CMPM 147

Lecture 1: Making and Growing
Accessibility

Any student who thinks s/he is in need of accommodation, based on the impact of a disability, should contact me privately to submit their Accommodation Authorization and discuss specific needs, preferably within the first two weeks of the quarter. Please contact the Disability Resource Center at 831-459-2089 in room 125 Hahn Student Services or by e-mail at drc@ucsc.edu to coordinate those accommodations.
Kate Compton

- kcompton@soe.ucsc.edu
- Office: E2 393, office hours Mon. 2:30-3:30 or by appt.
- Kresge College Room 319, MWF,12:30-1:45pm
- www.galaxykate.com
Part 1: a story

[Arthur] Are you telling me you originally made the Earth?

[Slartibartfast] Oh, yes. did you ever go to a place ...? I think it was called Norway.

[Arthur] No, I didn't.

[Slartibartfast] Pity. That was one of mine. Won an award, you know. Lovely crinkly edges. I was most upset to hear of its destruction.
Fascinating trade. Doing the coastlines are always my favourite. Used to have endless fun doing all the little fiddly bits round fjords.
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How do you make a game?
Concept art -> assets -> game
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Concept art -> assets -> game
Traditional asset creation

Concept

Assets

Product
Generative asset creation

Concept

Components

Process

Scripts

Iteration

Concept?

Product?

gameplay constraint failure

oh no
Generative asset creation

Understand process

Implement process

Build an experience plays with the process

Make new genres

Minecraft
Happy Action Theater
Galactic Arms Race
Nervous System
Treachery of Sanctuary
Proteus

‘Difficulty’ and ‘challenge’ become complicated
THE PROCESS MUST COME FIRST
Making vs Growing

“Things which are made, such as houses, furniture, and machines, are an assemblage of parts put together, or shaped, like sculpture, from the outside inwards. But things which grow shape themselves from within outwards. They are not assemblages of originally distinct parts; they partition themselves, elaborating their own structure from the whole to the parts, from the simple to the complex.”
“In other words, the original simple form, say of a living cell in the womb, progressively complicates itself, and that's the growing process, and it's quite different from the making process.

It's all process; it isn't 'stuff' on the one hand and 'form' on the other. It's just pattern-- life is pattern. It is a dance of energy.”
“Look, here is a tree in the garden and every summer is produces apples, and we call it an apple tree because the tree "apples." That's what it does. Alright, now here is a solar system inside a galaxy, and one of the peculiarities of this solar system is that at least on the planet earth, the thing peoples! In just the same way that an apple tree apples!”
“Process” is an aesthetic experience

“Horse and Rider”
Leonardo da Vinci
We enjoy puzzling out the ‘story’ behind art, even when we don’t know exactly what it is.

Doré’s “Saltimbanques”
What process made these?
What process made these?

Fungi

NASA wind map

Digital art by Istvan
What process made these?
How do we read process?
What process made this?
Leaving Clues

Why does this look so fake?
Leaving Clues
Made or grown?
Made or grown?

Zebrwood marquetry by Matt Bell

Seashell art by Blott Key-Wilson

Beetle shell embroidery
Made or grown?

Xenophoridae

the “shell-collecting shell”
Process on top of process
Process on top of process

Dwarf Fortress

Minecraft
Generative Art

Generated insects by Istvan
Generative Methods

Look outside of “Procedural Content”

Generative art

Generative music

Parametric Architecture

Natural processes

Industrial manufacturing

for more info, read “Generative Methods” Compton, Osborn, Mateas
Schedule

- **Mondays**: Homework/projects due, present in class
- **Wednesdays**: Lecture or tutorial
- **Friday**: Readings due, in-class discussion
Schedule

**Monday:** YOU ARE HERE

**Wednesday:** in-class activity, “Rules and Starting Conditions”

**Friday:** class discussion

Reading due Friday (finish reading responses 1 hour before class)

Chapter 1 of “The Self-Made Tapestry” (Phillip Ball)
Chapter 1 of “Generative Art” (Pearson)

Next week: Nature of Code
**Week 1: Rules and Generativity**
We start with in-class physical activities (modular origami, Vi Hart’s flower generation algorithm) to explore the idea that simple rules, when repeated, can create the complex structures we see in physics, biology, and society. Students learn that rules, starting conditions, and iterations all influence the finished product of a generative system. Students read about patterns in nature, and how they often share similar generative algorithms, and identify new patterns in nature and form hypotheses about what algorithms might have created them.

**Week 2: Repetition and Loops**
Students learn basic drawing with Processing (using transforms), and how to create shapes and animations on screen. We explore how overlapping and repeating forms creates complexity and juxtaposition, and how that can be used in aesthetic pursuits. HW: drawing generative shapes with Processing.

**Week 3: Interaction**
How do you respond to user input in a way that makes the user feel “more powerful” and more skillful than they actually are? Students apply knowledge of Processing drawing tools to build a “living-paintbrush” that draws complicated shapes
Week 4: Textures and grids
Simulating physical processes with grids. Students learn the ways arrays and grids are used in games and science simulations, and can represent the generation of patterns in animal skins and natural predator-prey distributions. We discuss the use of Perlin noise, and how it can be used as a starting seed for generative systems. Students create artificial ‘life’ that can access nearby cells to create reaction diffusion or Game Of Life simulations.

Week 5: Grammars and recursion
We discuss randomness and unpredictability as an aesthetic tool, and explore how recursive programming can generate random content that still has structure. We explore the basic concept of grammars using Tracery (a grammar-based storytelling tool). Students make story grammars to understand the balance between variation and control.

Week 6: Branching L-systems
Grammars also provide a robust way to model spatial phenomena, like trees and houses. We read and discuss the use of grammars to describe cities and trees. Students practice using Context Free Art.

Week 7: Fractals
In-class activity: making paper fractal Heighway dragons, and other pen-and-paper fractals to demystify what fractals are. Discuss self similarity and how that relates to recursion. Open ended assignment include making Peano curves and fractal terrain in Processing (or Context Free Art). STUDENTS PROPOSE FINAL PROJECTS

Schedule
Week 8: “Intelligent” Agents
Learning and review the basics of 2D vector math, and how it supports physical simulations by representing momentum and movement. Students learn to simulate ‘forces’ and move ‘agents’, and learn how that movement can be used to create ‘character’, by examining and reproducing famous agent-based systems like Boids flocks and Braitenberg vehicles.

Week 9: Evolution
Explore how other scientists/developers have used generativity to create evolutionary algorithms to design images and robots and vehicles. Compare supervised and unsupervised evolutionary algorithms, and techniques to involve human users in an evolutionary system.

Week 10: Constraints and Evaluations
How do we know whether a generative system is successful? How would you demonstrate the success of a generative system you had built, in a scientific paper or in a presentation? We will read about and discuss contemporary research in constraint solvers, and how this type of software can make generative solutions to fulfill real-world constraints. We will also read and discuss the latest approaches to evaluating generative systems.

Week 11: Final
Final project presentations.
Schedule

Monday: YOU ARE HERE

Wednesday: in-class activity, “Rules and Starting Conditions”

Friday: class discussion

Reading due Friday (finish reading responses 1 hour before class)

Chapter 1 of “The Self-Made Tapestry” (Phillip Ball)
Chapter 1 of “Generative Art” (Pearson)
Readings

**Some online articles** (academic and industry)

**Some playable artifacts** (web based, make sure you can run OpenGL)

**Nature of Code** by Daniel Shiffman (available from amazon or pay-what-you-want PDF)

Optional, recommended JS guides:

- *Javascript: the Good Parts*, Douglas Crockford
- *Javascript Patterns*, Stoyan Stefanov
- *Secrets of the Javascript Ninja*, John Resig
Grading

• 10% class participation

• 20% HW practice exercises and reading responses - graded based on completion

• 40% Assignments (3 Generations, Living Paintbrush, Story grammar, Context Free Art) - graded based on generativity, artistic merit, explanation, etc.

• 30% Final project

  • Proposal: 5%

  • Finished Work (due before finals): 15%

  • In-class presentation (during finals block): 10%

Late Work: 1 week extension, 20% off, and you still have to present it in class
Honor code

- This is not a class about how well you can code

- This is a class about how to think about processes, and how well you can use processes to build neat stuff. So do your own writing and think your own thoughts. Participate in discussion.

- Learn from each others code, and learn from online code online, but write your own because no-one has built the stuff you want to build.

- Document the assistance that you receive. Getting help is fine, but pretending you didn’t isn’t.
Class expectations

HW and Projects (submit to google drive)

- **Video**: 5-20 seconds, Giphy or other easy capture to mp4 (or youtube, etc)
- **Source and working version**
- **3 paragraph writeup (projects only)**
  - *(Goal): Practice explaining your work, and document how concept changes with implementation*
  - **Plan of attack**: one paragraph before you start, explaining your intentions and how you intend to build them.
  - **Post mortem**: one paragraph about how that worked out, and what you ended up with, and the modification and new directions that you took during the process
  - **Acknowledgements**: one paragraph to list any outside assistance, code snippets, library use, etc
  - Avoid software development kvetching *except* when explaining how it evolved your design
Class expectations

Reading response and discussion
20-40p of reading a week

Reading response
(borrowed from Jim’s 265 class)
* 1-2 paragraphs summarizing the main point(s) of the article.
* 1-2 paragraphs describing one of the following:
  • Something you found inspirational
  • A research question (or questions) the article suggests
  • Ways you could apply the technique
  • Aspects you liked/disliked about the article (please do *not* focus on the writing)
Class expectations

My promise to you:

I will never ask you to do anything that I don’t genuinely believe to be educational and a valuable use of your time.

My request of you

Do not turn in work that you don’t genuinely believe to be a good use of my time, your classmates time, and your time.

All you have is your time. If you feel like you’re wasting it, come see me.
Survey time!