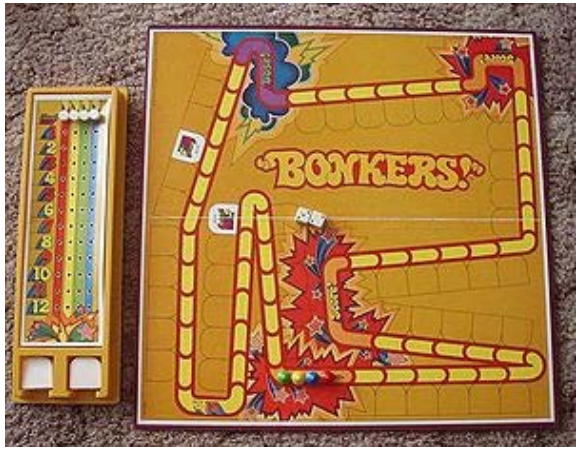


# What Can We Do Discretely?

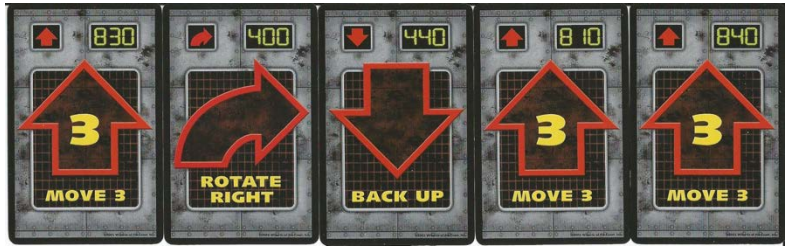
- **Evaluate emergent behavior**
  - Allow player to commit simultaneous actions
  - Model interactions as “board elements”
- **Model player cost-benefit analyses**
  - Model all resources with sources and sinks
  - Focus on economic dilemma challenges
- **Test player difficulty/usability**
  - Ideal for puzzle games (or puzzle elements)
  - Can also evaluate unusual interfaces

# Evaluating Emergent Behavior

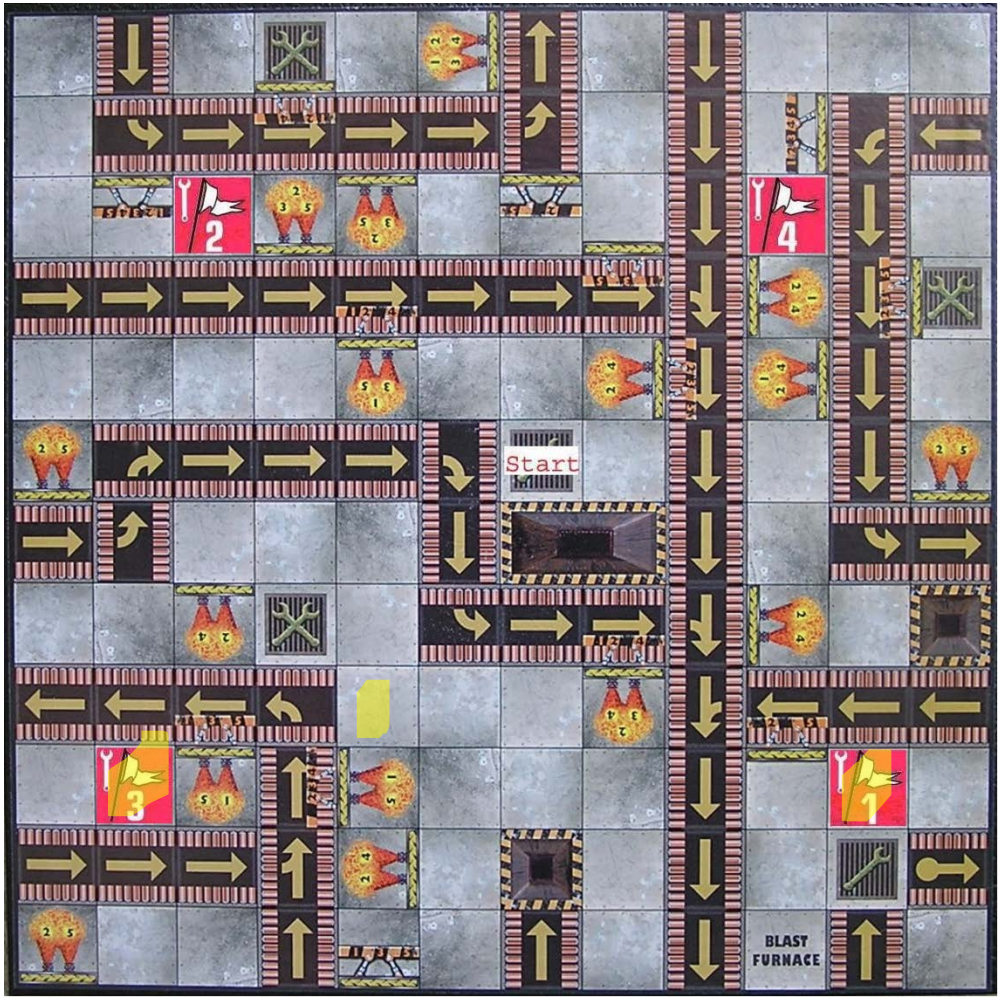
- **Recall**: coupled, context-dependent interactions
  - Requires an action and interaction
  - Or (alternatively) multiple actions
- Model interactions as "board elements"
  - Rules to follow after your action
  - May follow several in succession
  - **Examples**: *Chutes & Ladders*, *Bonkers, RoboRally*



# Case Study: *RoboRally*




- Player "programs" robot
  - Picks 5 movement cards
  - Committed to that choice
- After each card
  - Obey board elements in order
  - Check robot collisions
- Move = board elements + cards + collisions



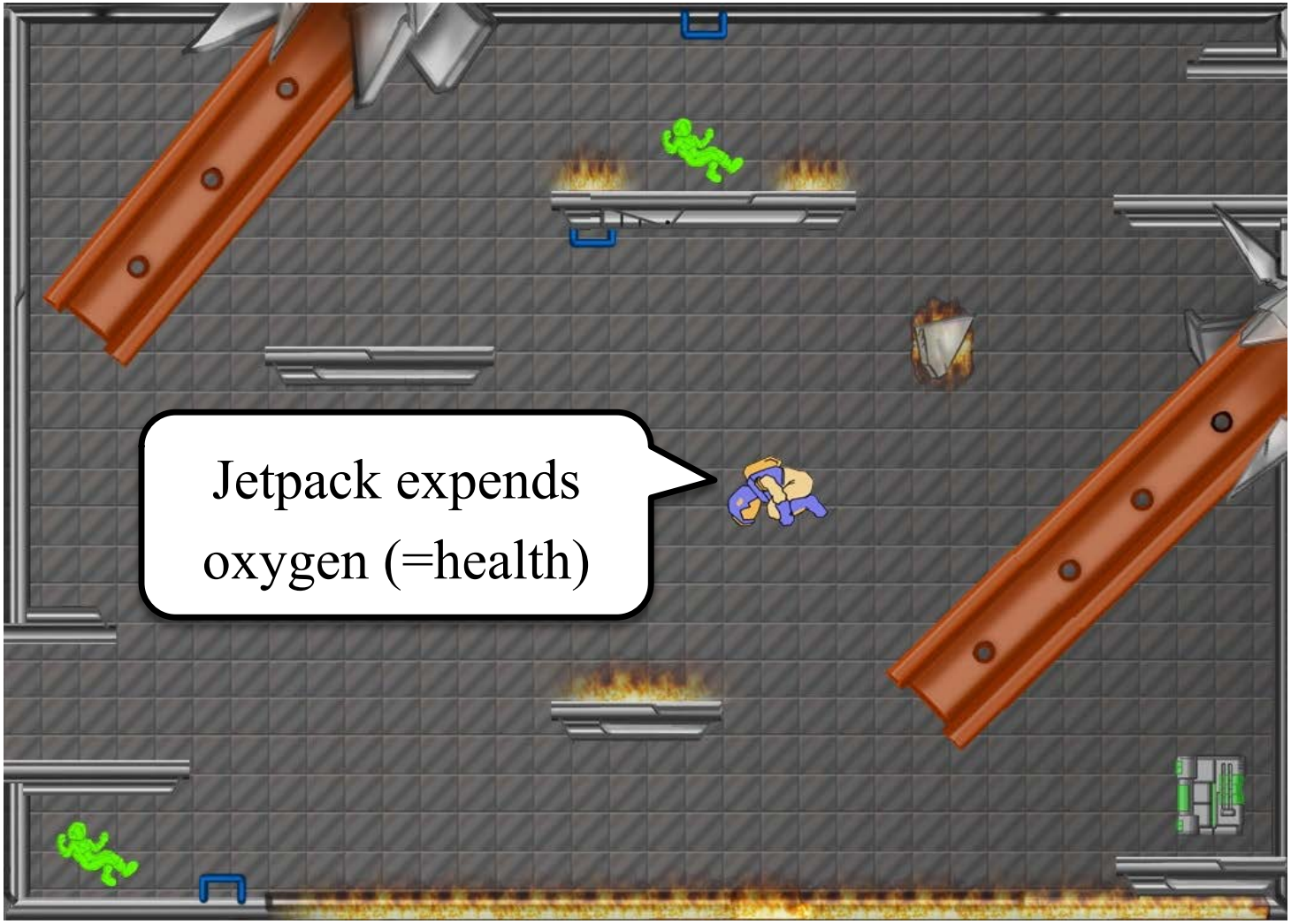
# Multiple Actions

- Necessary if have no interactions
  - Allow multiple actions in a turn
  - Typically needs complex turns
- Standard method: *action points*
  - Player has so many AP per turn
  - Actions cost AP to perform
  - Turn done when AP are all spent
- Might want other restrictions
  - Groups actions into types
  - Require types in certain order
  - **Example**: no attack after move


# Cost-Benefit Analysis

- Where nondigital prototypes really shine
  - Resources are very easy to discretize
  - Economic choices easily map to turns
  - Understanding dilemma challenges is important
- Some believe this is *all* of game design
  - Claim everything can be reduced to a resource
  - Common in board game adaptations of other media
  - **Example**: balance game with instability resource

# Case Study: *Bounce*



# Tracking Oxygen as a Resource

# Case Study: *Trino*

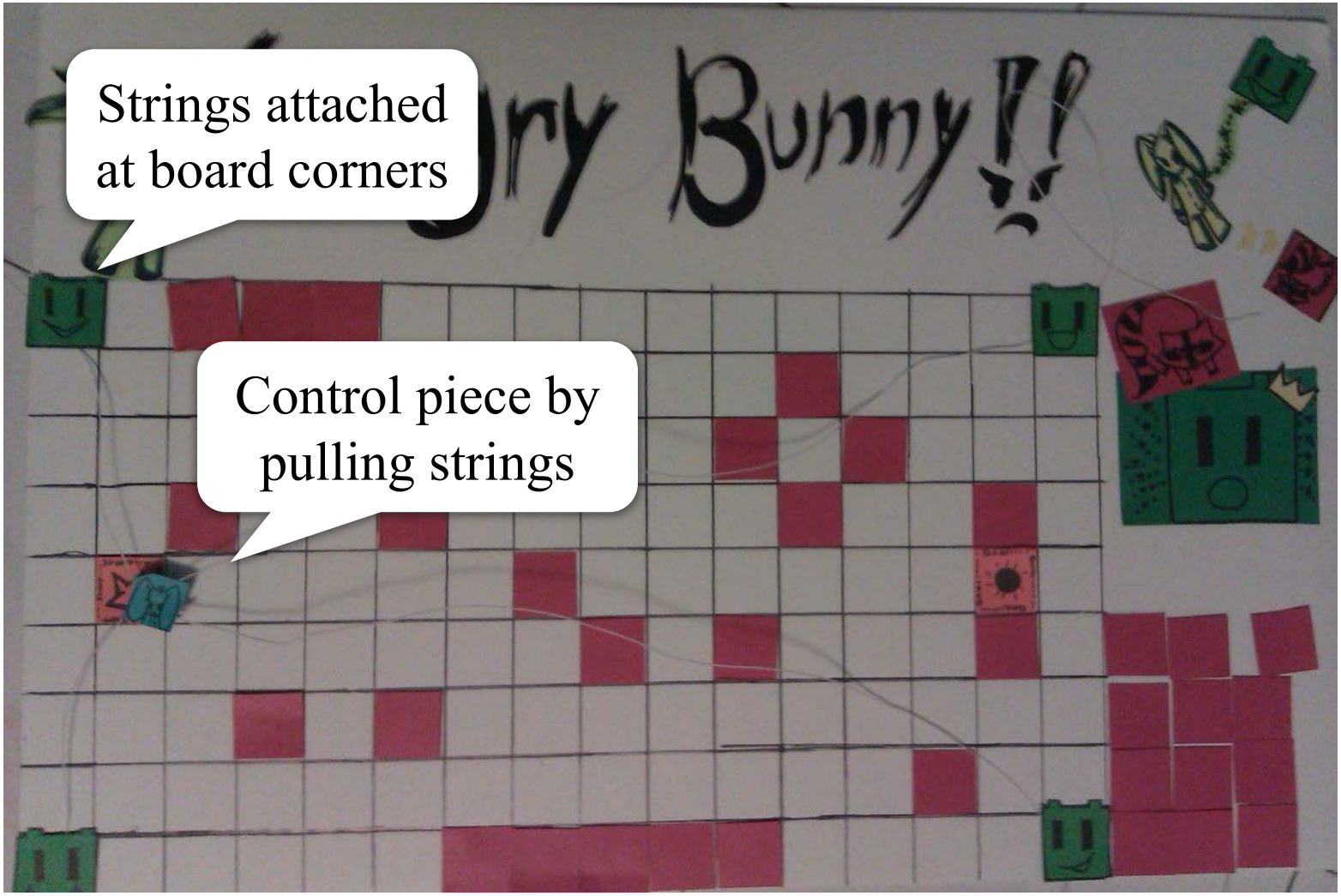
# Measuring Shapeshifting Resources

# Usability Analysis

- **Unusual user-interfaces**
  - Recall that actions correspond to inputs
  - Some inputs are not simple buttons
  - Example: touch gestures, motion controls
- **Puzzle-style games**
  - Create a game with module elements (e.g. cards)
  - Laying out levels creates a new game level
  - Allows you to quickly change and test levels

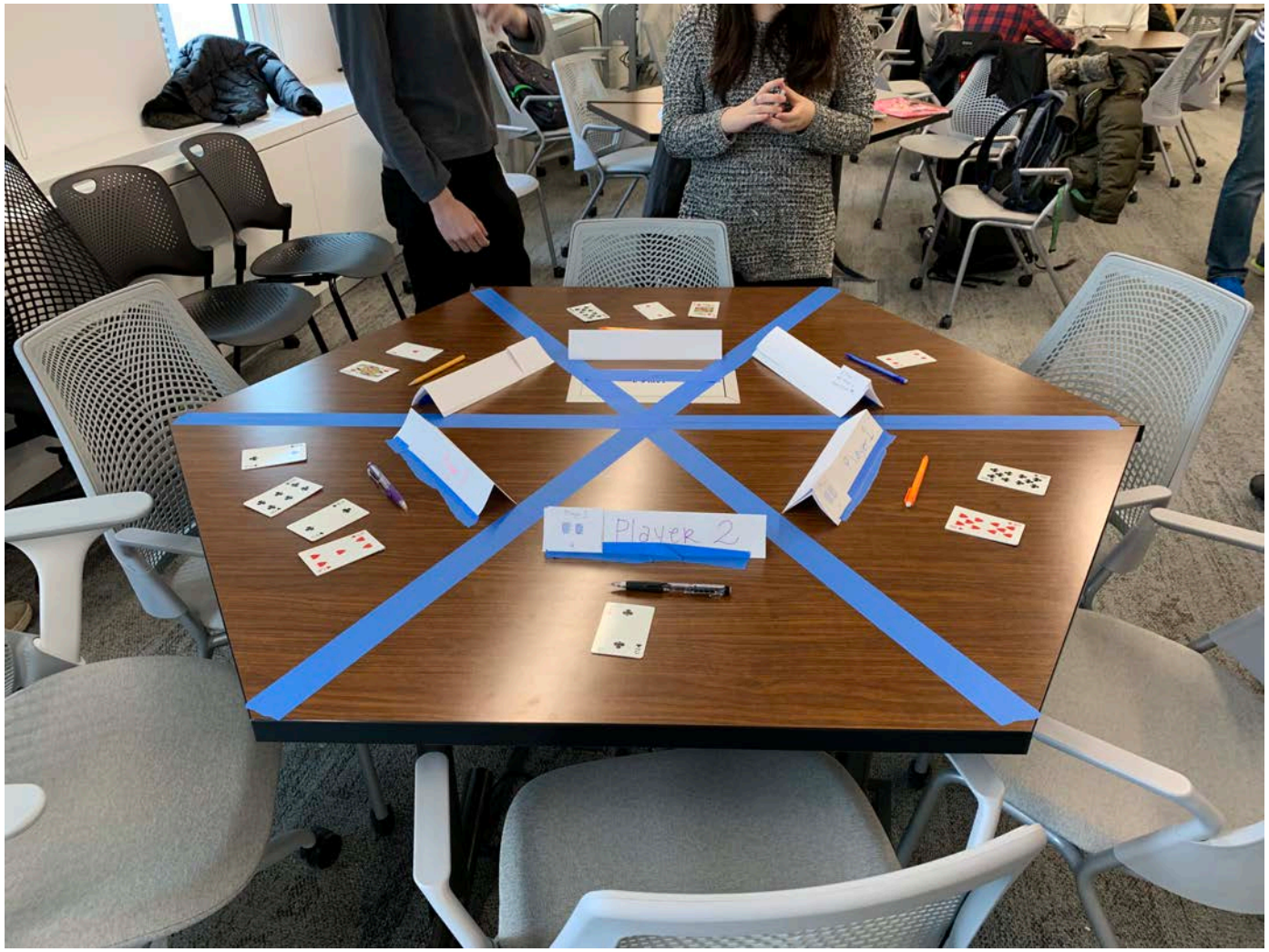
# Usability Analysis: *Angry Bunny*

# Modeling Movement Controls

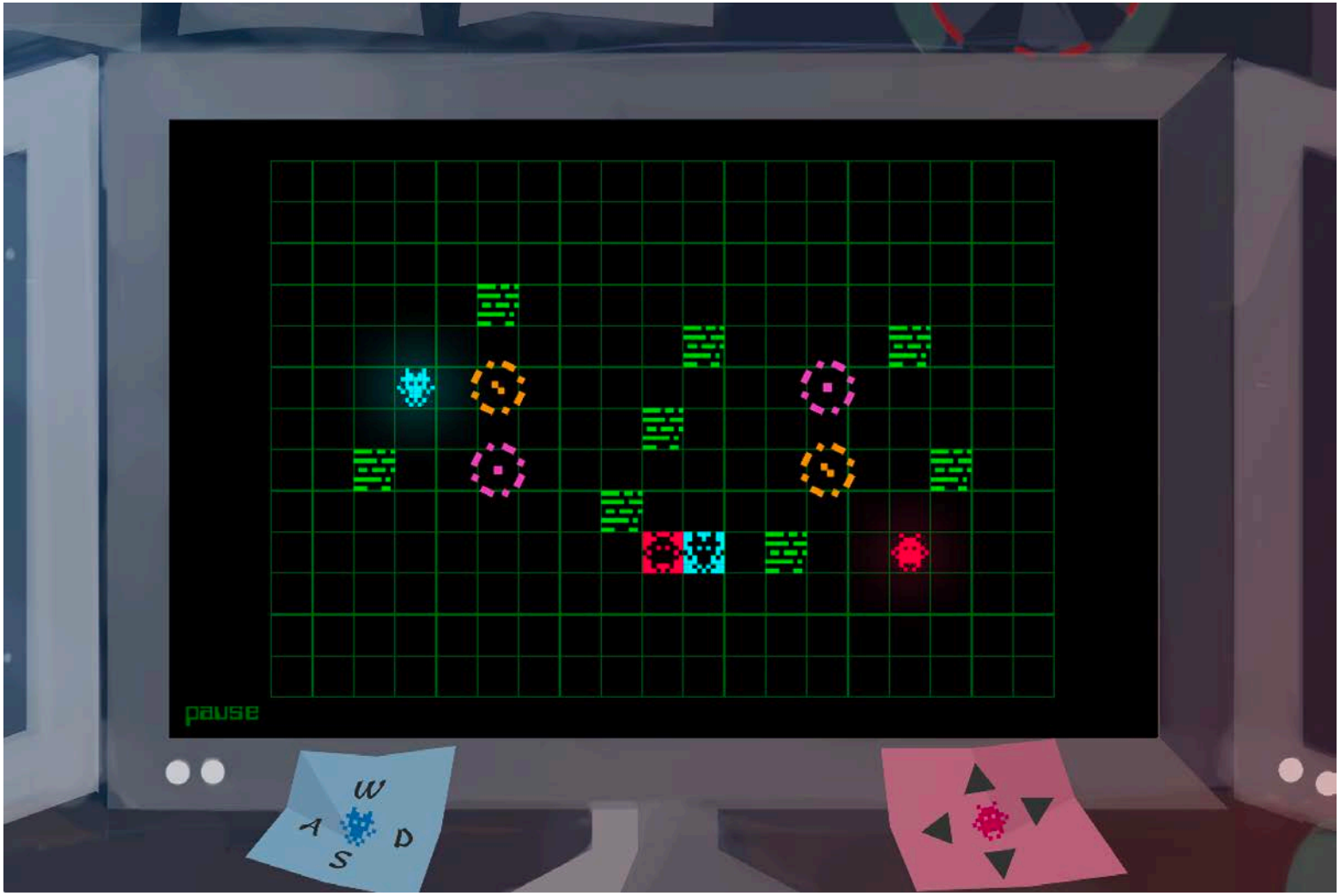


# Usability Analysis: *Family Style*

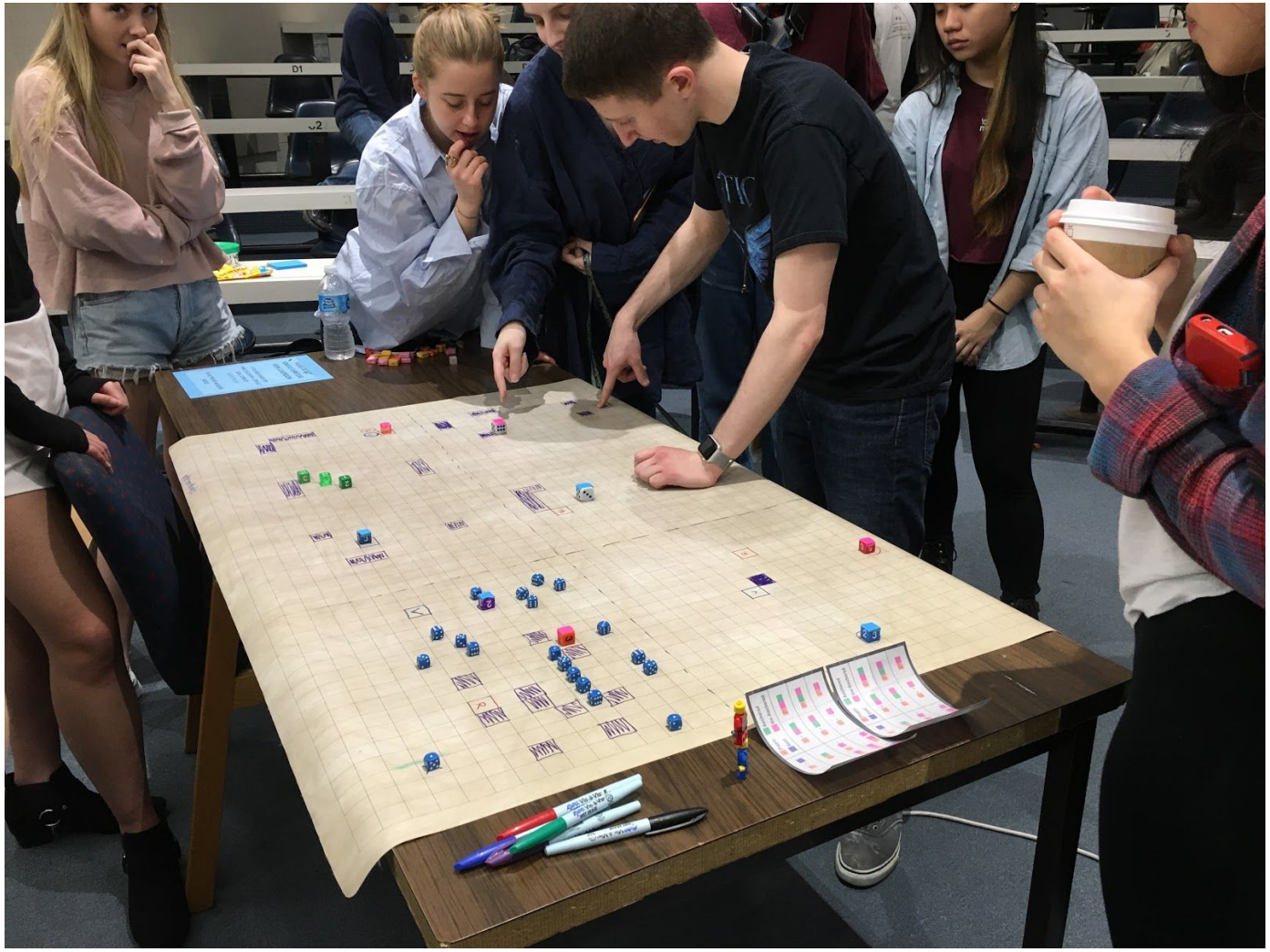
# Modeling Multiplayer Restrictions



# Difficulty Analysis: *Operation Bitwise*

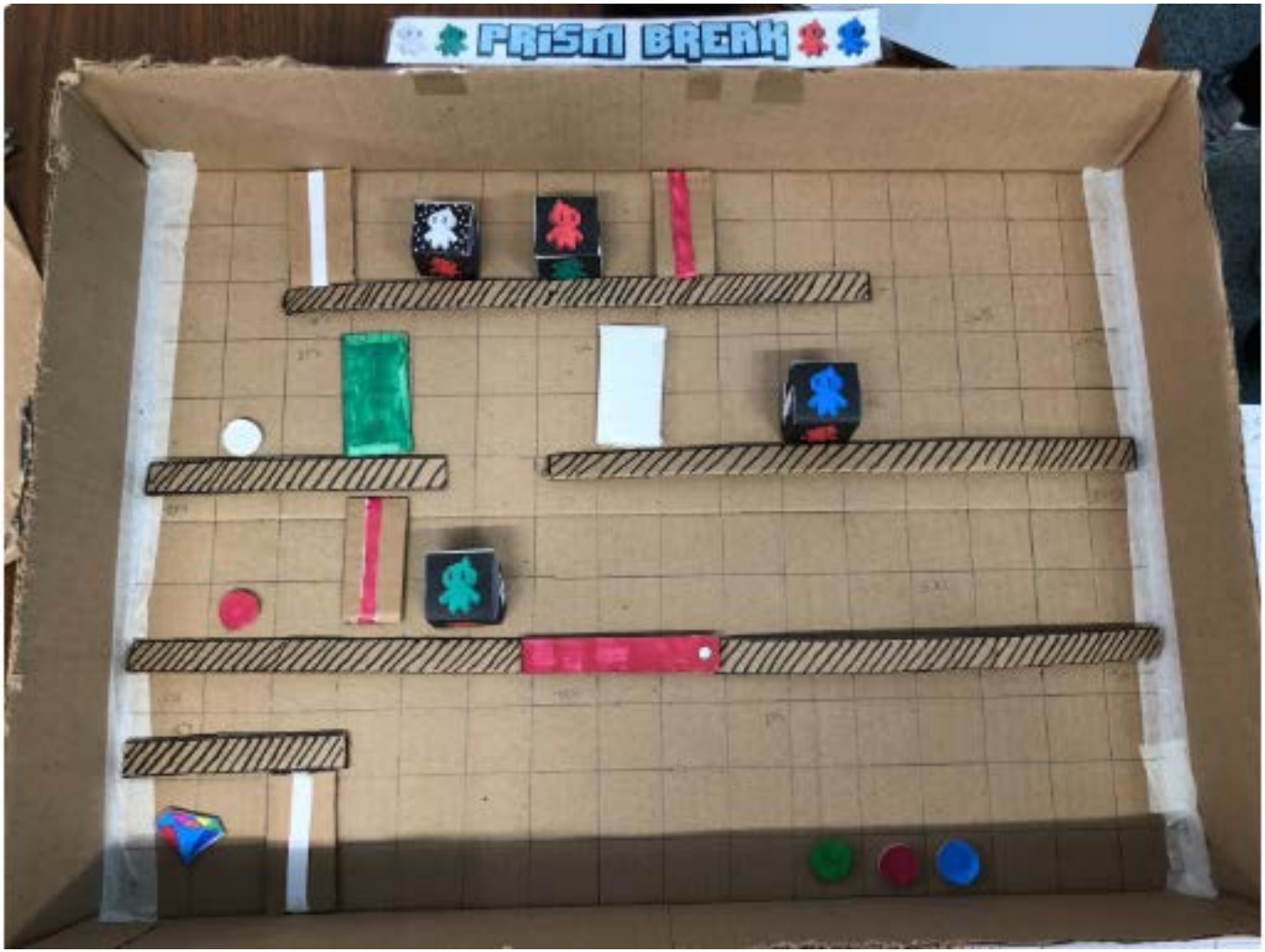


# Configurable Protoype from Elements



# Difficulty Analysis: *Prism Break*

# Exploring Specific Level Designs



# Most Important Thing: ***Progression***

- Do not want a **one-level** game
  - Major problem with endless runners
  - Survival games also have this problem
- We want some evidence of a **progression**
  - What is an easy level?
  - What is a medium level?
  - What is a hard level?
- Your prototype should be *reconfigurable*

# Easy

# Medium

# Hard

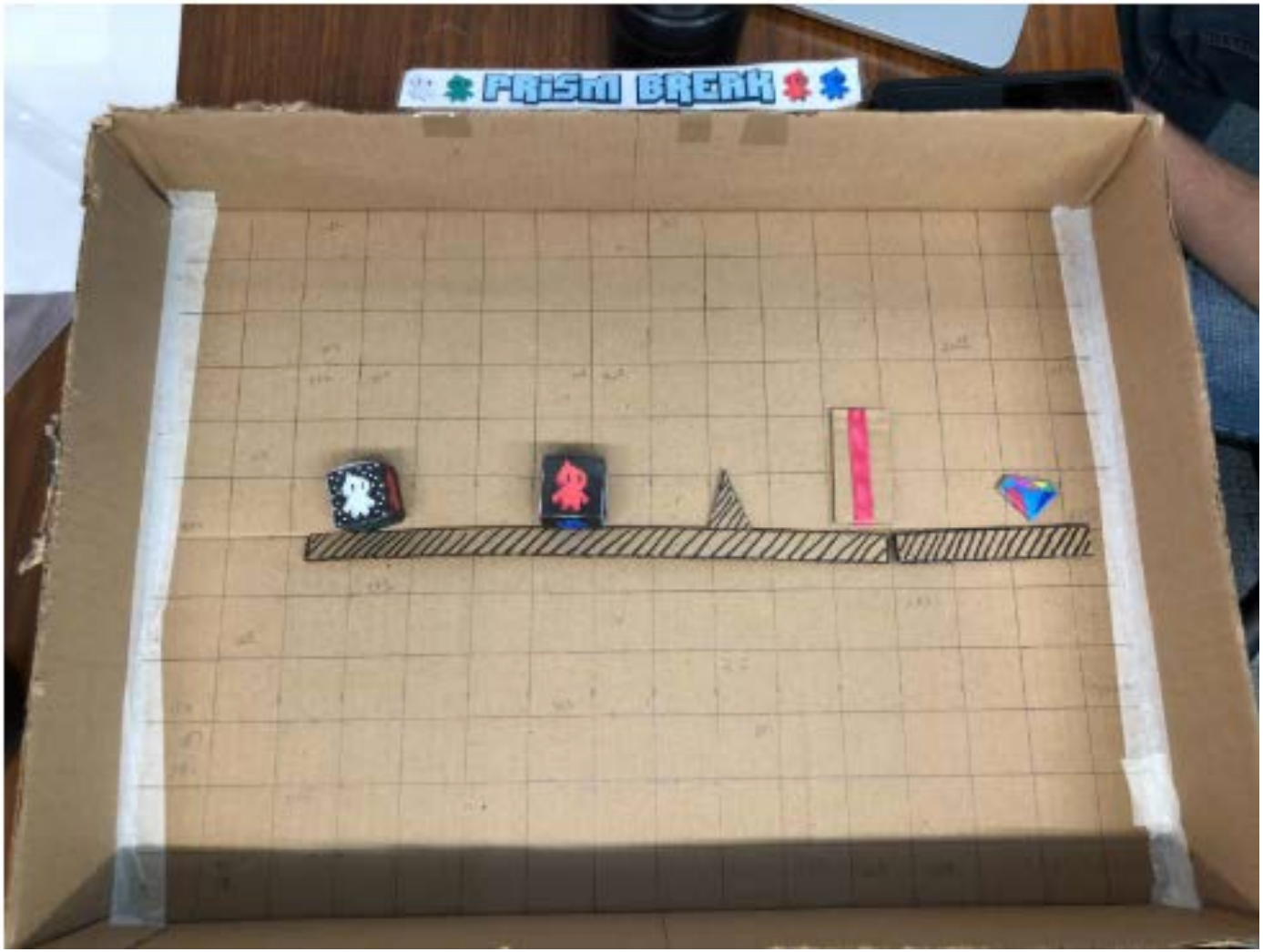
# The Difficulty Curve

Easy

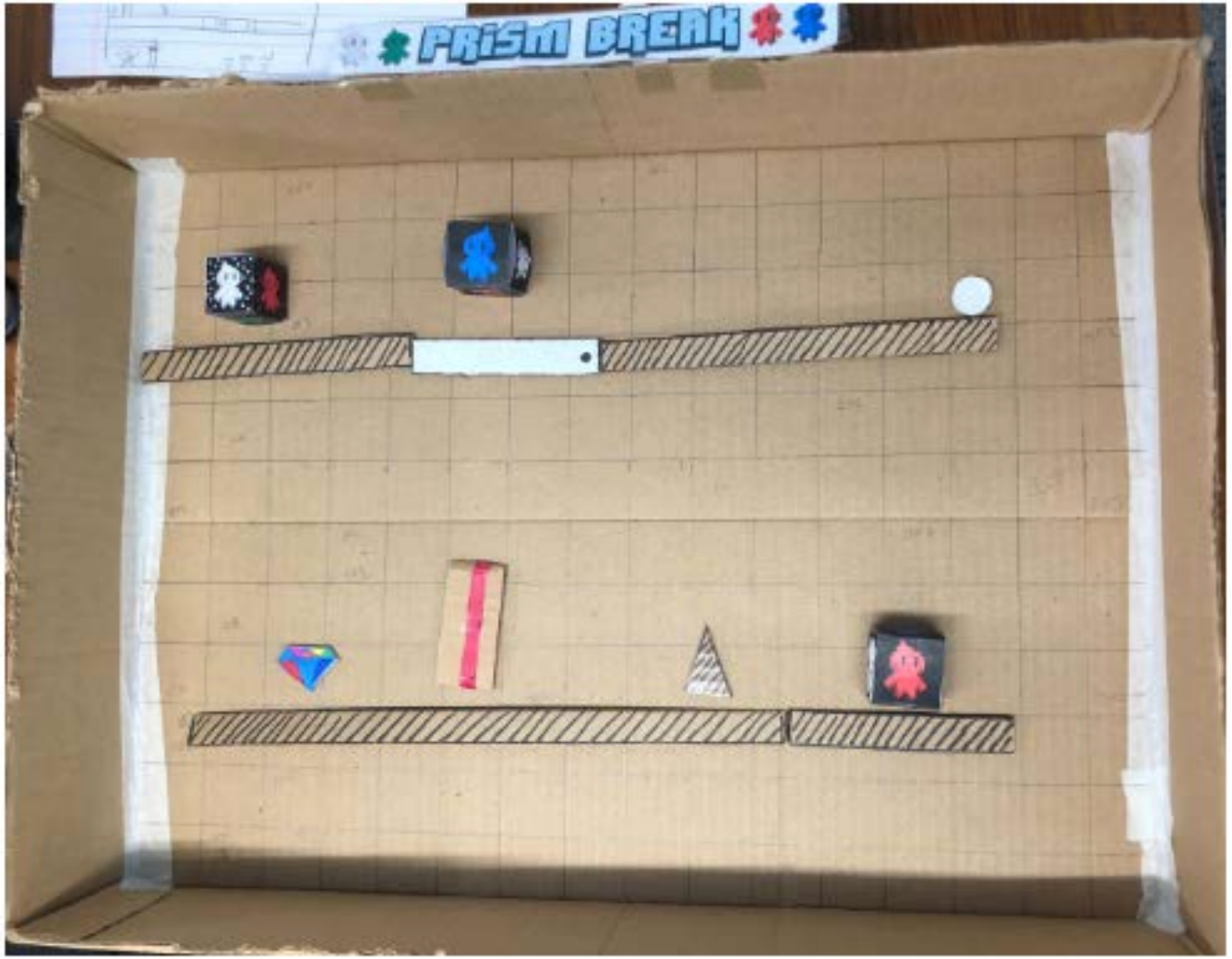

Medium


Hard

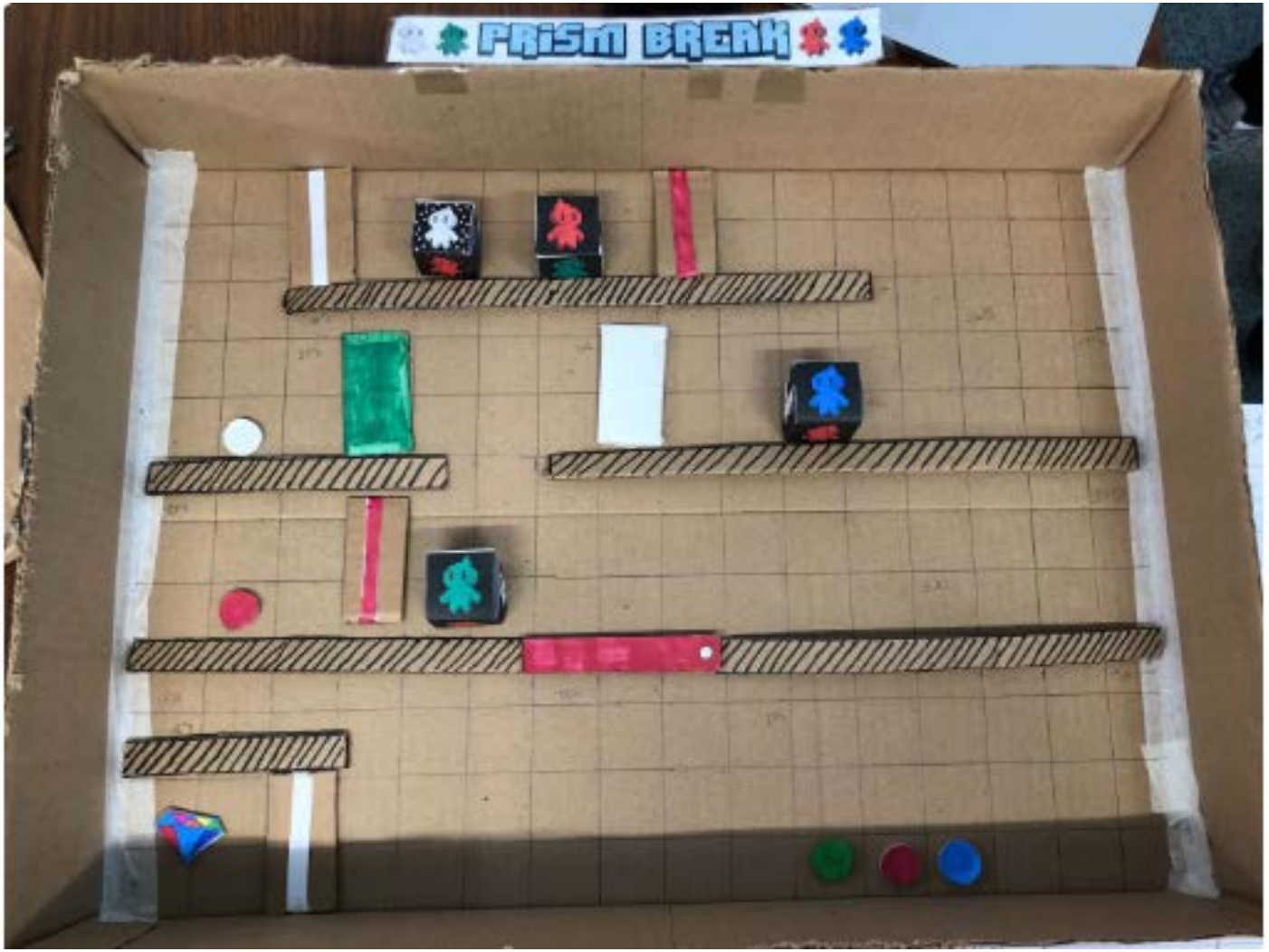
# **Easy:** *Prism Break*



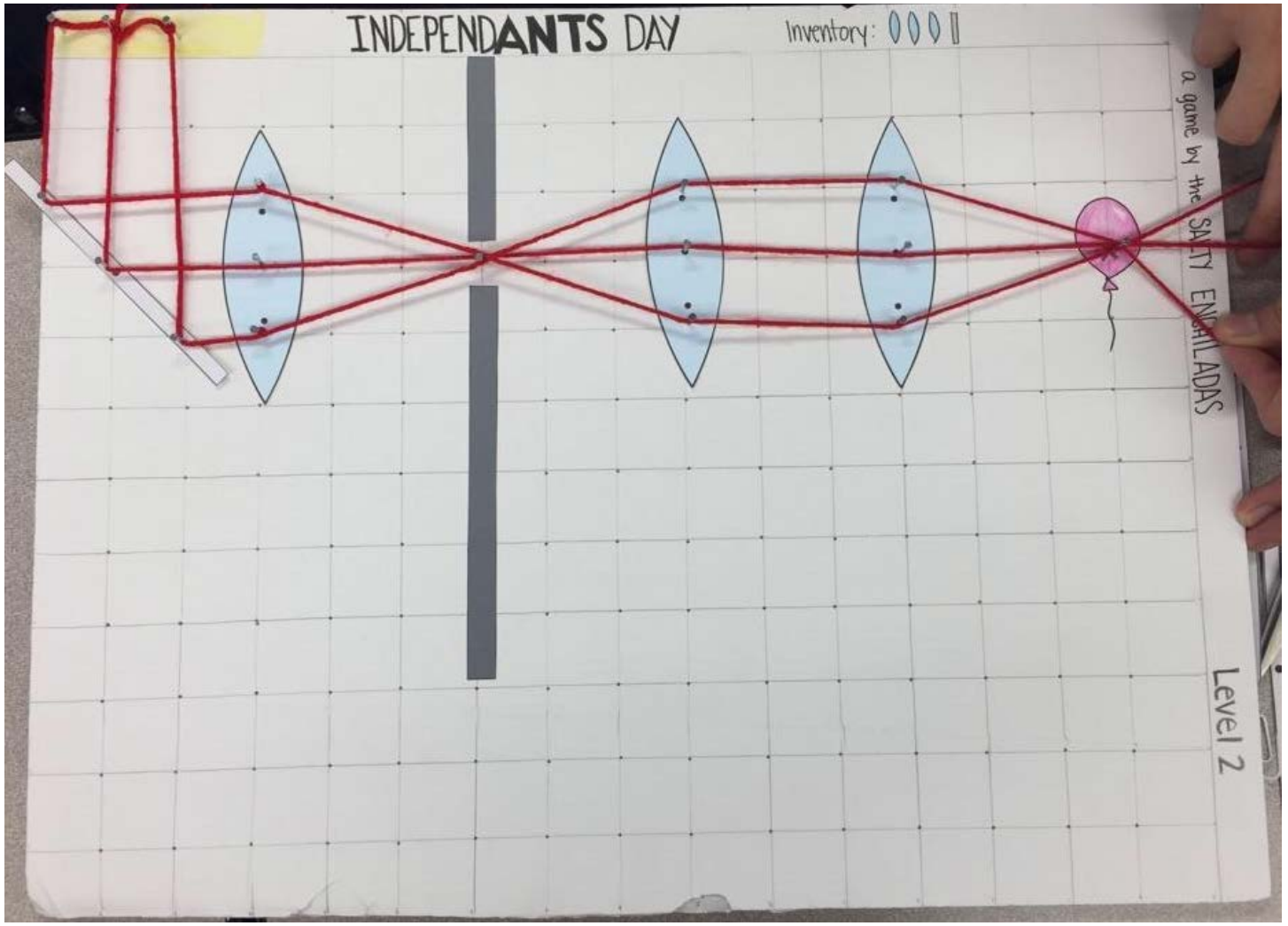
# **Medium:** *Prism Break*



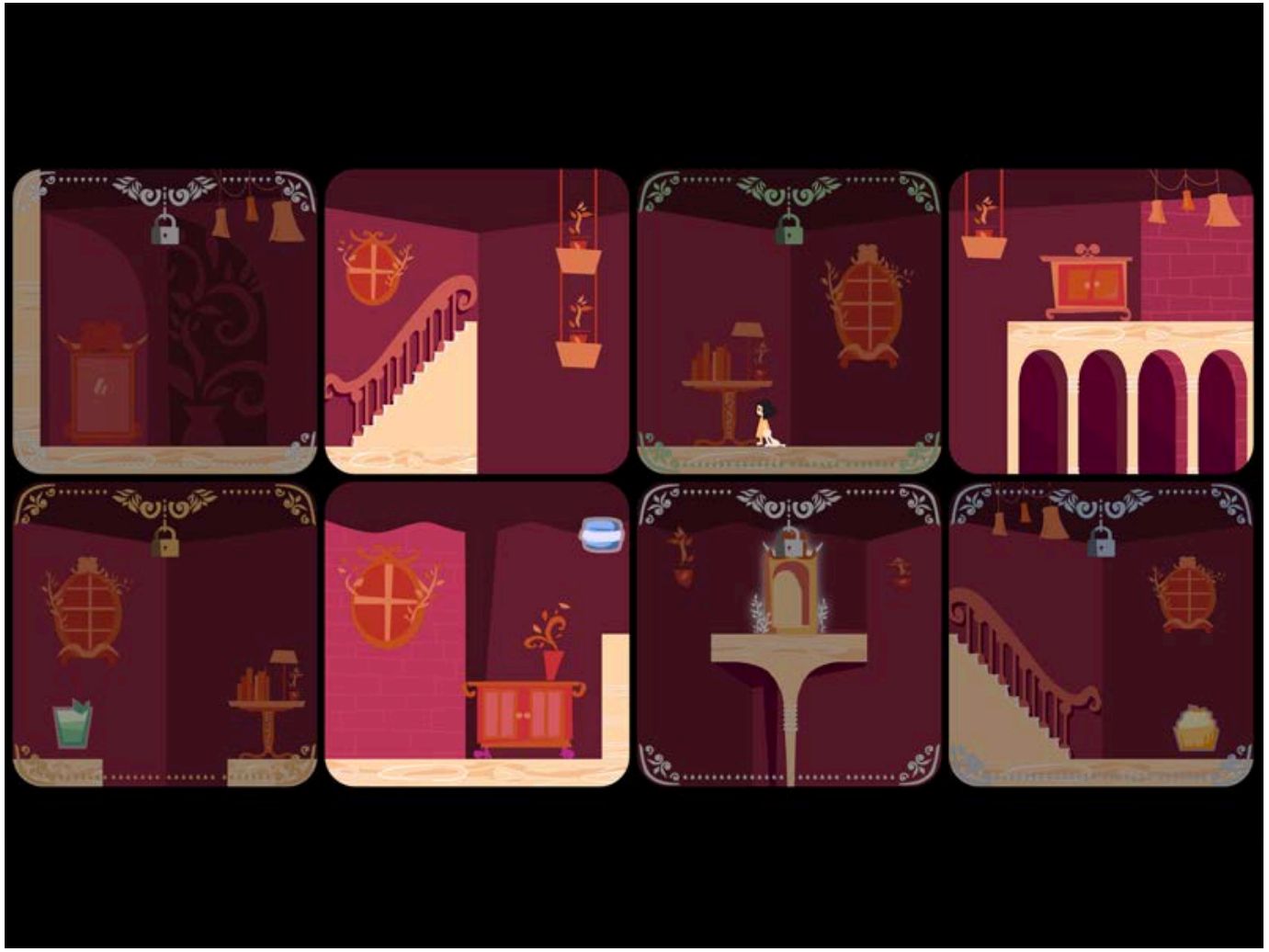
# **Hard:** *Prism Break*



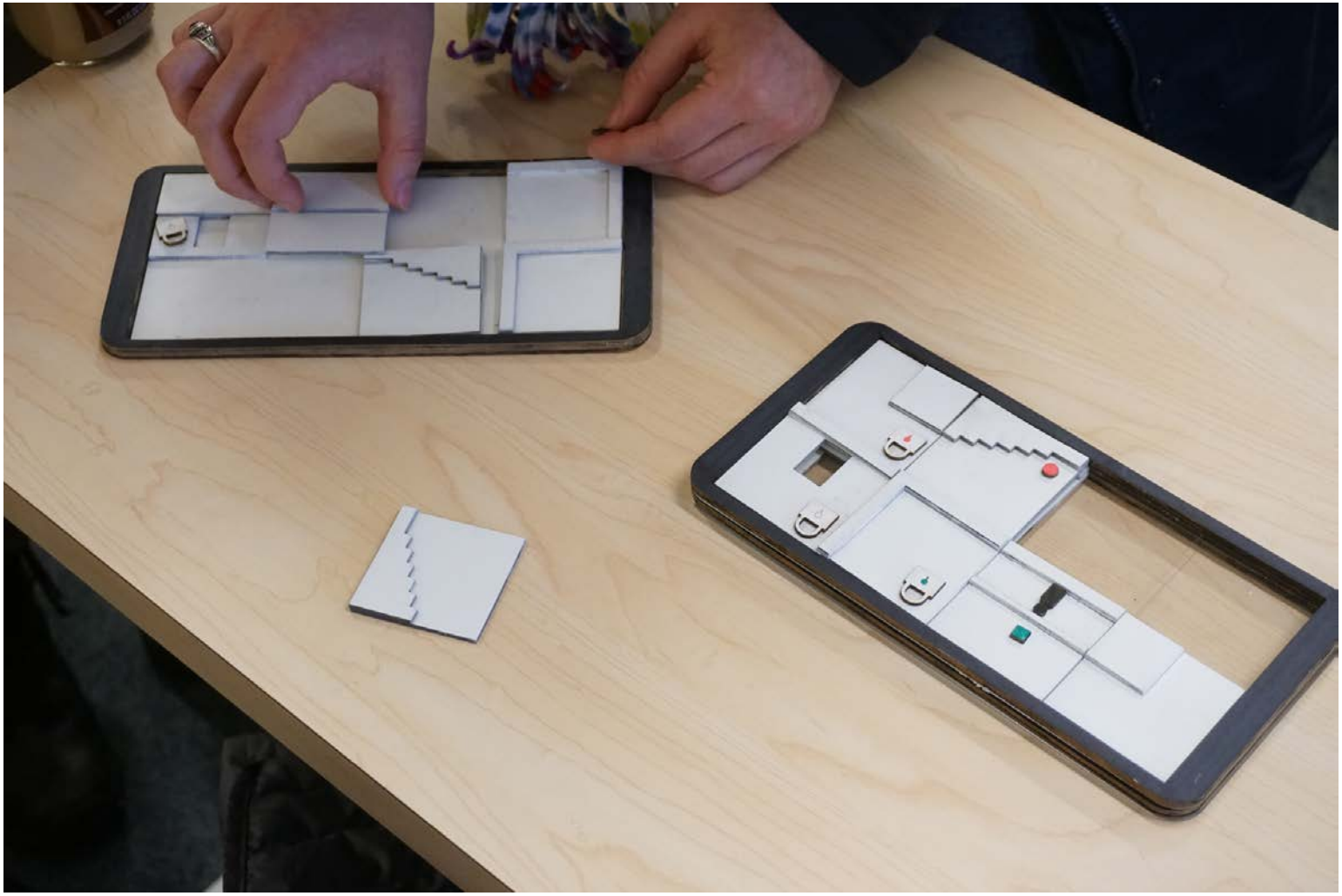
# Reconfigurable Prototypes



# **Case Study:** *Magic Moving Mansion*



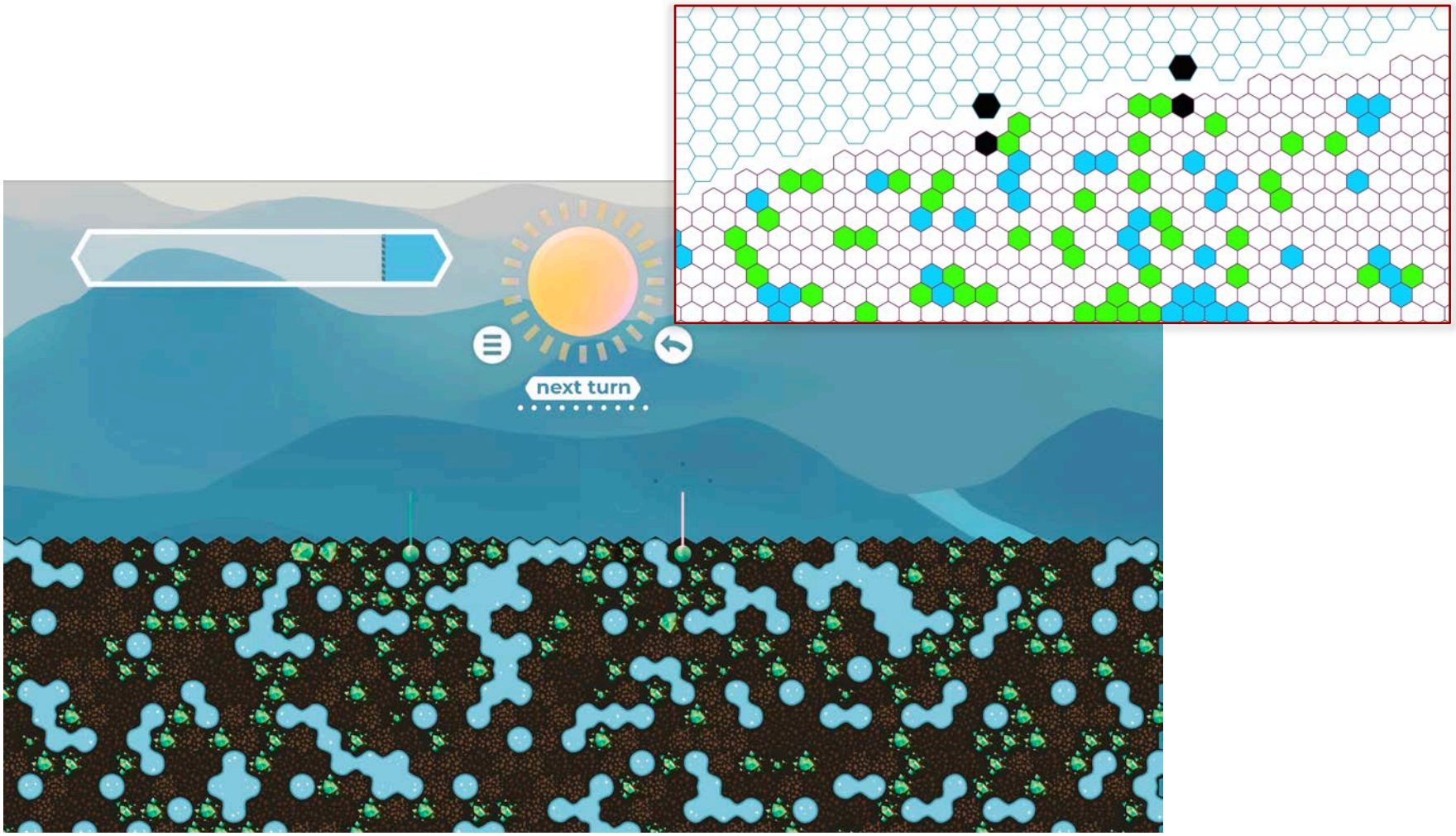
# Configurable Puzzles at Scale



# Reflecting on What You Have Learned

- Your prototype should teach you *something*
  - About one of the things covered today
  - Even if it is "this design will not work"
- You will be asked about this at **presentation**
  - Must be prepared to answer
  - Write-up as part of submission
- Lesson matters more than **physical artifact**
  - You are not going to sell this prototype

# Case Study: Flourish



# **Case Study:** Flourish

**Our game seemed unclear at the beginning for some players** because [they had to conceptually] balance growth above ground and below ground.

…

In general, we learned about the **specificity we need for different rules that we had thought needed less explanation.**

# Summary

- Nondigital prototypes are about **discretization**
  - Group continuous state into course groups
  - Simplify mechanics into discrete turns
  - Sometimes requires mechanics substitution
- They are ideal for **early gameplay testing**
  - Evaluate emergent behavior
  - Model player cost-benefit analyses
  - Test player difficulty or usability
  - Capture player experiences (advanced)