Intro GD Unit 2 - Mechanics and Structure

The second unit for planning purposes, although we often describe the first two units on this wiki as “the first unit” for students, since it’s when we look at games through the first of three lenses (formal structure). In this unit, which often covers weeks 3-5, students work together in groups for the first time, and on a project longer than a week. Accordingly, there’s an emphasis on playtesting, iteration and group collaboration!

Major Assignment III: Mechanics Game (usually assigned first session of week 3 due first session of week 5)

Educational Goals for Unit 2

- get comfortable with thinking about mechanics as a starting point for game ideas...
- ...including the possibilities created by common physical materials (grids, cards, dice, tokens)
- ...as well as more abstract structures of system & interaction (ticking clock, modular units, victory points, real-time play, etc)
- working well together in groups, in practice over a two-week assignment with 3-4 people
- playtesting with each other, with classmates, and with strangers (e.g. at Playtest Thursday, a barely-public space!)
- integrating finding from playtests into changes and iteration
- understanding the traditional role of uncertainty in games
- understanding basics of probability for games, including independent and dependent events (dice vs cards), perceptions and fallacies of probability, the difference between hidden information and randomness, etc.
- understanding basics of feedback loops, both reinforcing (“snowball” or “positive”) and balancing (“catch-up” or “negative”)
- practice writing rules for clarity and disambiguation
- (possibly) designing for intuitive learning, to make writing & learning rules easier
- (possibly) basics of Adobe Illustrator

Class-by-Class Lesson Plan

Sample lesson plans by Eric with times for each activity in each class, starting with the final class of the previous unit where the assignment for this unit is introduced.

Week 3, Class 1: Mechanics Game and Collaboration

The first part of this class is described in Unit 1: Mods and Intro since it’s the end of this unit and beginning of that one!

Pre-Class Prep

- For pitch presentations: make sure students have uploaded their presentations to a Google Drive shared folder, a Dropbox folder or file request, your Slack channel, etc. Presentations should all be one on machine, so that switching to the next one is easy! (Tip: if a TA’s laptop is being used for presentations, you can use your own to take notes! Or you can do so on your phone, tablet, notebook, etc.)
- Things will go even quicker if you have a pre-determined order for presentations (random order, or however). Have your TA write it on the board.
- Print materials for collaboration exercise -- See below, materials still to come
- Print and cut Mechanics and Material Cards for Mechanics Game assignment
- Familiarize yourself with the Mechanics Assignment Infosheet so you can answer questions about the cards.

Pitch Presentations – See Unit 1: Mods and Intro

Exercise: Collaboration Styles (new exercise still being designed, see below)

Major Assignment: Mechanics Game – See below

Week 3, Class 2: Probability and Feedback Loops

Uncertainty Probability Discussion – some of the main concepts from the readings (Rules of Play Ch.15)

- uncertainty in games: macro (don’t know who will win, outcome uncertain; many sources of uncertainty including other human players, hidden information such as unrevealed cards, as well as probability) and micro (probability and information)
- perceived vs real probability: it doesn’t actually work the way human beings think it does
  - Richard Garfield’s example of a streak of heads and tails coin-flips. Which one is real?
    - 00101001001010101001001010101010
    - 111000010100000001100100000101111111
  - Many people, including a lot of game-players, believe the first one is more natural, random and real, while something with long streaks and patterns like the second example is rigged or broken. But the second type (Garfield had an actually randomly-generated one in his talk) is the true example; randomness does not mean there are no streaks or patterns, quite the opposite. You need to alter or rig randomness to produce “evenly distributed noise” with no clumps.
• common fallacies in the perception of probability
  • thinking that “winning streaks” or “losing streaks” become more likely to continue or be broken – nope, chance stays the same
  • thinking that “lightning never strikes the same place twice” but also that “a particular slot machine can be lucky”
  • overvaluing a “long shot” with a big payout rather then a safe bet with a small payout
  • adding chances rather than multiplying – is the chance of rolling a 6 with two dice twice the chance of rolling a 6 with one die (2/6 rather than 1/6)? Nope! It's 1 - (5/6 x 5/6).

Some probability examples for discussion

• getting heads + tails – calculating the odds
  • You can double your money in a game where a coin is flipped twice, and you bet on how many heads – what's a good bet?
  • Have students call out their bets; “one head” is the best bet because it can occur two ways (first coin heads, second coin tails OR vice versa) whereas “two heads” and “zero heads” can only occur one way
  • Of course, you'll still only win half the time (“one head” happens 50% of the time)
• chance of having two daughters if you have two children (it’s 25% – this can be illustrated with a punnet square of the possibilities)
  • “If someone has two children and you know one of them is a daughter, what is the chance that I have two daughters?” Ask students to guess – answer is 33% because you can eliminate the “two boys” possibility in the above punnet square
• other examples of this kind are in Jesse’s slides, and in books on probability/statistics like The Drunkard’s Walk
  – can bring in discussion of how information changes probability, population statistics, etc.
• two students lying to a teacher/principal about a tire blowing out on their bus coming to school
  • they are separated and the principal asks them which tire blew out: what is the chance that they randomly pick the same tire and get away with it? Ask students to guess
  • it's 25% because there are 16 possible combinations (first student has 4 tires to pick from, second student has 4 tires to pick from) and in 4 of those they pick the same tire (front left + front left, front right + front right, etc)
  • Jesse has added: if the students are smart and don’t randomly pick a tire, they might be more likely to pick the front left tire, which in countries where you drive on the left side of the road is the most common to blow out
  • can point out that this is similar to the chance of rolling doubles (6 out of 36 combinations of two standard dice being rolled are doubles)
• monty haul problem: goat behind two doors, new car behind one door (and assume player wants the car, doesn't want the goat – someone always says "but I'd prefer a goat!" You can always change it to "nothing" or tell them you don't get to keep the goat, it's just a mascot.)
  • after player picks a door, game show host opens one of the other doors to reveal a goat (note: the game show host never reveals the car, always opening a door with a goat! this is important!)
  • should the player switch doors? yes, it's always better to switch.
  • Many students believe the chance of being right has gone from 1/3 in the first choice to 1/2 in the second choice, thus it doesn't matter if you switch
  • The real question is "what is the chance you were right or wrong in the first choice?" 1/3 chance of being right, 2/3 chance of being wrong. The game show host always eliminates (by opening) one of the doors in the 2/3 you did not pick – thus the only remaining door represents 2/3 chance of being right.
  • This is very hard for many students to wrap their heads around but is a great example of information changing a game situation! Can point out that many mathematicians were stumped by it, but it's now recognized to be the right answer. Marilyn Vos Savant, a newspaper columnist, published the solution in 1990 and many did not believe her (sexism?) but she was right!
  • There are online simulators of this that track success over thousands of trials and the probability is shown, empirically, to also level out around 1/3 success for not switching, 2/3 success for switching.

Exercise: Squodron (dice game about the intersection of probability and rock-paper-scissors — see below)

Exercise: Bugs vs Troopers (game illustrating the difficulty of estimating probability – see below)

Discussion of Cybernetic Systems (Rules of Play, Ch. 18 and/or “MDA” paper)

• Diagram some basic feedback loops
  • Microphone and speaker – positive feedback loop or “snowball” loop or “reinforcing” loop. Sound goes in mic, is amplified, comes out of speaker, is picked up by mic again, amplified more, etc. Screech! “Feedback.”
  • Air conditioner / thermostat – negative feedback loop or “catch-up” loop or “balancing” loop. Temperature goes up, air conditioner kicks in, lowers temperature, air conditioner goes off.
  • Predator / prey population dynamics – negative/balancing
  • Global warming – positive/reinforcing loop
  • “Rich get richer” – positive/reinforcing loop
• Game examples: rubber-band-ing in a racing game like Mario Kart. “Rich get richer” mechanics in Monopoly, or many other games where “winning helps you to win some more.” Kill-streak bonuses, economic build-up, etc.
  • Pool is a great elegant example that has both: if you sink a ball, you go again! Reinforcing/positive loop. The more balls you sink, the fewer viable targets you have to shoot! Balancing/negative loop. Both can be in a game!

Exercise: Kingdom (letting players play with and modify feedback loops – see below)

Week 4, Class 1: Writing Rules
In-Class Exercises

Exercise: Collaboration Styles

- **This is the first draft, subject to revision in the next week (as of September 12)**
- Count off students into groups of six. Your class probably doesn’t have exactly 12 or 18 students, so some groups will have fewer than six students. (In a class of 16, two groups should have five.)
- Give each group a set of **Collaboration Style Cards**. Students should read and pass around the cards, and select the one they feel represents them the best. If multiple people want the same card, it’s whoever claims it first, or decide with rock-scissors-paper.
- Tell students that they will be collaborating to solve a problem together – a fictional scenario, in which they will be playing the role described on their card. In that role, you should feel empowered to do any of the actions on the back of the card! Keep the front of your card towards your teammates so they can see what role you’re playing. The bottom of each card’s back lists some negative qualities of that role. You can dip into those negative qualities as you see fit, but don't let them take over entirely! If a teammate asks your role for help, or points out the negative quality you’re performing, switch back to your positive abilities.
- **Reveal the problem:** “Humans have made first contact with an alien species. We don’t know what their intentions are, and we’re having trouble communicating at all. These aliens seem to communicate only through moving symbols around – sometimes hiding, revealing, giving and receiving them with each other, sometimes placing them on a grid. It seems to be some kind of game. You have been tasked to design a game for humanity to communicate with the aliens.”
- Groups should begin brainstorming (some tips on brainstorming might help to display at this point?) while playing their roles.
- After one round of this (enough time for every group member to make some contribution & have each other respond) announce that the groups are switching. Count off each group up to six to create totally new groups of six. This time, the cards should be distributed randomly – you can't have the same card as last time! Repeat the exercise.

Exercise: Squoddron

- This exercise is explained in detail by Stone Librande in this presentation
  - LeBrande Dice Excs.pptx (Powerpoint)
  - LeBrande Dice Excs.pdf (PDF)
- **Materials**
  - Blank tables, and “X” markers for charting out possibilities of “custom dice”: dice roll tables.pdf
  - Blank tables, and tiles, for charting out remaining possibilities in the tile version where each tile can only be used once: dice tile tables.pdf
  - Some printed versions of these materials are also in the “Probability” box at the back of the adjunct area! Please return if used.
- **Introduction:** if two players each have one six-sided die and try to roll the higher number, what’s the chance of each winning? Intuitive: 50/50.
  - Seems obvious: we can plot out the results on a 6x6 grid to check. There are 6 ties as well, though! 16.6667% chance of a tie, so it’s not exactly “I win 50% of the time.”
  - This builds on the discussion of “rolling doubles” in the tire example, too.
- Can you design a more powerful die?
  - Design your own die (maybe using blank dice from prototyping cart, and erasable whiteboard markers!)
  - Numbers on the faces must add up to 21, like a standard die’s faces do (1+2+3+4+5+6)
  - Zero is allowed (blank face, loses to all higher numbers)
  - Fight a partner’s die. Don’t chart it out yet.
  - Who thinks they have a killer die? Chart out one matchup on the board, maybe between two confident players. You can mathematically determine which wins more often.
- Can you redesign a losing die to make it beat the other die? (Have losers of matchups redesign their die, fight again, repeat if desired.)
- Question: is there a best die? In an ecosystem of players constantly designing their own dice? (Idea of a local meta could be introduced.)
  - Every die has a “weak spot” – there are mathematical “rock, scissors, paper” formations (but more complex)
- Tiles vs. dice
  - Each player gets a “deck” of tiles 1-6 (printed from PDFs above, or borrowed from adjunct pit – and there are number tiles in the prototyping cart also, though there may not be enough)
  - 1v1 game. One version: shuffle your tiles and each draw one randomly, higher wins. This is basically like war.
  - Alternate version: pick which tile to play, but use each only once.
  - What’s the difference between this and dice battle? In this game, your “numbers” are a non-renewable resource that is used up over time. Not better or worse, just a different approach to chance.
  - Of the two versions of dice tiles, is it better to make it a random draw, or choice? Why? Can you imagine a reason to make it feel more random, out of the player’s control?
  - Have groups go through random game and determine odds as it’s played, using the dice tile tables above to show how
probability changes during a game as each tile is "used up." Maybe do this in front of the class the first time.

- **Wrapup discussion**
  - Connect these kinds of chance to Tetris blocks “bag” system (random + tiles).
  - In many versions of Tetris, the program makes a “bag” of equal number of pieces – perhaps 2 or 3 of each piece – then empties the bag randomly, then makes a new bag.
  - Why would they take this approach? What is the "worst" that could happen? Talk about streaks.
  - Make sure students get that these "bags" and "tiles" are more like decks of cards – and in their games, it's their choice to use "repeating" (dice) randomness or "less repeating" (card) randomness.

**Exercise: Bugs vs Troopers**

**Exercise: Kingdom**

- Simple game design exercise to let students play with identifying and modifying feedback loops in games

**Materials**

- Game rules and number cards: *Kingdom.pdf*
  - Note that the number cards are small, and flimsy especially if printed on regular paper! May want to print on cardstock. We might want to make some larger ones, as they are hard to hold in a "hand."
  - Some printed versions of these materials are also in the "Probability" box at the back of the adjunct area! Please return if used.

**Setup**

- Groups of 3-5.
- Each player gets 10 generic tokens (use cubes from prototyping cart, or chips) and puts them in a common pool in the middle.
- Shuffle the deck of all number cards (equal number of cards 1-5, printable version has 10 of each for 50 cards) and deal 3 to each player.
- Play the game, rules are fairly self-explanatory.
- Discuss feedback loops (could interweave this with discussion above)
  - What are the negative/balancing loops (thief: weak negative) and positive/reinforcing loops (farm: strong positive)?
  - Thief and farm also represent a Euro-style game mechanic (generate resources efficiently) vs. an American-style game (direct targeting or "attack" against another player)
  - What is wrong with the game now? What do you want to change? What happens when you add some feedback loops?
  - If there is time, let each group try modifying 1-2 rules and writing the new rules on the instruction sheet. Good practice at writing rules too, and at balancing loops. Share and discuss.

**Exercise: Rules of Mancala**

**Major Assignments**

**Major Assignment: Mechanics Game**

- Have the **Mechanics and Material Cards** ready, just one copy of each card.
- Divide students into teams of 3-4. At this point in the semester, random group assignment is probably still fine. There should ideally be 4 groups, 5 if you have a class larger than 17.
- Show the cards and explain that these will be the constraints they're working with for this project. You can use the **Mechanics Game Infosheet** to answer questions about what the cards mean.
- Have groups roll to see who goes first. (High roll or low roll, your pick.) Do a "snake draft" with the two types of cards: if group A is going first and D last, then have them pick A B C D C B A. Group A will pick either a material constraint (blue card) or abstract mechanical constraint (red card) first, but will also pick last – either a blue card or red card depending on which they didn't pick first. Group D will be the last to pick a card, but gets to pick two cards.
- Make it clear that the constraints picked are not the only elements of the game they'll make, but should be among the primary elements, strongly contributing to the feel of the game (not just incidental).
- Make sure to give each group a copy of the **Mechanics Game Infosheet** – it describes their constraint and gives them a required game to play for each abstract mechanical constraint.
- **For Fall 2019** the required games will be available in Gwynna Forgham-Thrift's office, in the admin staff hallway. The non-required games are in the library but are unavailable due to time requirements for unpacking!
- **Their game is due in two weeks** but they must have a working prototype in one week. Explain the lab schedule: there's no lab for the next two classes, then a lab session, then the game is due. They should meet outside of class!
- If you want to you can require students to playtest at Playtest Thursday for this project. Pick the final Thursday before the game is due?
- It's OK to try out different ideas for this project; try using brainstorming techniques from the collaboration discussion. But remember: to move forward, you have to stop brainstorming and start prototyping! It's possible to brainstorm or discuss/argue forever; sooner or later, you have to try something.
Readings for Unit 2 - Mechanics and Structure

Assigned Week 2 (at end of last unit) to be discussed in Week 3

**Standard Readings** (These readings are referenced in the lesson plan, tend to relate to unit educational goals, and are often from Rules of Play, but can be supplemented / replaced!)

- *Rules of Play, Chapter 15: Games as Systems of Uncertainty* (sources of uncertainty, randomness and probability, basics of probabilities with dice, the feeling of chance in games, fallacies of probability)
- *Rules of Play, Chapter 18: Games as Cybernetic Systems* (feedback loops, dynamic difficulty)

**Alternate Readings** (Someone's assigned one or more of these in the past! Feel free to sample.)

- *MDA: A Formal Approach to Game Design and Game Research* by Robin Hunicke, Marc LeBlanc, and Robert Zubeck (mechanics/dynamics/aesthetics framework, feedback loops)