the gamedesigninitiative
at cornell university

Lecture 2

Mechanics Revisited

Purpose of Today's Lecture

- Give a review of formal **design elements**
  - Not everyone here has had the Intro Games course
  - And for the rest of you, it has been over a year
- Develop a deeper understanding of **mechanics**
  - Understand the important of interactions
  - Understand the *analysis* challenges
- Set us up for the **later lectures** on mechanics
  - Monetization and mobile game design

Actions

- **Verbs** that describe what the player can **do**
  - Walk (left or right)
  - Run (walk, but faster!)
  - Jump (up; jump/run for left or right)
  - Shoot (left or right)

Action Platformer

- Does not need to be attached to an avatar
  - Build (RTS or simulation)
  - Swap (Bejeweled clones)
  - Rotate (Stacking games)

Primary Actions

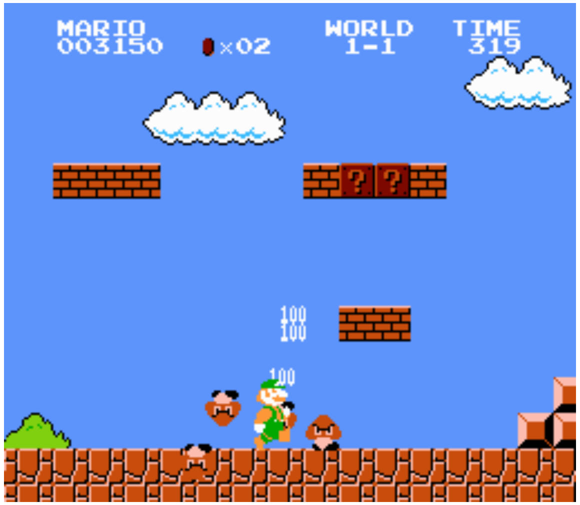
- How do verbs, goals relate?
  - Imagine there no challenges
  - What verbs *must* you have?
- **Example**: Platformers
  - **Goal**: reach exit location
  - Only need movement verbs
  - Killing enemies is *optional*
  - Other actions are *secondary*
- **Goal**: Focus on primary
  - Secondary verbs lead to bloat
  - Add features with interactions

Secondary Actions are Acceptable

- Often in **puzzle platformers**
  - Platformer verbs + something
  - “Innovation on the cheap”
- Verb that alters “geography”
  - Access hard-to-reach areas
  - Directly overcome *challenges*
  - Not directly needed for goal
- But do this sparingly!
  - Indies have one new verb!
  - Other features are *interactions*

Interactions

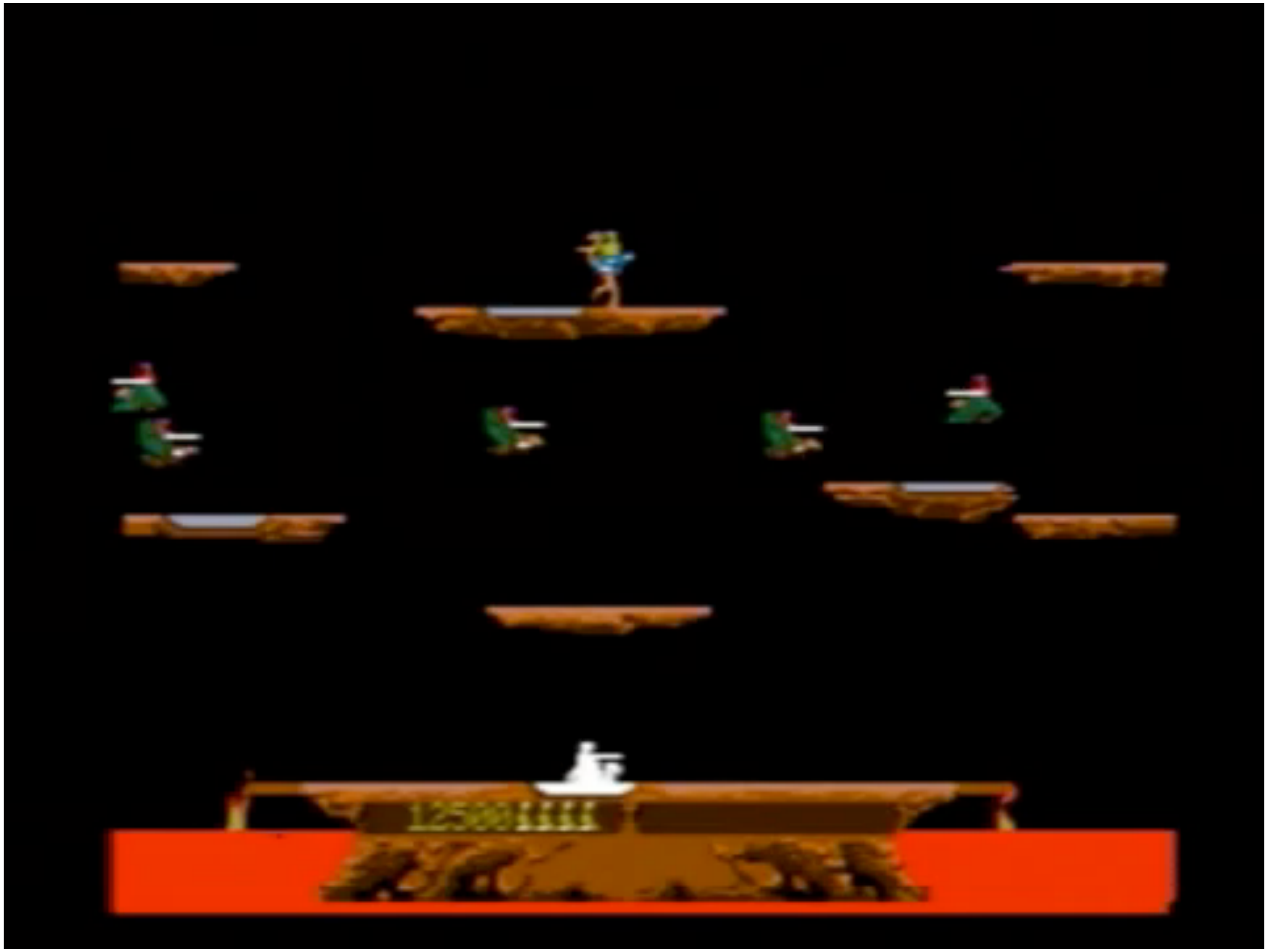
- Not a *direct* action of player
  - Outcome of the **game state**
  - Can happen without controller
- **Example**: collisions
  - Accidental or player forced
  - May be bad (take damage)
  - May be good (gain power-up)
- **Other Examples**:
  - Spatial proximity
  - Line-of-sight
  - Resource acquisition



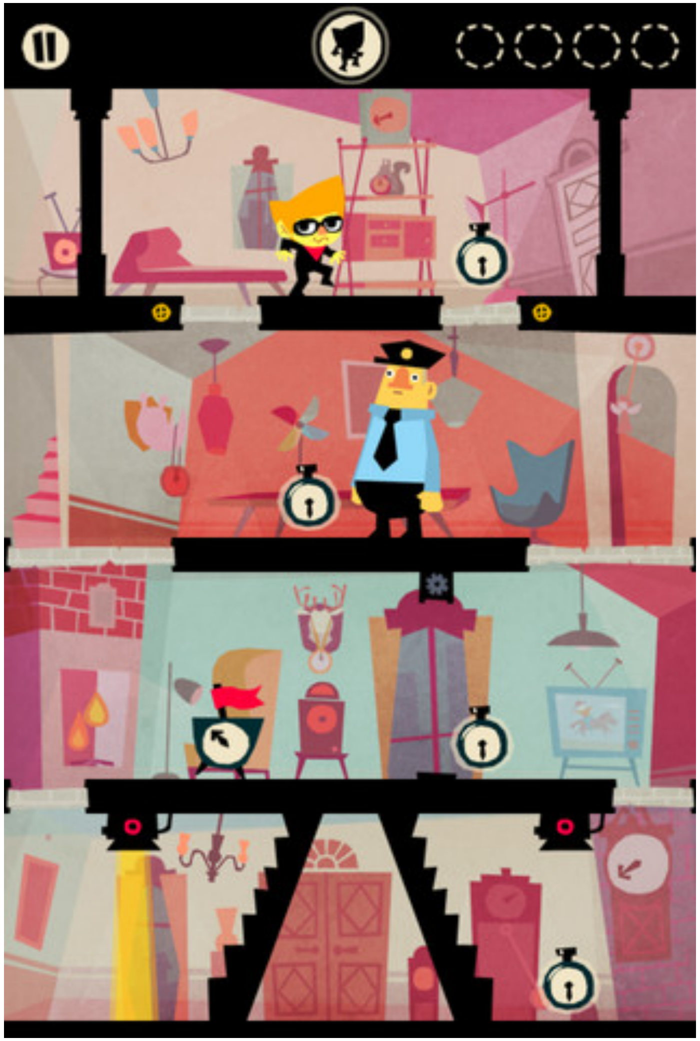
Game Mechanics

- **Game mechanic**
  - Relationship between verbs and interactions
  - Often call this relationship the "rules"
  - **Gameplay** is manifestation of these rules
- **Example**: Joust
  - Verbs: Flap; go left or right
  - Interaction: Collision with opponent
  - Rule: If hit opponent, lower player dies

Gameplay Example: *Joust*

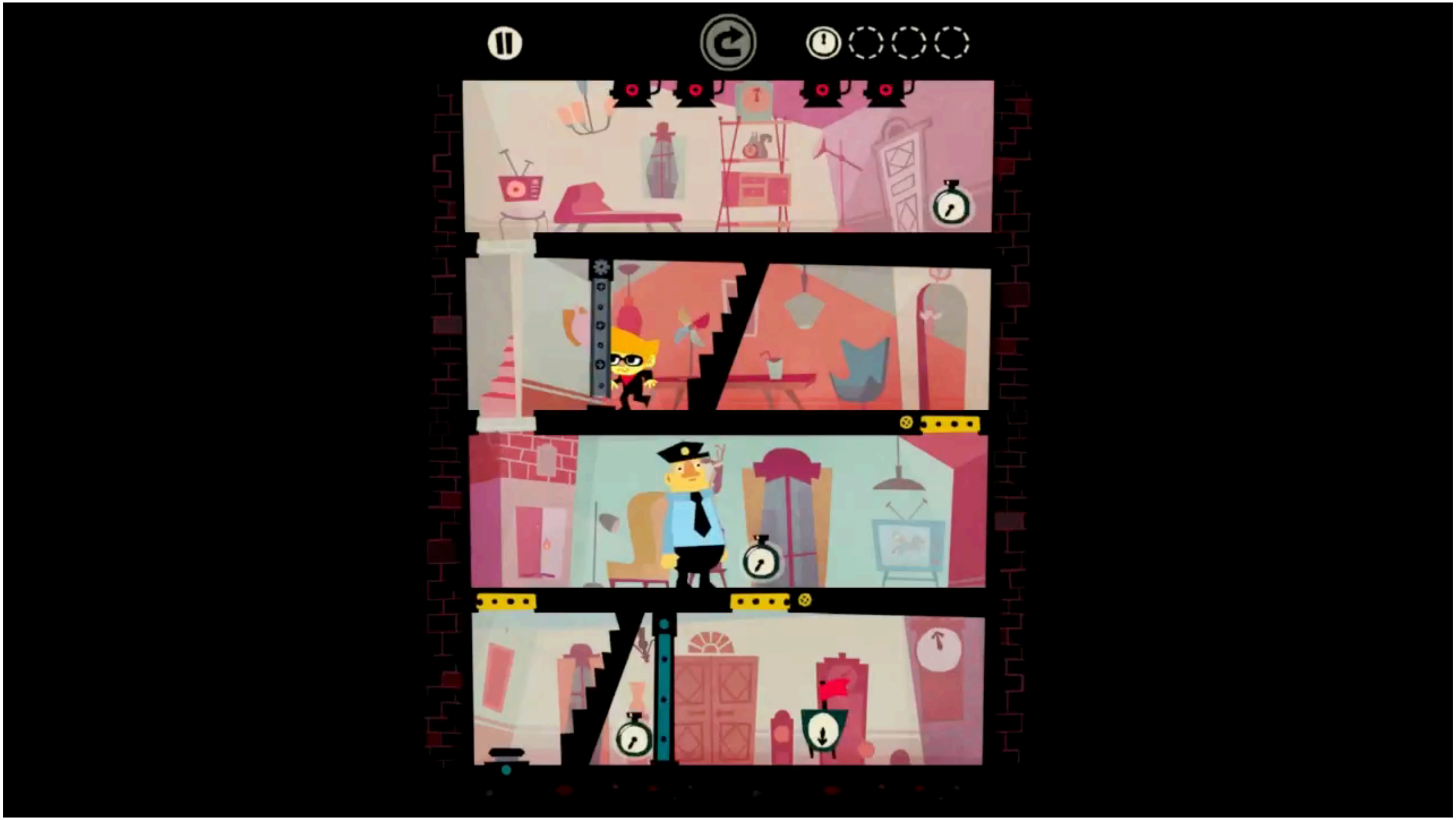


Design Goal: Verb Minimalism



- Can we limit to **one** verb?
  - Mechanics are all interactions
  - Common in mobile, tablet
  - Due to lack of input modes
- **Example**: Sneak Beat Bandit
  - Has only one verb: *move*
  - Rhythm game; move to beat
  - All movement on rails
  - If obstacle in way, turn
  - Line-of-sight mechanics

Beat Sneak Bandit



Avoid Verb Proxies

- **Proxy**: verb that activates another verb
  - "Use an item" (what does the item do?)
  - "Shoot" (what does the weapon do?)
- Make your verbs **outcome oriented**
  - Fire standard projectile (like shoot, but says what it shoots)
  - Fire freezing beam (what is does and how it is applied)
- Important questions to ask
  - Does it help me reach a goal?
  - Does it overcome a challenge?

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Behavior is defined by *interaction* of projectile with the environment

- Important questions to ask
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Understanding Game State

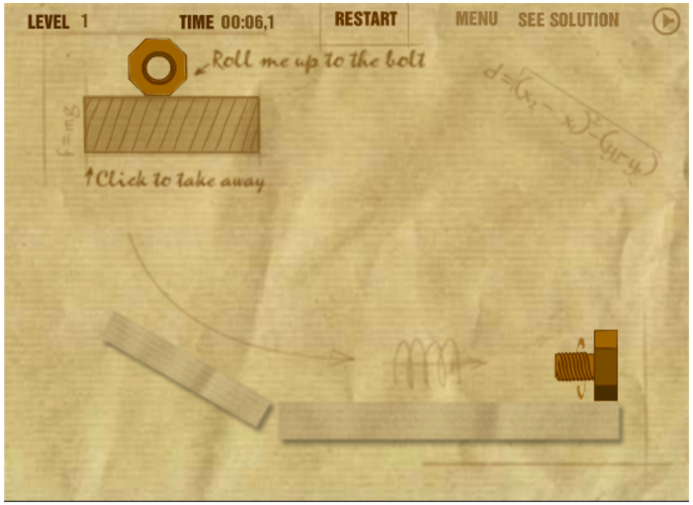
- Many game state values are **spatial**
  - Represent location of a game *entity*
  - Also physical values like velocity, acceleration
- Entities act as containers for non-spatial values
  - Values that never change: **attributes**
  - Values that can change: **resources**
- Attributes, resources can be global as well
  - Though most mechanics are at entity level…

Actions Affecting Spatial State

- Typically we what we would call *movement*
- But there are many ways to implement
  - **Direct** movement of avatar (e.g. WASD)
  - **Indirect** movement of avatar (e.g. pathfinding)
  - Alter the **environment** (e.g. removing platforms)
- Area of much potential *innovation*
  - Particularly given the limitations of mobile

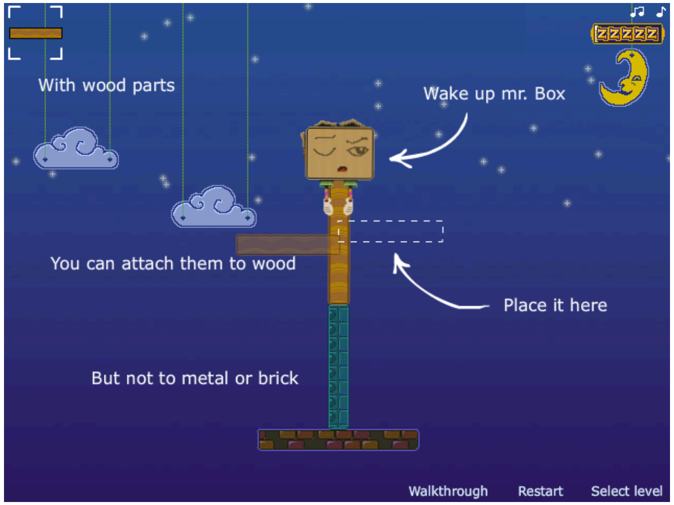
Altering the Environment

- Found in "physics" games
  - No direct control of avatar
  - Can only remove/add/move obstacles in environment
  - Movement is "natural"
- **Example**: *Screw the Nut*
- Physics is a rule system
  - Interaction, not action
  - Takes one state to another
  - Also one that is complex to understand/model



Roll me up to the bolt

Click to take away



With wood parts

Wake up mr. Box

You can attach them to wood

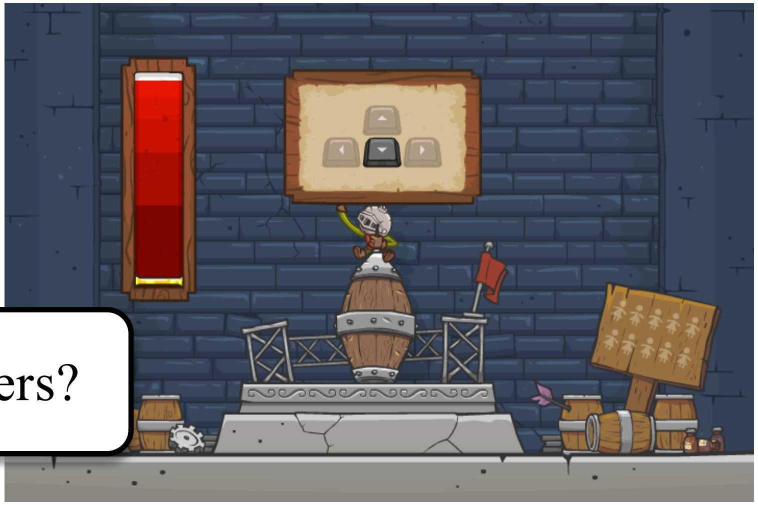
Place it here

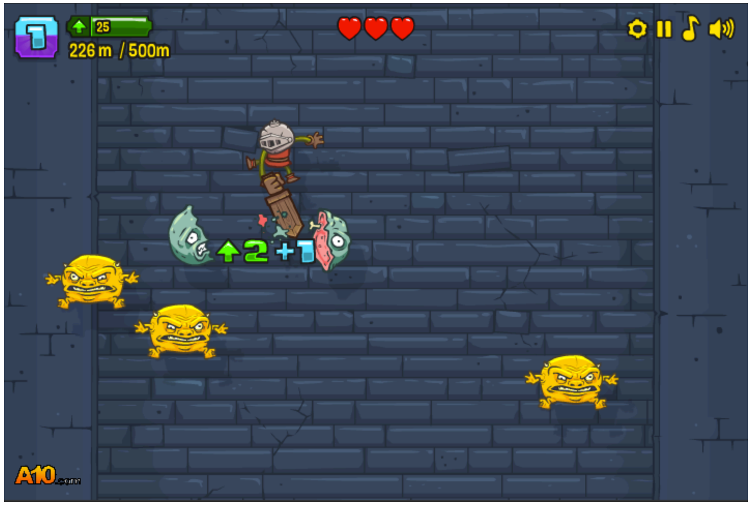
But not to metal or brick

Innovating Avatar Movement

- 2D games move on 2-axes
  - Classic: left-right/up-down
  - Unless top-down game, one of these axes is restricted
- Is jump the only option?
  - Launcher/trajectory verbs
  - (Limited) teleportation
- **Example**: *Knightmare Tower*
  - Launcher-style game
  - Vertical movement is boosts gained from killing enemies

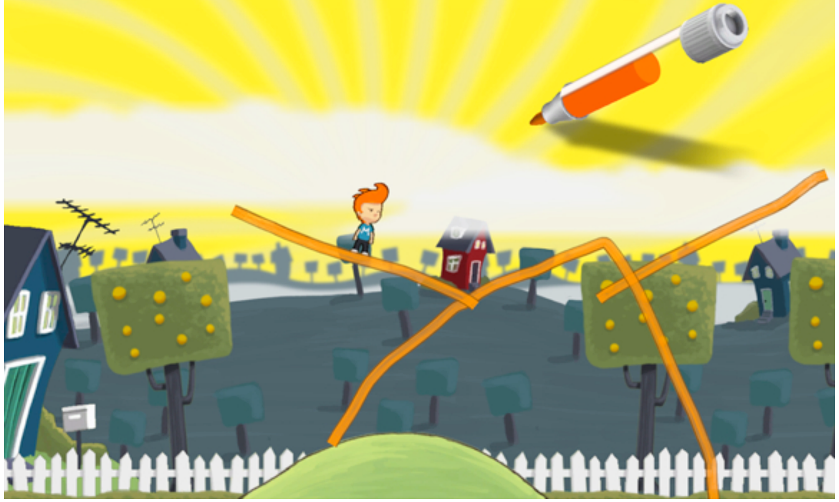
Others?

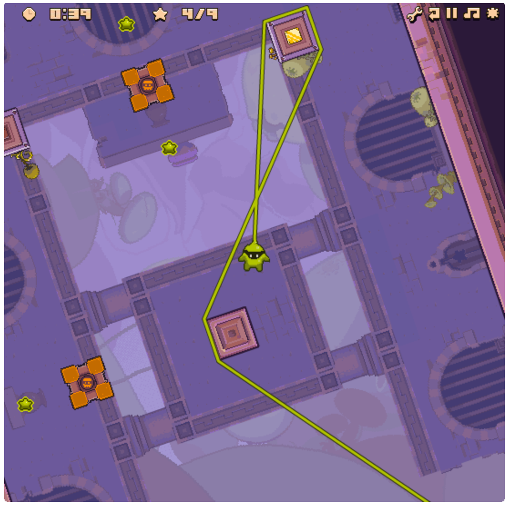




Environment **AND** Avatar

- Possible to split the verbs
  - Some for avatar movement
  - Others for environment
- Found in "drawing" games
  - Draw missing platforms
  - Avatar walks on platforms
  - **Ex**: Max & Magic Marker
- Innovate by limiting avatar
  - Move on single axis
  - Combine with environment
  - **Example**: Swindler





Combining Actions

- Verbs can combine in interesting ways
  - Run and jump in a platformer
  - Strafing fire in a shooter

- Typically result of the interactions
  - Each verb interacts with environment in different way
  - Combination of two give extra feature for “free”
  - This is an example of **emergent behavior**
- Not all combinations are emergent
  - **Example**: Double jump is not a feature of interactions
  - This type of verb combination is a *distinct action*

Combining Actions

Running Jump

- Can move while in midair
  - Just horizontal movement
  - Not realistic; it is a game
  - Many platformer challenges assume this type of control
- Different than a *long jump*
  - Less height than reg. jump
  - No control once in the air
  - Would be a **distinct action**

Strafing Fire

- Based on "real life" property
  - Bullets travel in straight line
  - Movement changes origin
  - Walking side-side makes a spray (used in covering fire)
- But some features are gamy
  - Bullets slower than life
  - Character faster than life
  - Creates interesting effects

Combining Actions

Interaction(?)

ump

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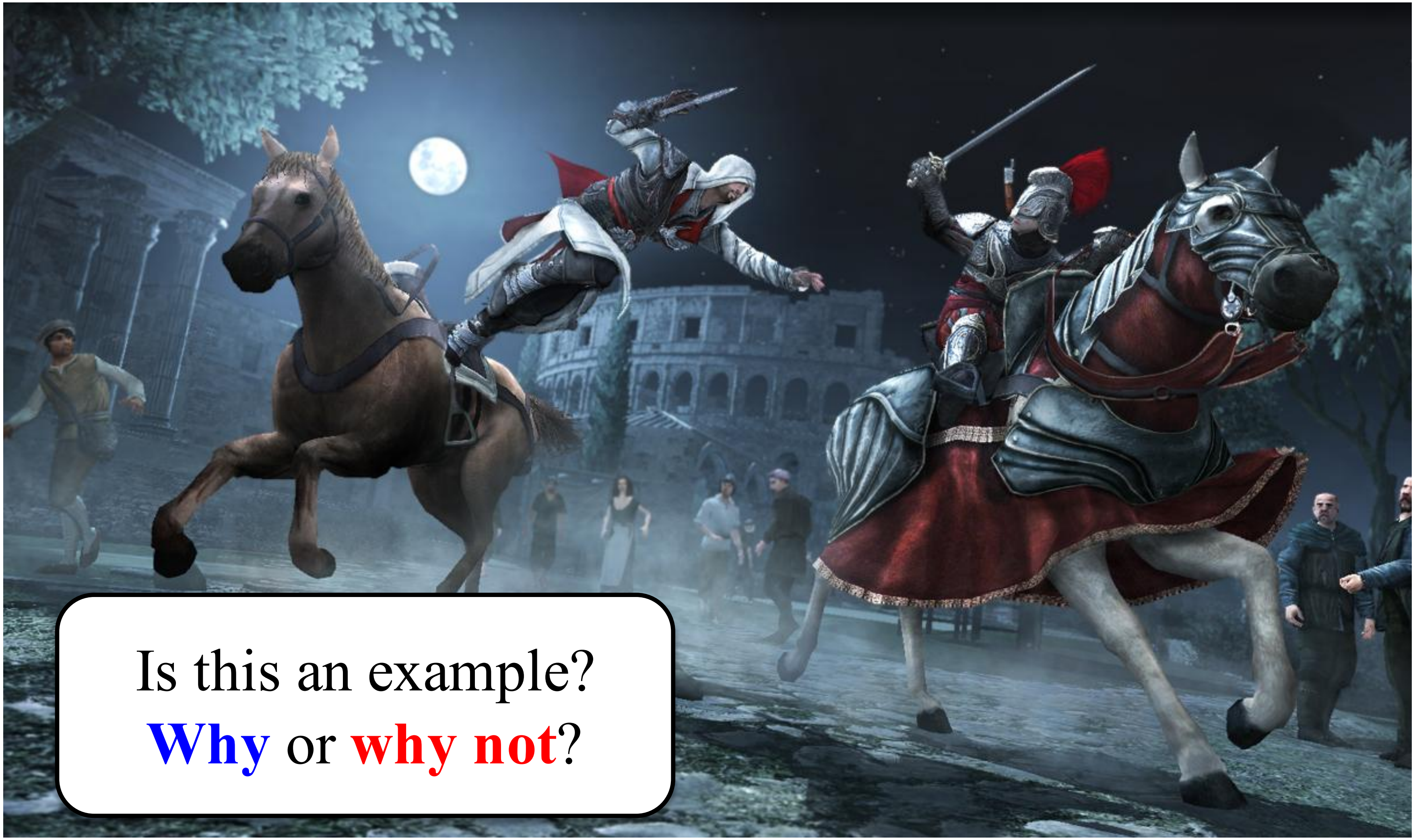


Is this an example?

Why or **why not**?

Common Spatial Interactions

Collisions

- Can effect *resources*
  - Player takes damage
  - Player gains power-up
  - Player-NPC transfer gold
- Can effect *spatial values*
  - Bounce off collision point
  - Swing from attached rope
  - Attraction to magnet/charge

Detection

- Examples:
  - Line-of-sight (w/ obstacles)
  - Spatial proximity
- Can have *direct* effects
  - Alarms in a stealth game
- Can have *indirect* effects
  - Tower defense targeting
  - Adjust NPC reactions

Resource-Spatial Interactions

Resource Affects Spatial

- Resources can unlock areas
  - Keys are a trivial resource
  - Also use resource thresholds
  - **Ex**: Collect all tokens to pass
- Resources affect difficulty
  - Adjust input device sensitivity
  - **Ex**: Deadeye meter in *RDR*
  - **Ex**: Jet packs to increase jump

Spatial Affects Resources

- Resources made by entities
  - Have a spatial location
  - **Ex**: Time to transfer resources
  - **Ex**: Sources be captured
- Resource values are entities
  - Take up physical volume
  - Need space to acquire
  - **Ex**: Inventory in *Deux Ex*

Actions and Limitations

- You cannot always perform an action
  - Shooting may require ammo
  - Cannot (always) jump in mid air
- **Limitation**: requirement to perform action
  - Boolean test (like an `if-then`)
  - **Example**: double jump is different from jump
- Primary use of resources in game design
  - Presence of resource allows action; may consume

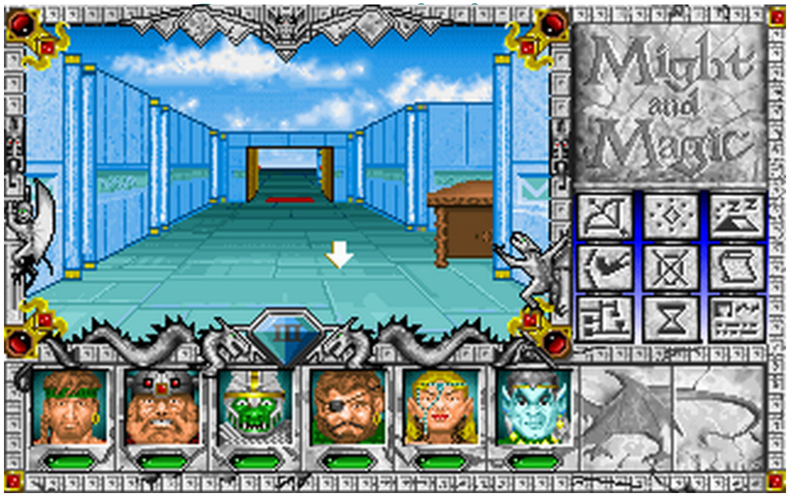
Balancing Resources

- Sources: How a resource can increase
  - **Examples** (player): ammunition clips, health packs
  - **Example** (external): spawn points
- Drains: How a resource can decrease
  - **Examples** (player): firing weapon, player damage
  - **Examples** (external): monster death
- Adjust sources and sinks to "balance" economy
  - Together, determine "price" of resource
  - Price of resource should reflect its "power"

Design Problem: Pricing Resources

Underpricing

- Cheap, powerful actions
  - Players favor these verbs
  - Limits play variety
- Examples:
  - Buff spells in most RPGs
  - *Dragon Age* cold spells



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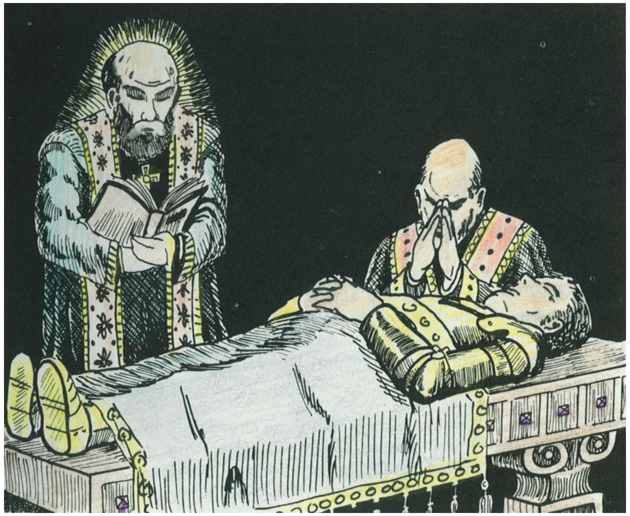

Overpricing

- Expensive, weak actions
  - Usage is "penalized"
  - Waste of designers' time
- Examples:
  - Shredder ammo in ME2
  - *Raise Dead* in early D&D

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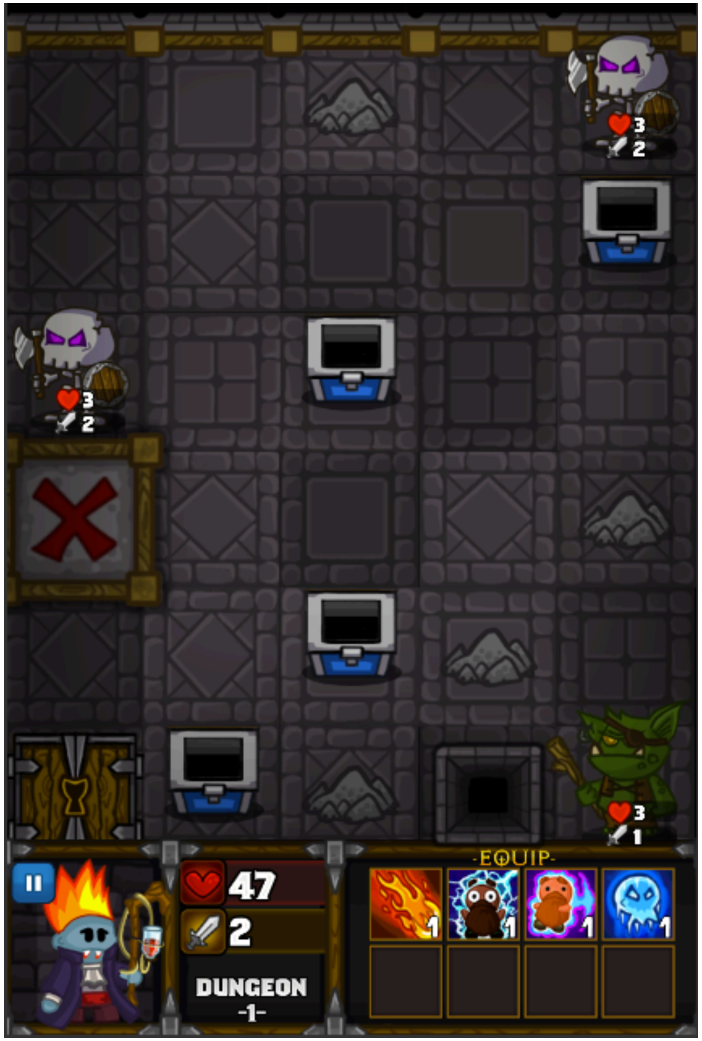
- Resource usage determines difficulty
  - *Resident Evil*: Availability of ammunition
  - D&D 3.x: 20% resource per encounter

Resource Analysis: Dungelot

- Simple combat mechanic
  - Each round, swap damage
  - Enemy dies when health is 0
- Player goes until health is 0
  - There is healing in game
  - …but too sparse to go forever
- Two primary characters
  - **Paladin**: can lessen damage
  - **Vampire**: drains blood to heal
  - Which is better?



Bad Design: “Engines”

- Actions combine to make resources free
  - Spend one resource to get another
  - Use new resource to get old one back
- **Example**: *Dragon Age: Origins*
  - Resources: Health, Mana
  - Small health loss; regain much mana
  - Small mana loss; heal much damage
  - Solution? Cool-down time

Summary

- **Mechanics** combine **actions** and **interactions**
  - Actions are a direct result of player controls
  - Interactions triggered by a particular game state
  - Input limitations make interactions very important
- Interactions depend on the **game state**
  - Spatial state associated with physics, detection
  - Resources associated with limitations, unlocking