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 on one 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

Pre-Class Prep

- Decide which probability examples you want to discuss! There are several of them, and more in books like The Drunkard's Walk.
- For Squoddron, Have one table from dice roll tables.pdf printed/cut for every two students, and optionally a set of red and black X tokens – without these, you'll need more tables as they'll have to mark Xs on the sheets.
- If you're also doing the "Tiles vs Dice" section of Squoddron, do the same for dice tile tables.pdf where you'll definitely need one set of 12 tiles (1-6 red, 1-6 black) for every two students.
- For Bug vs Troopers, print the first two pages of BUG vs TROOPERS.pdf two-sided and cut in half to get two rules half-sheets. One half-sheet for every two students. Also print one board (last page) for every two students, and trooper and skull tokens – a dozen per pair of students is probably plenty.
- For Kingdom, print rules and and print+cut the "cards" (little rectangles 1-5) from Kingdom.pdf. Determine how many groups of 3-5 you are likely to have (four groups in most cases). Every group will need a half-dozen rules sheets and all 50 cards (10 copies of numbers 1-5)
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?
    - 001001001001010100101001011010
    - 1100000010000000110011000000101111111
  - 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 possibility, 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 hall 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 gameshow 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:** Squoddron *(dice game about the intersection of probability and rock-paper-scissors — see below)*

**Exercise:** Bug 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-banding 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)

Assign Readings for Next Class – see below

Check in on Mechanics Game

- By next class they should have a working prototype of a game that matches their criteria. This must include rules.
- They should have already played their required game as research–that's the first thing they should have done! If not, get on it.

Week 4, Class 1: Writing Rules

Pre-Class Prep

- For the Mancala exercise you’ll either need a couple Mancala sets or a couple printable Mancala boards like this one, designed for 11 x 17 paper: mancala-board.12hole.printable.pdf. Fall 2019: remember the library needs one week advance notice to unpack games! We might have just enough for two sections to run at a time (four sets) but probably not three. If you're printing boards, you'll also need some small tokens, like cubes or gems, from the prototyping cart.
- You should also familiarize yourself with Mancala! Try playing on a paper sheet like the one above. Check out the rules: Mancala_a_instructions.pdf
- Make a shared Google Drive folder for the Mancala rules exercise; if you invite all the students to this folder before class, it can save some time. (Alternately, you can just use Slack, but Google Drive might be a little faster.)

Discuss Readings (with some optional slides about writing rules)

- Rob Daviau, "Design Intuitively". Perhaps best known as the creator of the Legacy game genre, starting with Risk Legacy, then Pandemic Legacy, Seafall, Werewolf Legacy, etc.
- Can we be critical of ideas of "good design?" Is there such a thing as universally good design, separate from context and goals?
- Daviau’s flowchart loop is a great, easy way of thinking about the formal system of a game, and can apply to many.
- Some aspects of the reading are problematic, like Daviau's reliance on the old assumption that "white means good, black means evil." (Again, as designers we have to think on multiple levels at once.)
- Mike Selinker, "Writing Precise Rules". A real challenge with lots of tips in this reading.
- You can also use some slides with succinct advice on rule-writing by Game Center alumnus Josh Raab, in PDF format: Writing Rules.pdf or PowerPoint: Writing Rules.pptx or Keynote: Writing Rules.key

Exercise: Rules of Mancala – see below

Check in on Mechanics games

- Groups should now have a playable prototype.
- If you're doing "the switch," this is the class to do it in. Have each group playtest another group's game, swapping games so they're playtesting yours and vice versa. If possible, they should try to figure out how to play from the rules, but if it's ok to ask for clarifications from the designers. After the playtest, announce that they must learn how to let go of their work and send it out into the world, and not be so attached to pet ideas… so each group will inherit another group's project and take it over! Specifically, the game you just tested is now yours. The new groups should mod and change each game as they see fit, and grading will take into consideration both halves (the foundation you laid for another group's finishing work, and how well you finished the project you inherited). It's optional to play the required research game and you can use the former group as consultants for advice if you want.
- If not doing the "switch" there still may be time for a playtest in this class, or at least a go-around check-in.

Optional: Illustrator demo (depending on time)

- Basics of the program
- Lay out a sample card, maybe a creature for a dueling game
- Find stock images online to use as centerpiece illustration
- Find an icon to use as the "suit" of the card
- Students can help brainstorm or just yell out content ideas, improv- style
- Create a sheet of 8 cards (maybe simple backs, too!) ready for printing on a 8.5 x 11 sheet of cardstock

Week 4, Class 2: Mechanics Game Lab

Work on finishing Mechanics Game

This is not a lab that we're recommending instructors attend, since adjuncts are only being paid for half of the labs. The students' main task
is to finish their mechanics games, which are due and will be played in the next class.

TAs should supervise, troubleshoot, playtest, and give last-minute production advice (avoid big changes or time-consuming tweaks, focus on making the game clear, maybe trimming half-baked stuff away).

**Week 5, Class 1: Play & Critique Mechanics Game**

**Major Assignment Due: Mechanics Game**

- Most or all of the class will be playing and discussing the mechanics games. Be sure to leave about the same amount of time for each game. You might ask groups to tell you the approximate game length of each game so that you can plan ahead.
- Another good thing to know at the outset is number of players, to get set up quickly. You can have your TA ask for this and playtime, and make a randomized order to write up on a whiteboard.
- For these games, you can start using the rules to learn the game. Read the rules out loud and try to use them to play the game. There will definitely be confusions and ambiguities - try and figure them out, or ask the designers to clarify if it starts to take up too much time. The point is not to put the students on the spot but to have them start to realize the need for clear rules and the difficulty of writing them well.
- You probably want to remind the class again about the role of giving and receiving criticism well in the class, perhaps referencing the collaboration readings.
- If you have time left over, you can start to talk about the pivot from rules to experience, from formal systems to social play. You could do the first social play exercise (Five Fingers) - it is pretty fast (about 15-20 minutes including setup and brief discussion)

**Assign Readings for Next Class (Unit 3) – to come**

**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.”
- If the students ask for more information about the aliens (they might do this especially if they're in the "Blue" role) tell them that it's all classified, probably because nobody even knows anything.
- 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: Squodron**

- 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!)
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](attachment: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.

Exercise: Bug vs Troopers

- This exercise was inspired by Sid Meier's comment about having to tweak randomness so that it feels right, because many human players perceive an actual 50/50 win rate as being unfairly tilted against them, while a 70% win rate feels around "even odds." This is also a game that introduces players to more complex use of probability in a game. Useful for students who haven't thought about game probabilities in terms of "percentages" and guesstimates before.

**Materials:** [BUG vs TROOPERS.pdf](attachment:BUG vs TROOPERS.pdf) (print first two pages two-sided and cut in half to create rules half-sheets, which have the basic rules on one side and a moddable "the sequel" on the other)

**Introduction**
- First, go slowly through the idea of percentile dice rolling, especially rolling under the target number (70% chance, roll 01-70 on two dice) and using one die as the "10s" die. Understanding that low rolls are better is unfamiliar to students who haven't seen this before.
- Distribute materials to groups of 2: a rules half-sheet with "the sequel" version on the back side, a board with the big bug on one end and trooper carrier on the other, and a bunch of tokens (a dozen troopers, some "skull" icon wound tokens).
- Go through first turn with everyone together, watching two players in the middle
  - Trooper player gets 4 troopers. Bug player gets 1 bug (no bug token, they just have their side of the board)
  - Bug attacks first, and attacks each trooper one at a time. If the attack succeeds (percentile roll equal to or less than the bug's attack strength) the trooper is destroyed.
  - Then troopers attack the bug just once, adding their attack values together to create a single large attack value. If the attack succeeds, the bug takes one wound token.
  - Troopers then get reinforcements, one for each starting HP of the Bug (ignoring wound tokens)
  - Troopers win if Bug has wound tokens equal to its starting HP; Bug wins if all Troopers are destroyed.
- Every pair of students plays one game to understand it
- Then the real exercise: flip the sheet over to do "the sequel." Now the student pairs must set five variables (attack strength for each, starting number of troopers and HP, and who goes first) to try and achieve the two balance challenges. They should do one at a time, and keep track of their design decisions and the outcome in the provided blank spaces.
- 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

- Have two students play Mancala in the middle of the room as other students watch, and you explain to them how to play. Don't provide written rules! Your explanation and watching the two players are the only guides to what's going on.
- If you don't know Mancala well, try playing the game before class and maybe keep these rules handy: Mancala_Instructions.pdf (The sets in the library have instructions too, of course.)
- After the demonstration of Mancala is done, put students in pairs right away (don't pair the two demo players together). These pairs have one task: write up the rules of Mancala as clearly and concisely as possible. They should think about:
  - How to organize or "chunk" the information. What kinds of rules are there?
  - Redundancy (sometimes it helps to repeat an idea) vs. Brevity (simple and easy to understand)
  - Visual explanations can make understanding quicker and easier – is there something worth visualizing in Mancala? (If you're short on time, maybe skip the suggestion to visualize.)
- Each pair should write their rules up in a Google Doc, and put the doc inside of the shared Google Drive folder that you set up before class (or just create a new doc inside that folder!)
- This way, you can easily show all the rules and compare them. How are the approaches different? Are there aspects of the game that some pairs left out, included, or led with at the beginning? What are advantages and disadvantages of these approaches? How are the rules organized into sections?

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. They should play this game ASAP as initial research.
  - 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, Class 2 (at end of last unit) to be discussed in Week 3, Class 2 (Probability and Feedback)

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)

Assigned Week 3, Class 2 to be discussed in Week 4, Class 1 (Writing Rules)

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)

- "Writing Precise Rules" by Mike Selinker
- "Design Intuitively" by Rob Daviau (clarity of materials, themes, naming etc that aid in comprehension, beyond just writing clear rules)