Foundations of Generative Art Systems - a hybrid survey and studio class for graduate students

Philip Galanter, BA, MFA
Interactive Telecommunications Program, New York University, New York, USA.
e-mail: galanter@nyu.edu.

Abstract

The Interactive Telecommunications Program is a well known professional master's program for artists interested in new media, and is part of the Tisch School of the Arts...informally known as the "NYU Film School". ITP graduates are very much in demand, and can be found in creative leadership positions throughout the multimedia industry.

For two years the author has taught a class exclusively focused on generative art. This talk will outline the structure of the class, discuss the challenges and rewards of teaching such an eclectic and interdisciplinary mix of topics, and show examples of student work.

1. About this paper

In the context of the conference this talk is an informal field report, and correspondingly this paper provides a casual content overview for practitioners in the field rather than a formal analysis from the point of view of instructional research.

2. Catalog Description

The content of the class is best summarized by the official catalog description:

“Foundations of Generative Art Systems

This interdisciplinary class provides students with a broad overview of topics and techniques, which contribute to the theory, and practice of what may be called "generative art." While visual works are the primary concern, the class also includes generative techniques for, and examples of, music, installation, performance, and other forms. Early generative applications in minimal, conceptual, Fluxus, and other art movements are quickly covered, followed by an

introduction to techniques from the new science of complexity including; chaos, cellular automata and Conway's game of life, genetic algorithms, neural networks, reaction-diffusion systems, fractals, artificial life and L-Systems.

Each topic is presented with an emphasis on the qualitative and conceptual, and as a module of both artistic interest and utility. Having thus set the stage, each student will then select a personal direction for deeper study via creative projects. For projects, most will choose to use a computer-based tool, but no particular programming experience or practice is expected. Alternatives can include media environments such as Director/Lingo or Max, simulation environments such as StarLogoT or Matlab, and languages such as Java or c. In addition, some students may choose to explore analog electronic, mechanical, chemical, conceptual, or other alternatives. Along with in class discussion and critique sessions, students can expect to undertake a few small directed projects, a take-home topical mid-term exam, and a final creative project. “

3. Program Context

The Interactive Telecommunications Program (ITP) is described in official announcements as follows:

“A pioneering graduate center for the study and design of new communications media forms and applications, ITP is internationally recognized as a unique and vital contributor of new ideas and talented individuals to the emerging professional world of multimedia and telecommunications. The program is guided by a hands-on approach to learning that relies on collaboration rather than competition in an environment where exploration, analysis, risk and failure can freely occur. Emphasizing the user's creativity rather than the machine, the program challenges students to combine ideas and the tools of computers, video, sound, graphics, animation, and text in new and imaginative ways.

ITP's goal is to train a new kind of professional: one whose understanding of technology is informed by a strong sense of aesthetics and ethics. Graduate students come from a rich mix of disciplines, cultures and experiences. They enter with backgrounds in such diverse fields as music composition, sculpture, writing, biology, library science, law, cultural theory, architecture, dance and computer science. Men and women are equally represented, as are

cultures from Eastern Europe to East Asia, from South America to Canada and several regions of the United States."

It is worth emphasizing that ITP students tend to come from extremely diverse backgrounds and it is difficult to make any assumptions about their technical or creative background. Some may be painters who have virtually never used computers at all. Some may be experienced industrial programmers who are still shy about calling themselves artists. Some may be business people while others may be scriptwriters or dancers. And, of course, some are already accomplished new media artists.

3.1 Program Requirements

The Program takes 2 years to complete, and all students are expected to commit to the program on a full-time basis. There are few required courses, but first year students take the following foundation set of classes. Interestingly over the past few years the emphasis has moved from tightly focusing on web and other screen based forms to including the design and construction of embedded systems referred to as "physical computing" within the program. This evolution is now reflected in the first semester foundation courses.

• Introduction to Computational Media primarily covers screen-based interactivity via hands-on assignments using Macromedia Director and programming in Lingo.

• Introduction to Physical Computing focuses on the design and construction of objects and installations with embedded processors. Students execute hands-on projects using the Basic Stamp processor and alternate input such as proximity, sound, light, and temperature detection.

• Elements of Visual Language provides students with a broad introduction to, and an opportunity to exercise, the elements of design as applied to computer media.

• Communications Lab primarily students with hands-on experience for a broad number of technologies including video, audio, online communities, authoring environments, and the World Wide Web, as well as readings and lectures in human factors, media, and critical theory.

• Applications of Interactive Technonologies engages the entire first year class in a series of lectures by leaders in the artistic, non-profit, and commercial new media sectors. Via

discussions led by the Program founder and Department Chair Red Burns, this class helps shape and maintain the unique culture and collaborative tradition of the department.

3.2 Program Electives

Students are encouraged to set their own goals and to pursue their own visions within the broad palette of creative, technical, and critical classes offered by the department. Electives are divided between workshops, which tend to be hands-on technical or art studio classes, and seminars, which tend to be theory and criticism based classes.

Workshops include classes such as CGI Programming with Perl, Live Video Workshop, Multi-User Experience, Digital Sound Lab, Expressing With Technology, Game Design, Dynamic Data on the Web, Video Art, Digital Sound Workshop/MIDI, Interactive Computing in Public Places, Interaction Design, Web Development with Dynamic Objects, Introduction to 3D, Programming for Non-Programmers, Programming for Programmers, Experimental Digital Video, Physical Computing II , Virtual Spaces, and more.

Seminars include classes such as New Media & Interpersonal Behaviour, Social Applications of Internet Technology, Interactive Applications for Collaboration and Learning, Starting a Company, Information Contours, Applications of Terrestrial Wireless Systems, Storytelling in the Age of Digital Technology, Media & Society: The Battle for Cyberspace, Images and the Information Age, Semiotics: The Crisis of Absolutism and the Rise of Relativism, Interactivity and Children, and more.

3.3 Final Projects

As a requirement for graduation students must complete a final project of significant technical and creative sophistication. Students do this formally within a single 4 credit course. As a practical matter, however, students can work on their final project within the context of their other workshop classes as well. While ITP is not a terminal MFA (Master of Fine Arts) degree program, but rather a professional Master Degree program, the final projects are typically of very high quality.

4. Foundations of Generative Art Systems

The class Foundations of Generative Art Systems was designed with the following goals in mind.

• To establish Generative Art as a theme that predates and is not restricted to computer art.

• To provide historical, theoretical, and critical perspectives along with purely technical information. In other words, to teach both the "how" and "why" of generative art.

• To present generative techniques as algorithms independent of any particular computer programming environment.

• To present the class in such a way that both novice and experienced programmers will feel the materials are both challenging and within reach.

• To structure the class in such a way that complexity science is presented as a significant subtext, and an indication of the direction that generative art may take in the future.

4.1 Readings

The class primarily uses 4 books:

Istvan Hargittai and Magdolna Hargittai. (1994). Symmetry: a unifying concept. California, Shelter Publications.

Casti, John L. (1994). Complexification: explaining a paradoxical world through the science of surprise. New York, HarperCollins.

Stewart, I. (1998). Life's Other Secret: the new mathematics of the living world. New York, John Wiley.

Flake, Gary William (1998). The Computational Beauty of Nature. Cambridge MA, MIT Press.

The Hargittai book is a wonderfully illustrated introduction to symmetry operations and tiling. In combination the Casti and Stewart books provide a useful qualitative introduction to all manner of complexity related topics such as fractals, chaos, cellular automata. The Flake book covers many of the same materials, but at the detailed level required for software

implementation, and is supplemented with online code examples and Java applets at a website designed to accompany the book.

Additional assigned and optional readings include excerpts from Aaron's Code by McCorduck, "Paragraphs on Conceptual Art" by Sol Lewitt, the Scientific American tensegrity article "the Architecture of Life" by Donald Ingber, a document by the artist Paul Hertz documenting his "Ignotus" project, excerpts from Experimental Music by Nyman, and The Language of Mathematics by Devlin, Design by Numbers by John Maeda, Turtles, Termites, and Traffic Jams by Resnick, the classic paper An Experiment in Musical Composition by Brooks, Hopkins, Neumann, and Wright, excerpts from Neural Networks for Statistical Modelling by Smith, and an excerpt from Catastrophe Theory by Zeeman.

Given the breadth of topics there is no intention that the students will acquire in depth mastery of all or even most of the material. The intention is to provide the student with a visceral understanding of where each path leads, allowing them to study further and then implement the one or two or three methods that best contribute to their artistic vision.

4.2 Lectures and Class Interaction

The class meets 14 times for 2.5 hours each session. Lectures are intended to deliver the kernel concepts from the readings, art history and theory yet to be published in the context of generative art, and software presentations demonstrating key methods and concepts.

The chart on the following pages outlines the 14 sessions in terms of content and assignments.

Foundations of Generative Art Systems

	Topic 1	Topic 2	Topic 3	Homework Assignments	
				Creative	Topical
1 09/10	Meet other students & class ground rules	What is Generative Art?	Symmetry and Tiling Part 1		Symmetry - entire book Computational Beauty ch 1
2 09/17	Symmetry and Tiling Part 2	Metacomposition and Basic Generative Methods	Discussion of Topics to date	Project 1 - due in 1 week *tiling and basic methods*	Excerpts by McCorduck, and Lewitt.
3 09/24	Conceptual, Minimal, and Fluxus Art		Short Critiques of Project 1		Excerpts by Devlin, and Nyman.
4 10/01	Chance and Randomness in Art	Probability and Chance Operations	Class exercise project brainstorming	Project 2 - due in 2 weeks *chance and basic methods*	Life's other secret ch 1-4
5 10/08	Genetic Programming Part 1	Genetic Programming Part 2	Class exercise project brainstorming		Complexification ch 6 Computational Beauty ch 15-16
6 10/15	Cellular Automata (& Conway's Life)		Short Critiques of Project 2	Final Project Proposal due in 1 week	Life's other secret ch 5-8

7 10/22	Fractals and L-Systems		Short Critiques of Project 2		Computational Beauty ch 5-9
8 10/29	Individual Appointments			Work on Final Project due at last class meeting	Life's other secret ch 9-12 Computational Beauty ch 18, 19, 22
9 11/05	Neural Networks and Fuzzy Logic		Final project in progress Critiques		Paper by Brooks et al.
10 11/12	Finite State Machines		Final project in progress Critiques		Complexification ch 1-2
11 11/19	Catastrophe Theory		Final project in progress Critiques	Take Home Exercise due in 1 week	Complexification ch 3 Computational Beauty ch 10-14
12 11/26	Artificial Life		Final project in progress Critiques	Work on Final Project due at last class meeting	Complexification ch 7
13 12/3	Chaos & Complexity		Final project in progress Critiques		
14 12/10	Final Projects Show and Tell				

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4.3 Student Projects

The tradition in the Program is that ultimately students prove their worth in their projects, and this tradition is carried forward in this class. Students spend a good deal of time outside of class working on a final project. And in addition to 2 in-class critiques of their works in

progress, each student has a required private meeting with the instructor, as well as office hour visits as needed.

The results of this extremely eclectic class have been very satisfying. Projects have ranged from the purely non-digital and mechanical to the entirely virtual. And just about every technique, medium, and attitude touched upon in the class appearing at least once in student work.

5. Additional Information

The website for this class is available at:

http://www.philipgalanter.com/genartclass

The website includes complete lecture notes, assignments, software sources, an up-to-date bibliography, and more.