Bilkent University
COMMUNICATION AND DESIGN

CS 155 INTERACTIVE MEDIA DESIGN & DEVELOPMENT

FALL 2022

Instructor

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FINAL

Choose one of the following projects:

Project A: Generative Landscape

"Write a program that presents an ever-changing, imaginative "landscape." Populate your landscape with features that are suitable for your concept: trees, buildings, vehicles, animals, people, food items, body parts, hairs, seaweed, space junk, zombies, etc.

Give consideration to the depth of variation in your landscape: after how much time does your landscape become predictable? How might you forestall this as long as possible? How can you generate a landscape that is both coherent and engaging?

Consider: foreground, middle-ground, and background "layers"; variation at the macro-scale, meso-scale, and micro-scale; natural and human-made features; utopia, dystopia, and heterotopia; the immersive use of motion parallax; and the potential for surprise through the placement of infrequent features."

Excerpt From: Code as Creative Medium by Golan Levin, https://itunes.apple.com/WebObjects/MZStore.woa/wa/viewBook?id=0

The project will be graded based on your technical and visual creativity (each 50%).

Submit a .zip file (lastname.zip) containing all your files.

or

Project B: Virtual Creature

"Your job, Dr. Frankenstein, is to create new life. Program a species of virtual organism: it could be a sensate creature, a dynamic flock or swarm, an artificial cell-culture, a novel plant, or an ecosystem. Your software should algorithmically generate the form and behavior of your new lifeform(s). Will they be able to sleep, reproduce, die, or eat one another? Consider the relationships between the individuals in your species and develop a corresponding interplay of simulated forces such as attraction or avoidance. Your creature may benefit from inhabiting an ecosystem or environment with abiotic elements that present additional constraints or opportunities."

"Give consideration to the potential for your creature to operate as a cultural artifact. Can it attain special relevance through metaphor or commentary or by addressing a real human need or interest?"

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The project will be graded based on your technical and visual creativity (50% each).

Submit a .zip file (lastname.zip) containing all your files.

Deadline: 26/12/2022 23:59

Regarding assignments and Moodle

Before each critic session the assignments are uploaded in Moodle regularly as seen below:

Projects given in section 01 and section 02 are due on Moodle until each Monday 23:59.

The works should be uploaded before the deadline. If not, the student will receive an F or 0 points.

Each project should be labelled in a certain way -the size of the projects and the quality of the images should meet the requirements.

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Generative Landscape

Generative Landscape
World-making and terraforming

Brief

Write a program that presents an ever-changing, imaginative "landscape." Populate your landscape with features that are suitable for your concept: trees, buildings, vehicles, animals, people, food items, body parts, hairs, seaweed, space junk, zombies, etc.

Give consideration to the depth of variation in your landscape: after how much time does your landscape become predictable? How might you forestall this as long as possible? How can you generate a landscape that is both coherent and engaging?

Consider: foreground, middle-ground, and background "layers"; variation at the macro-scale, meso-scale, and micro-scale; natural and human-made features; utopia, dystopia, and heterotopia; the immersive use of motion parallax; and the potential for surprise through the placement of infrequent features.

Learning Objectives

- Apply principles of generative design to terrain, scenery, and worlds of the imagination
- Bias randomness to carefully regulate probabilities
- Carry out a metadesign process

Variations

- Populate your landscape with one or more of the "three verticals" (people, trees, and buildings): according to Jungian psychology, these are the defining psychological features of landscapes.
- Pay attention to the manner in which the landscape moves past the "camera." For example, it might appear to scroll by (as if you were looking out the window of a train); or approach from a first-person point of view (as if you were driving, or riding a roller coaster), or slide underneath (as if you were looking out of a glass-bottomed airplane). Consider a moving or even roving camera, capable of rotation as well as translation.
- Depict an outside scene, an interior one (such as objects on a conveyor belt), or an altogether dreamlike one.
- Experiment with 3D (as in noise terrains); 2D (as in side-scrolling video games); "2.5D" layered spaces; orthographic views; or even nonlinear, non-Cartesian geometries.
- Give consideration to sound and the possibility for audiovisual synchronicities (as in *Guitar Hero*).
- Make an autonomous creature, vehicle, or other character traverse your landscape.
- Implement features in your landscape that grow, evolve, or erode over time.

Making It Meaningful

We are a migrant species, instilled with a wanderlust that continually clamors for new horizons. Before the modern era of mobility, landscape paintings were often the primary means by which people could visualize faraway lands and mentally escape to them. Today, eight-year-olds trade "seeds" for favored Minecraft worlds, and procedurally generated environments have become commonplace in video games, where the algorithmic production of novel landscapes is an economic necessity for inexhaustible play. For the meta-designer and artist-programmer, there is assuredly something godlike about calling forth world upon world. It is probably not a coincidence that the first all-CGI sequence in a feature film depicted the synthesis of an entire planet, in the triumphant "Genesis Sequence" of *Star Trek II* (1982).

Generative design systems, whether used to create faces, landscapes, creatures, or chairs, define seemingly infinite possibility spaces. Pay heed, however, to what Kate Compton calls the "10,000 Bowls of Oatmeal Problem": "I can easily generate 10,000 bowls of plain oatmeal, with each oat being in a different position and different orientation, and mathematically speaking they will all be completely unique. But the user will likely just see a lot of oatmeal."[i] As Compton indicates, the challenge and opportunity of meta-design is in architecting systems whose results offer *perceptual uniqueness*, and are thus meaningfully distinct.

This assignment asks you to bring forth a world from your imagination. Alternatively, you may create an accurate computational representation of a very real place—and generate "more" of it.

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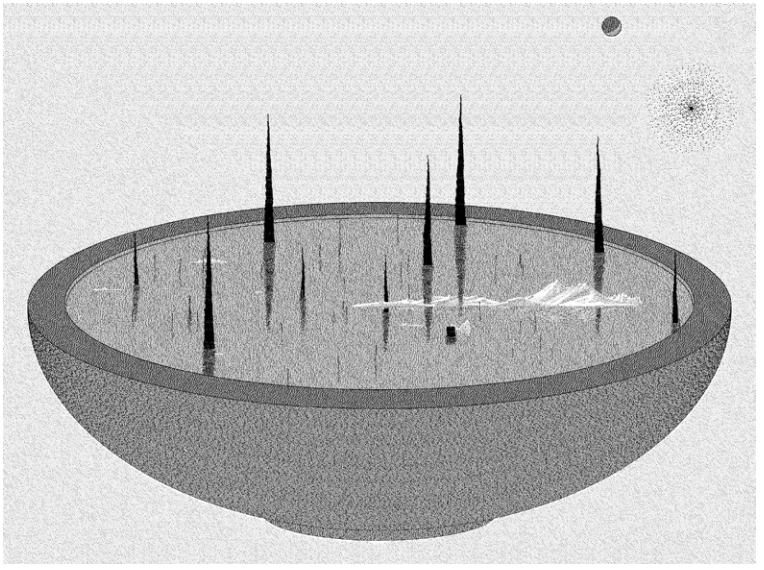

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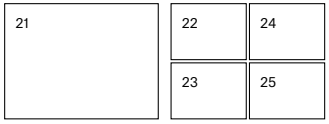

Captions

21. Daniel Brown generates dystopian housing projects in his beautifully lit fractal series, *Travelling by Numbers* (2016).

22. Kristyn Janae Solie's *Lonely Planets* (2013) is a stylized 3D terrain that shifts between minimalism and psychedelia. The work was created for Casey Reas's undergraduate course, Live Cinema through Creative Coding.

23. "Fractional noise" mountains (c. 1982), developed by Benoît Mandelbrot and Richard F. Voss at IBM, were a landmark in mathematical terrain synthesis.

24. Everest Pipkin generates barren flowerpot landscapes in *Mirror Lake* (2015), a poetic and mysterious browser experience.

25. In Jared Tarbell's classic *Substrate* (2003), simulated urban tectonics arise from elementary principles of accretion, branching, and feedback.

Additional Projects

Memo Akten and Daniel Berio, *Bozork Quest*, 2013, scene generated with a fragment shader.

Tom Beddard, *Surface Detail*, 2011, evolving fractal landscape.

Tom Betts, *British Countryside Generator*, 2014, procedural world engine.

Ian Cheng, *Emissaries*, 2015–2017, trilogy of evolving animated worlds.

Char Davies, *Osmose*, 1995, interactive VR.

Field.io, *Interim Camp*, 2009, generative software and film.

Simon Geilfus, *Muon glNext*, 2014, landscape generation software.

Chaim Gingold, *Earth: A Primer*, 2015, interactive book app.

Beatrice Glow, *Mannahatta VR: Envisioning Lenapeway*, 2016, immersive visualization.

Michel Gondry, *Chemical Brothers "Star Guitar,"* 2003, video clip.

Vi Hart et al., *Float*, 2015, virtual reality game.

Hello Games, *No Man's Sky*, 2016, multiplayer video game.

Robert Hodgin, *Audio-Generated Landscape*, 2008, audio-generated landscape system.

Robert Hodgin, *Meander*, 2020, procedural map generator.

Anders Hoff, *Isopleth*, 2015, virtual landscape generator.

Joanie Lemercier, *La Montagne*, 2016–2018, digital print on paper and projection.

Jon McCormack, *Morphogenesis Series*, 2001–2004, computer model and prints on photo media.

Joe McKay, *Sunset Solitaire*, 2007, software projection and performance.

Vera Molnár, *Variations St. Victoire*, 1989–1996, silkscreen prints on canvas.

Anastasia Opara, *Procedural Lake Village*, 2017, generative 3D landscape.

Paolo Pedercini and Everest Pipkin, *Lichenia*, 2019, city building game.

Planetside Software, *Terragen*, 2008, scenery generator software.

Davide Quayola, *Pleasant Places*, 2015, digital paintings.

Jonathan Zawada, *Over Time*, 2011, 3D models and oil on canvas.

Readings

Kate Compton, Joseph C. Osborn, and Michael Mateas, "Generative Methods" (paper presented at 4th Workshop on Procedural Content Generation in Games, Chania, Greece, May 2013).

Ian Cheng, "Worlding Raga: 2—What Is a World?" *Ribbonfarm, Constructions in Magical Thinking* (blog), March 5, 2019.

Philip Galanter, "Generative Art Theory," in *A Companion to Digital Art*, ed. Christiane Paul (Hoboken, NJ: John Wiley & Sons, Inc., 2016), 146–175.

Robert Hodgin, "Default Title, Double Click to Edit" (lecture, Eyeo Festival, Minneapolis, MN, June 2014).

Jon McCormack et al., "Ten Questions Concerning Generative Computer Art," *Leonardo* 47, no. 2 (April 2014): 135–141.

Paolo Pedercini, "SimCities and SimCrises" (lecture, 1st International City Gaming Conference, Rotterdam, Netherlands, 2017).

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Virtual Creature

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Virtual Creature
Creating artificial life

Brief

Your job, Dr. Frankenstein, is to create new life. Program a species of virtual organism: it could be a sensate creature, a dynamic flock or swarm, an artificial cell-culture, a novel plant, or an ecosystem. Your software should algorithmically generate the form and behavior of your new lifeform(s). Will they be able to sleep, reproduce, die, or eat one another? Consider the relationships between the individuals in your species and develop a corresponding interplay of simulated forces such as attraction or avoidance. Your creature may benefit from inhabiting an ecosystem or environment with abiotic elements that present additional constraints or opportunities.

Give consideration to the potential for your creature to operate as a cultural artifact. Can it attain special relevance through metaphor or commentary or by addressing a real human need or interest?

Learning Objectives

- Review, discuss, and write functions to animate different types of organic motion
- Design and implement programs using an object-oriented programming approach
- Program an interaction between objects

Variations

- Create an ecosystem containing a pair or "dyad" of creatures that respond to each other in some way: predator/prey, symbionts, etc.
- Program your creature so that its appearance arises from its behaviors, or vice versa. For example, consider how an amoeba's pseudopod is both the visual boundary of its body and also the expression of a tropism. Perhaps the form of your creature's body emerges from an underlying particle simulation, ragdoll physics, or reinforcement learning system.
- Write object-oriented code to encapsulate your species of creature. Exchange your code with other students whose creatures implement the same protocols (eat, sleep, forage, etc.). Collect at least two other species and combine them in an ecosystem. *This variation can be executed using a versioning tool such as GitHub, spurring insights into collaborative software development and the importance of code comments.*
- Present your digital ecosystem as an augmented projection, siting it on a specific surface. Can your (virtual) lifeforms respond to the physical characteristics of your (real) chosen location?

Making It Meaningful

As the myths of Pygmalion, Golem, and Frankenstein show, the god-like desire to create artificial life (AL) persists throughout our folklore. This impulse also underlies the history of robotics, where gestures are mechanically automated in the *Karikuri* of Japan and in the early automata of Europe, like Turriano's "Praying Monk" (c. 1560) or de Vaucanson's "Defecating Duck" (1738). With computers, software simulations of life systems allow behaviors and interactions to be programmed and scaled across massive multiagent systems. Many of these systems exhibit *emergence,* where self-regulation, apparent intelligence, and coordinated behaviors arise from simple rules followed by many actors.

Whether the medium is hardware or software, the goal of AL is to create the impression that an engineered system is *alive*. Unlike the creative work of "character design," where the focus is on visual appearance, this assignment is concerned with the construction of a creature with responsive, dynamic behaviors that are contingent on environmental interactions. To emphasize this, an instructor may challenge students to instill lifelike behavior in creatures whose bodies are restricted to ultra-minimal forms, such as a pair of rectangles.

A creature without a context is boring—with nothing to do, and no one to do it to. Stories happen, character is perceived, meanings are made when an agent operates on or within an environment that likewise acts on it. By placing a creature into feedback with external forces or subjects, and especially with the actions of an interacting user, we can create companions that stave off loneliness or appear to have feelings, virtual pets like the Tamagotchi that evoke empathy through their fragility, or sublime simulated ecosystems that evolve in surprising ways.

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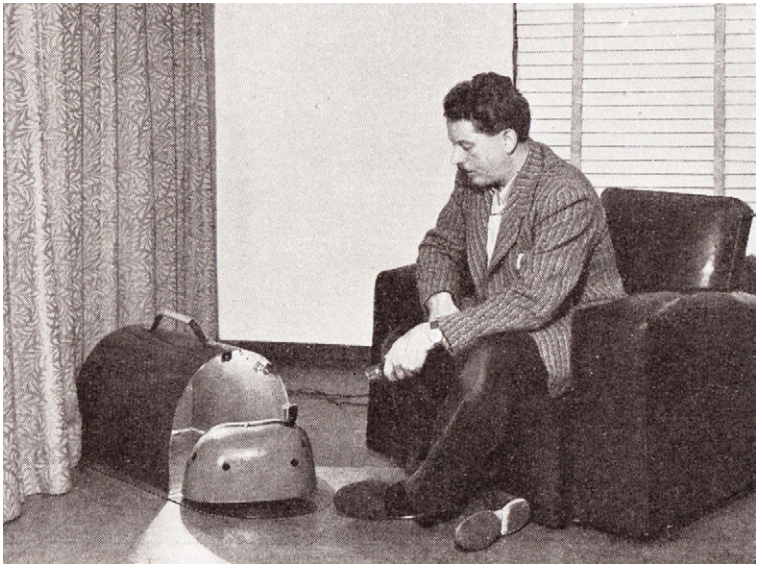

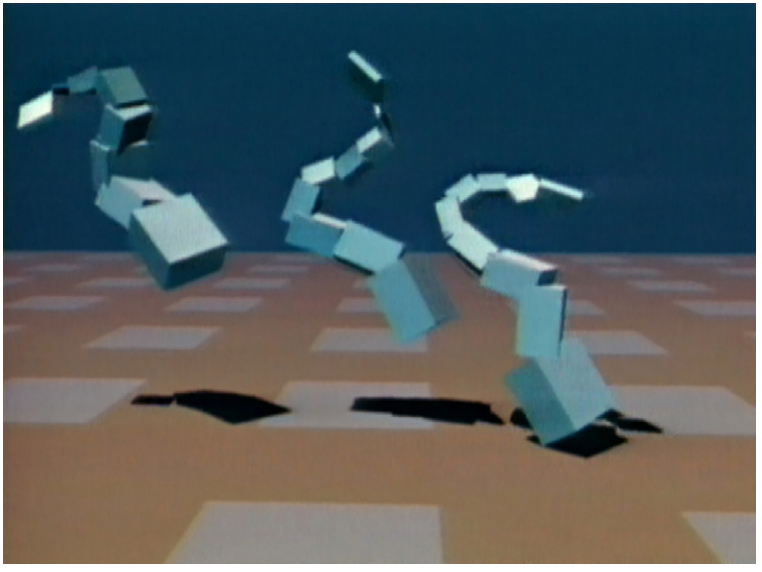

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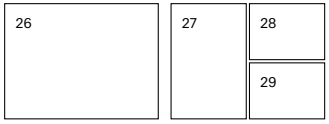

Captions

26. Brent Watanabe's *San Andreas Streaming Deer Cam* (2015–2016) is a live video stream from a computer running a modified version of *Grand Theft Auto V*. The artist's mod creates an autonomous deer and follows it as it wanders through a fictional city, interacting with its surroundings and the game's AI characters. During one of its streaming episodes, the deer wandered along a moonlit beach, caused a traffic jam on a major freeway, got caught in a gangland gun battle, and was chased by the police.

27. *Connected Worlds* (2015) by Design IO (Theo Watson and Emily Gobeille) is a large-scale interactive installation developed for New York's Great Hall of Science. The work presents six immersive habitats, projected across both walls and floors, that allow visitors to interact with simulated water flows and learn about the role of the water cycle in different ecosystems. Watson and Gobeille devised dozens of responsive creature species to populate the space.

28. Neurophysiologist William Grey Walter's "tortoises" of 1948–1949 were early electronic robots capable of phototaxis and object avoidance.

29. Karl Sims's *Evolved Virtual Creatures* (1994) presents simulated creatures that evolve charming and idiosyncratic methods of locomotion using genetic algorithms.

Additional Projects

Ian Cheng, *Bob (Bag of Beliefs)*, 2018–2019, animations of evolving artificial lifeforms.

James Conway, *Game of Life,* 1970, cellular automaton.

Sofia Crespo, *Neural Zoo*, 2018, creatures generated with neural nets.

Wim Delvoye, *Cloaca*, 2000–2007, large-scale digestion machine.

Ulrike Gabriel, *Terrain 01*, 1993, photoresponsive robotic installation.

Alexandra Daisy Ginsberg. *The Substitute*, 2019, video installation and animation.

Edward Ihnatowicz, *Senster*, 1970, interactive robotic sculpture.

William Latham, *Mutator C*, 1993, generated 3D renderings.

Golan Levin et al., *Single Cell* and *Double Cell*, 2001–2002, online bestiary.

Jon McCormack, *Morphogenesis Series*, 2002, computer model and prints on photo media.

Brandon Morse, *A Confidence of Vertices*, 2008, generated animation.

Adrià Navarro, *Generative Play*, 2013, generated characters and card game.

Jane Prophet and Gordon Selley, *TechnoSphere*, 1995–2002, online environment and generative design tool.

Matt Pyke (Universal Everything), *Nokia Friends*, 2008, generative squishy characters.

Susana Soares, *Upflanze*, 2014, hypothetical plant archetypes.

Christa Sommerer and Laurent Mignonneau, *A-Volve*, 1994–1995, interactive installation.

Christa Sommerer and Laurent Mignonneau, *Lifewriter*, 2006, interactive installation.

Francis Tseng and Fei Liu, *Humans of Simulated New York*, 2016, participatory economic simulation.

Juanelo Turriano, *Automaton of a Friar*, c. 1560, Smithsonian Institution, National Museum of American History.

Jacques de Vaucanson, *Canard Digérateur*, 1739, automaton in the form of a duck.

Lukas Vojir, *Processing Monsters*, 2008–2010, online bestiary.

Will Wright and Chaim Gingold et al., *Spore Creature Creator,* 2002–2008, creature construction software.

Readings

Jean Baudrillard, *Simulacra and Simulation* (Ann Arbor: University of Michigan Press, 1994).

Valentino Braitenberg, *Vehicles: Experiments in Synthetic Psychology* (Cambridge, MA: MIT Press, 1984).

Bert Wang-Chak Chan, "Lenia: Biology of Artificial Life," *Complex Systems* 28, no. 3 (2019), 251–286.

Ian Cheng et al., *Emissaries Guide to Worlding* (London: Koenig Books, 2018).

Craig W. Reynolds, "Steering Behaviors For Autonomous Characters," *Proceedings of the Game Developers Conference* (1999), 763–782.

Daniel Shiffman, *The Nature of Code: Simulating Natural Systems with Processing* (self-pub., 2012).

Mitchell Whitelaw, *Metacreation: Art and Artificial Life* (Cambridge, MA: MIT Press, 2006).

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