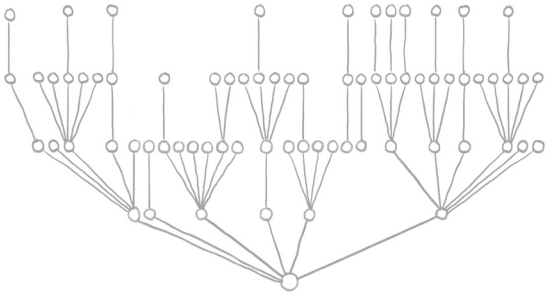


WILL WRIGHT | CHAPTER 18

System Design

TERMS

cellular automaton (n.) A grid-based system in which cells have programmed rules for population or depopulation.

agent (n.) An object that populates your system. Each has their own properties and behaviors.

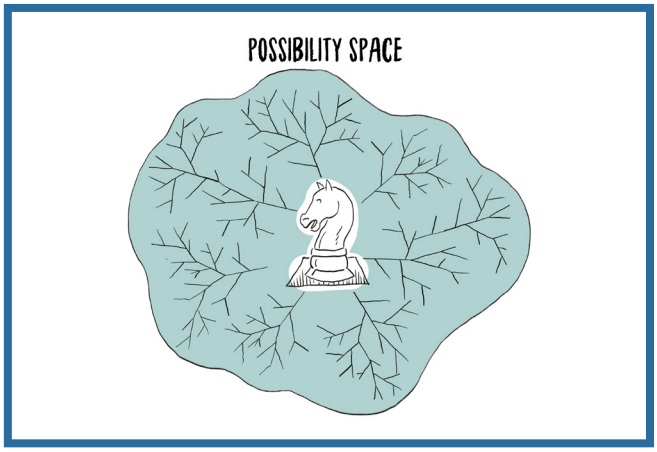
network (n.) Linked pathways through which agents move within your system.

layer (n.) Global parameters which govern the behavior of agents within your system.

stable system (n.) A system in which outcomes do not vary dramatically based on small changes in initial conditions.

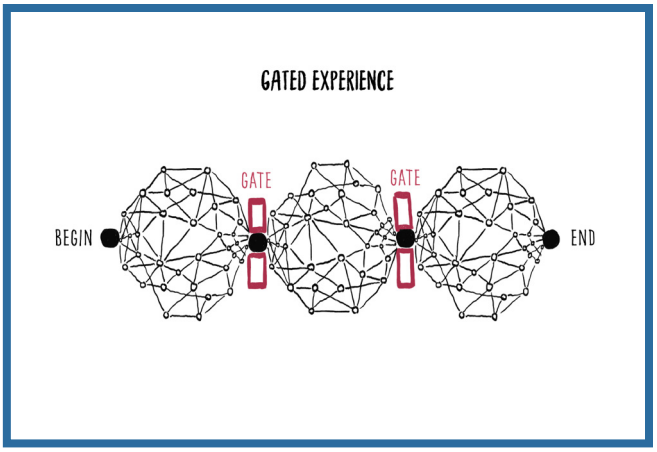
chaotic system (n.) A system in which outcomes vary dramatically based on small changes in initial conditions.

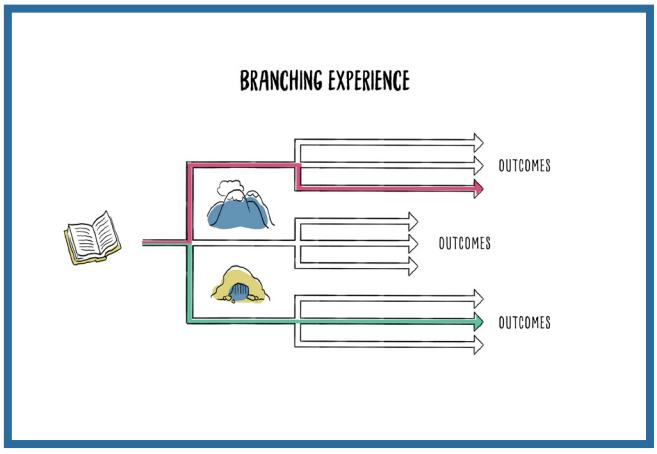
determinism (n.) Moments in which players can predict the outcomes of their behaviors with certainty.



1. **Game systems are structured with agents, networks, and layers.** When designing your own systems, think about agents as characters that your player can immediately read, and even empathize with. The networks of your system should be clear and legible, so your player can see which channels of movement are available to the agents.

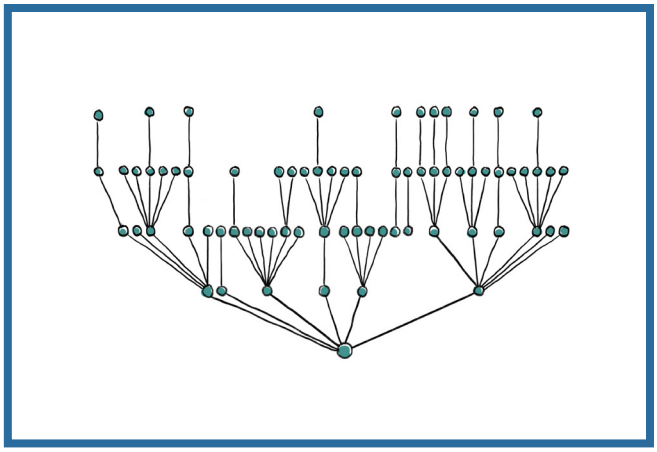
Games are interactive systems operated by your player. Knowledge in the fundamentals of system design will help you build and discover more robust and interesting interactions in your game.





2. **Even a simple rules layer within your system can create incredibly complex, unpredictable outcomes.** Encouraging emergent behaviors will enable you to produce play patterns that vary from game to game, or even moment to moment, to keep gameplay fresh.

3. **Common game dynamics include growth, allocation, destruction, and evolution**. Each produces different emotions and challenges for the player. When you discover a dynamic in your game system, theme it in a way that it becomes more clear. Find metaphors in nature and society that match the behavior in your system, such as a spreading wildfire to describe a destruction dynamic, or migrating populations to describe an allocation dynamic.



4. **Stable systems are more likely to produce determinism, while chaotic systems have outcomes that seem more random to the player.** Too much stability risks boring players, but too much chaos makes the player feel out of control. Use your system dynamics to strike a balance.

5. **When balancing and tuning your system, make dramatic changes to the variables rather than small incremental ones.** Push your system to its outer limits to discover what is possible, then slowly reign it back in until it is fun for the player. Learning what's possible at the extremes helps you discover what the balanced choices are likely to be.

LEARN MORE

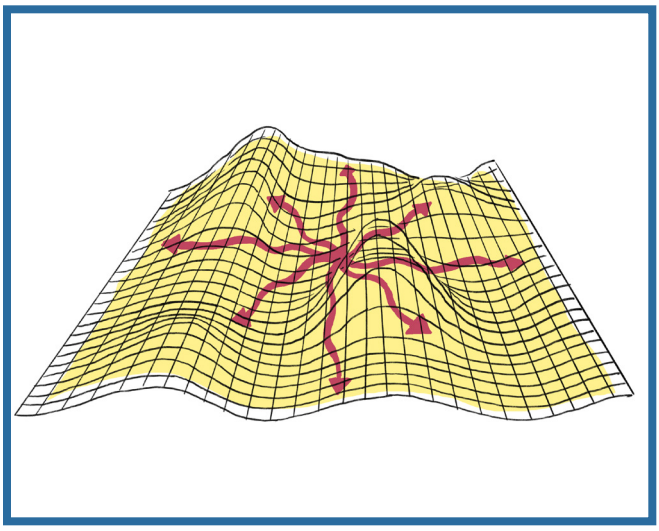
- Play John Conway's *Game of Life*. Imagine how his system could be applied in other game contexts. Consider what metaphors in nature or society you could use to theme the system's dynamics, or the behavior of the agents within it.

- Play with Nicky Case's interactive system modeling tool Loopy. First, look at the example for "Automation and Job Loss" to get a sense of how the tool works. Next, build your own simple system based on one of your concepts from your Concept Book.

- Read *Thinking in Systems: A Primer* by Donella H. Meadows (Chelsea Green Publishing, 2008). As you do, consider how systems in the natural and social world can be adapted into small-scale game experiences.

ASSIGNMENTS

- Use the sheet on the following page to learn more about balancing your system through positive and negative feedback loops.



- *Hacking simple systems:* Add small rules to folk games and board games and see what kind of behavior emerges during play. Add randomness to make the system more chaotic, or determinism to make it more stable. Here are some examples to follow:

  — Create a rule for what happens when there is a tie in Rock, Paper, Scissors.
  — Draw a larger grid for Tic-Tac-Toe. Design a way for it to be played by four players in teams of two.
  — Circle two spaces on a checkerboard. Design rules for duplicating the pieces that land on the circled spaces.
  — Allocate 20 chips to each player before a game of War. Allow them to spend those chips to add to the value of their cards before and after the card is flipped (at different rates).

- *Using Feedback Loops:* Play the most recent prototype for your Capstone Game. Identify the agents, networks, and layers within it. Then, design a positive or negative feedback loop (see the sheet on the following page) and integrate it into the game. Add a description of the mechanic to the Core Mechanics section of your GDD (1.g).

"So as we start building open-ended games...We're actually looking at a possibility space that is vast. And this is when we really have to view it now as a system."

USING FEEDBACK LOOPS IN GAME SYSTEMS

Complete the following exercises to learn how positive and negative feedback loops can reinforce player behavior and balance outcomes within a game system. Record your answers to the exercises in your Concept Book.

POSITIVE FEEDBACK LOOP

In a positive feedback loop, players are rewarded for successful behavior. The reward reinforces that behavior, so the player is more likely to pursue it again. Positive feedback loops create a "snowball" effect, in which the winning player continues to win more and more quickly.

Ex: In Massive Online Battle Arena (MOBA) games like League of Legends (Riot Games, 2009), players receive gold for killing enemy players. They can then spend that gold on better items in the shop, which makes them more powerful during the next fight, and therefore more likely to win the next fight.

TASK 1: Describe several positive feedback loops from your favorite games.

TASK 2: Think of a game you enjoy that slows down dramatically at some point during play. Consider games that become a grind, or even reach a stalemate. Then, design a game mechanic with a positive feedback loop that will accelerate progress through that period in the game.

NEGATIVE FEEDBACK LOOP

In a negative feedback loop, players are punished or disadvantaged for successful behavior. Negative feedback loops balance play and create parity among competitors. Often, they present as "catch-up" or "rubber banding" mechanics, which propel players who are losing into a winning position and vice-versa.

Ex: In Mario Kart, the racer in first place gets the worst items, while the last-place racer gets the best. This creates a dynamic in which the last players always have a chance to catch up, while the player in first is constantly in danger of losing their position.

TASK 3: Describe several negative feedback loops from your favorite games, as well as the game dynamics they create.

TASK 4: Think of a game you enjoy that has a sense of inevitability about the eventual winner midway through the game, or even earlier. Consider games in which you feel bad playing from a losing position, because you know there is no way you will win. Then, design a "catch up" mechanic for this game, with negative feedback to inhibit the winning player.