

Pandaemonium Architecture - Generative Algorithms, Machine Learning, Modeling and Simulation, and Social Engineering for Artists

Scott Benzel Spring 2020 Revised Syllabus Mondays 4-6:50 via Zoom

'...rituals of reversal... "rewire" the crucial connections in the social structure by providing symbolic statements of traditional social imperatives and basic categories of...world view.'

Evon Z. Vogt, *Rituals of Reversal as a Means of Rewiring Social Structure*

Pandaemonium Architecture was introduced at the 1958 *Mechanisation of Thought Processes* symposium as an early pattern recognition model for AI. Named for the demon-inhabited city in Milton's *Paradise Lost*, the *Pandaemonium Architecture* assemblage employs 'demons' -bits of information or code- that 'scream' in order to ascend a hierarchy of algorithmic hurdles. The metaphorical implications were not lost on the early innovators of AI. Evon Vogt's *Rituals of Reversal as a Means of Rewiring Social Structure* examines the annual Highland Maya Zinacanteco rituals invoking the reversal of social, gender, and even species roles as a means of 'rewiring' the social structure of the community. Contemporary social structures are being radically 'rewired' with ever-increasing speed by largely invisible machine-learning algorithms and predictive processes. Netflix's, Amazon's, and Facebook's algorithms are the best-known examples of an increasingly pervasive methodology quietly remaking society.

This course posits that artists employing machine learning, generative algorithms, predictive models and other technics can make art –employing these tools of what Deleuze labelled ‘*The Societies of Control*’- that is evocative, powerful, critical, and perhaps socially transformative. To this end the course examines the history, development and sociopolitics of Machine Learning and AI, including precomputational wargaming, cybernetics, game theory, neocybernetics, the so-called *Californian Ideology*, *The Silicon Ideology*, et al. The course will examine the history of philosophical thought informing Machine Learning and AI, including the work of the Churchlands, Sellars, Hui, and Negarastani. Critical perspectives including Wark’s *Hacker Manifesto*, Levine's uncovering the roots of the internet in military counterinsurrection, Delanda's examinations of Realist Social Ontology, Assemblage Theory, and Modeling and Simulation, Golumbia and Sandifer's critical analyses of AGI and crypto, Laruelle's opposition to the digital, Roden’s ‘*demontology*’, and Colebrook’s ‘*counterethics*’ will be examined.

AI and ML can be applied to any digital artistic medium, including video, sound, text, still images, and 3d modeling and printing. Further, ML can be 'trained' on almost any digital information, making it a powerful tool in the artist's arsenal. Generative Adversarial Nets, a currently popular form of ML, combine generative and adversarial operations and function as rapidly iterated critique, analogous to artistic critique or hyperspeed natural selection, quickly evolving its objects to high levels of complexity. Predictive Analytics employs game theory, statistical analysis, data analysis, scenario planning, and Modeling and Simulation to create accurate predictive models for different aspects of the future. Social Engineering operates on individuals and masses to 'create' this future. These are the tools of the technocracy. Artists should consider picking them up as well.

Participants in the course will explore and employ basic Artificial Intelligence and Machine Learning, including simple app-based generative and Alife algorithms, online toy AI's like *DeepDream* and *experiments.with.google*, languages like *Core ML* and *SciKit-Learn*, and programs including *GANS (Generative Adversarial Nets)*, *Minimax* and *Maxout* neural networks to make art. The course will explore tactics and strategies employed by the technocracy and hackers including *SE* or Social Engineering, Hypocognition, Obfuscation, and consider ways in which they might be put to use by artists. Labs will demonstrate the use of tools and resources to research and create ML-based artworks and will allow time for participants to focus on Final Projects.

Conceptual skills, computer literacy, and basic programming skills are required. Advanced coding will not be necessary, however, advanced coders are encouraged to participate.

Introductory Readings

Gilles Deleuze, *Postscript on the Societies of Control*

Yuk Hui, from *On the Existence of Digital Objects*

1. January 27 The Varieties of Machine Learning Ensemble Learning, ANNs, Supervised, Unsupervised, and Reinforcement learning, Simple vs. Deep Learning

Pandaemonium Architecture Godel, von Neumann, Turing's "Computing Machinery and Intelligence" and the Imitation Game; "Feedback Mechanisms and Circular Causal Systems in Biological and Social Systems" or The Macy Conferences, Wiener, Shannon, Turing, Bush; the Mechanisation of Thought Processes symposia; Pandaemonium Architecture; the AI Winter, the ML Spring

The Game of Life, CA, Second Order Cybernetics to Neocybernetics Conway's Game of Life, a brief history of alife and CA, Wolfram's *A New Kind of Science*; Second Order Cybernetics, von Foerster, Matarana, Varela, Luhmann, et al.

Sozialeplastik, Neuroplastique, Abstraction and the Hack Beuys, Plastik, Malabou, Neuroplastic, Neuroplastique; Wark, Abstraction and the Hack; Hacking vs. Central Processing

Lab MacOS and iOS-based online generative algorithms: alife, Golly, Wolframtones, Noatiki, Wotja; toy AIs: Muglife, Deepdream, et al. Project: make an alife algorithm using Golly, song using Wolframtones or Wotja, image using Muglife, Deepdream, et al.

Readings

Martin Gardner, *MATHEMATICAL GAMES* The fantastic combinations of John Conway's new solitaire game "life"
McKenzie Wark, from *A hacker manifesto*

Additional Reading/Primary Documents

O.G. Selfridge, *Pandemonium: A Paradigm For Learning*

Stephen Wolfram, from *A New Kind of Science*

Catherine Malabou, from *What should we do with our Brain?*

2. February 3 Why Model? "All models are wrong, but some are useful." George Box
Inference, Prediction, and modelling, Game Theory to Predictive Algorithmics, Modeling and Simulation

A Brief History of Strategy, the Birth of Game Theory, Modeling and Simulation, Prediction
Thucydides, the Melian Dialogue, Sun Tzu, Machiavelli, Napoleon, Clausewitz, Hart, von Neumann, Scenario Planning, Prediction Markets, Implicit vs. Explicit Models, Modelling for Explanation or Prediction, SEAS VIS, PALANTIR, The Noosphere

Simulation and Simulationism Dick, Baudrillard, *Simulacra and Simulation*; *Simulationism in Art*; Bostrom, et al.
Simulation Theory

The Great White Robot God *The Hollerith Tabulator, The Californian Ideology, The Silicon Ideology, Columbia's Great White Robot God, Levine's Surveillance Valley, Sandifer's Basilisk*

Lab arXiv, Github, exploring Online Prediction Markets, exploring SEAS VIS, PALANTIR, et al.; Project: find and summarize a paper on arXiv, make a bet on a Prediction Market, summarize a project on Github

Readings

Joshua M. Epstein, *Why Model?* *Journal of Artificial Societies and Social Simulation*

David Golumbia, *The Great White Robot God*

Additional Reading/Primary Documents

Jean Baudrillard, *The Precession of Simulacra* from *Simulations*

Elizabeth Sandifer, from *Neoreaction, a Basilisk*

3. February 10 Perceptrons and linearly separable problems Minsky, Papert, Scalars, Vectors, Sets, Training, Sorting, Decision Trees, Leaf nodes, Entropy splits

The Varieties of Agents, Subject v. Swarm v. Protean Ooze Roden, Delanda, Realist Social Ontology, Assemblages, Agential Realism

The Varieties of Neural Net: Deep vs. Simple Learning, ANNs, Sigmoid neurons, feedforward neural nets, convolutional nets, recurrent nets, long short-term memory (LSTM) nets, and autoencoders

Lab beginning CoreML, MakeML, DeepNN, exploring Perceptrons

Readings

Minsky and Papert, from *Perceptrons, an Introduction to Perceptual Geometry*
CoreML docs

February 17 NO CLASS, PRESIDENT'S DAY

4. February 24 Eliminative Materialism and the Evolution of Neurophilosophy The Churchlands, Sellars

Sentience, Sapience, Geist Hegel, Brandom, Negarestani, Kanzi, Geist

Digital Philosophy, Digital Physics, Quantum Philosophy Fredkin, Wolfram, Rucker, Deutsch. et al.

Lab experiments.withgoogle, OpenAI gym, beginning SciKit-Learn, et al. Project: make something using an experiments.with.google or OpenAI gym project, explore SciKit-Learn's User Guide

Readings

Reza Negarestani, from *Intelligence and Spirit*

Additional Reading/Primary Documents

Paul M. Churchland, from *Eliminative Materialism and the propositional attitudes*
Edward Fredkin, *Finite Nature*

5. March 2 Minimax/Maxout/Supermax; Analogy and Computation "if you look at the monopolistic firm as an example of a maximum system, you can connect up its structural relations with those that prevail for an entropy-maximizing thermodynamic system...absolute temperature and entropy have to each other the same conjugate or dual relation that the wage rate has to labor or the land rent has to acres of land." Samuelson

The Anasazi model Sugarscape, MaiseScape, 'Life with the Artificial Anasazi'

Gradient descent ML algorithms: Linear and Polynomial Regression, Logistic Regression, k-Nearest Neighbors, Support Vector Machines, Decision Trees, Random Forests, Ensemble methods

Lab explore Maxout Nets, other ANNs and ML algorithms, beginning Python, Jupyter; Project: tutorial on python.org

Readings

Jared Diamond, "Life with the Artificial Anasazi," *Nature*
Ian J. Goodfellow, et al. *Maxout Networks*

6. March 9 A Brief History of Alternate Realities: ARGs to IRL/ARGs SF, SE, ARGs to IRL/ARGs; ong's hat, the beast, ilovebees, Year Zero, Cicada 3301, Q, The Yes Men, et al.

Pentesting to APTs to SE to Gamified Realpolitik Pentesting, blackhat/grayhat/whitehat, 'malicious hacker' to 'offensive security'; APTs, Fancy Bear, et al.; SE: TAO, IRA, CA/SCL, Black Cube, Psygroup, Palantir, Academi, Qanon, Social Credit and The People's War on Terror; Anonymous, Wikileaks, Pursuance, Resistbot, et al.

Uses of Hypocognition distraction, hypocognition, suppression, capture, addiction maximizers

Hypercognition SF, Information gathering, Communication modeling, elicitation, preloading, pretexting, human buffer overflow, microexpressions, persuasion, framing, manipulation, mitigation

Lab explore SE, Torch, Tensorflow

Readings

Joseph Matheny, *The Incunabula Papers*, original scan

Christopher Hadnagy, from *Social Engineering, The Art of Human Hacking*, skim

Additional Reading/Primary Documents

Shazeda Ahmed, *The Messy Truth About Social Credit*

Darren Byler, *Ghost World*

8. March 23 Generative Adversarial Nets "The generative model can be thought of as analogous to a team of counterfeiters, trying to produce fake currency and use it without detection, while the discriminative model is analogous to the police, trying to detect the counterfeit currency. Competition in this game drives both teams to improve their methods until the counterfeits are indistinguishable from the genuine articles." Ian J. Goodfellow, et al.; BigGAN, AudioGAN, et al. goals, training, crawling, sets

Models, Antimodels?, Projects *The Yes Men*, Steve Kurtz and Critical Art Ensemble, Cory Arcangel, ISCA, Mao Ying, Phillippe Pasquier, et al.

Lab Pt. I: Your Project: Defining Your Project, goals, tools, areas of research, accessing and allocating resources **Team up, For April 6, write a description of your Project**

Due to the necessity for Teleconferencing, presentations of projects will consist of web-based work or documentation and/or talks about the project via tele-platform using Zoom and applications such as QT or PC video, Keynote, Powerpoint, etc.

Lab Pt. II: We will be breaking into two groups, those with access to Macs and those with access to PCs Mac users will be going further into Core ML and begin exploring PlaidML+OpenCL, PC users will begin experimenting with PC-based GANs via whitepapers and Github-hosted APIs; **Over the break both Mac and PC users can do the useful Python tutorials at python.org and Tensorflow or Swift for Tensorflow tutorials at tensorflow.org**

Readings

Ian J. Goodfellow, et al., *Generative Adversarial Nets*

Thierry de Duve, from *Kant after Duchamp, Acts III and IV*

Additional Reading/Primary Documents

Andrew Brock, Jeff Donahue, Karen Simonyan, *Large Scale Gans...High Fidelity Natural Image Synthesis*

Chris Donahue, Julian McAuley, Miller Puckette, *Adversarial Audio Synthesis*

MARCH 30 NO CLASS, SPRING BREAK

9. April 6 Read Project Descriptions

Dark Pools, Lit Markets: a brief history of fintech HFT, dark pools; Renaissance Capital, et al.

Crypto cryptography to cryptocurrency, Enigma and Turing's bombes, Colossus, AZX, MT.GOX, Satoshi Nakamoto, et al. and the Blockchain, Columbia's Software as Rightwing Extremism

Art, Sapience, Critique Kant and aesthetic judgement, de Duve, Kant after Duchamp

Lab beginning Ether, Remix, Solidity, Geth, Mist, Metamask, IOTA **Project:** experiment with Remix or work on Your Project

Additional Reading/Primary Documents

Satoshi Nakamoto, *Bitcoin: A Peer-to-Peer Electronic Cash System*

David Golumbia, from *Bitcoin, Software as Rightwing Extremism*

10. April 13 Illuminating Abstractions "Art is a lie that helps us see the truth." Picasso "Abstraction reflected the economic mechanization of consciousness" Meyer Shapiro; Girard and Mimetic Violence, the Lotka-Volterra ecosystem model, Hooke's Law, Kermack-McKendrick epidemic equations

Abstraction and Levelism Kant's 'antinomies of pure reason', Levelism, epistemological, ontological, methodological

Art, technology, and abstraction Deleuze and Guattari's Abstract Machines, Zepke's Art as Abstract Machine

Cognitive Hierarchies, Heterarchy, Rhizomatics A Cognitive Hierarchy Model Of Games, Cognitive asymmetry, Heterarchy as "an emergent organizational form with distinctive network properties ... and multiple organizing principles." per Stark, "a partially ordered level structure implicating a rampant interactional complexity." per Kontopoulos; Rhizomatics per Deleuze and Guattari

Obfuscation Chaff, False tells, MAI (making analysis inefficient), Babble tapes, Operation Vula, Quote stuffing, Hydras, Vortex, "Bayesian flooding" and "unselling", FaceCloak, likefarming; Understanding information asymmetry

Lab: Your Project, Teleconference with your partner and/or Scott- during these periods, I will be available via Zoom to meet with individuals and teams

Readings

Carole L. Crumley, *Heterarchy*

Finn Brunton, Helen Nissenbaum, from *Obfuscation, a User's Guide for Privacy and Protest*

Geoff Shullenberger, *Mimesis, Violence, and Facebook*, Peter Thiel's French Connection

Luciano Floridi, *The Method of Levels of Abstraction*

Stephen Zepke, *Art as Abstract Machine*

Additional Readings/Primary Documents

Colin F. Camerer, Teck-Hua Ho, et al., *A Cognitive Hierarchy Model Of Games*

11. April 20 Rewiring Social Structure Vogt's Rituals of Reversal as a Means of Rewiring Social Structure; Algorithmic Austerity

Assymetrical Likewar 'Black Propaganda', O.S. to Counterintel, the 'Wilderness of Mirrors' to 'the Strategy of Tension' to Tailored Access Operations; Trapwire, Social Credit, Affect Recognition, and pseudoPSY

Lab Your Project

Readings

Evon Z. Vogt, *Rituals of Reversal as a Means of Rewiring Social Structure*

SecDev Group, *Tracking GhostNet, investigating a cyber espionage network*, Information warfare monitor

Additional Reading/Primary Documents

Stuart Candy, *Mapping Possibility Space*, from *The Futures of everyday life, politics and the design of experiential scenarios*

Tiqqun, from *The Cybernetic Hypothesis*

12. April 27 Demontology *I must Create a System, or be enslav'd by another Mans / I will not Reason and Compare; my business is to Create* William Blake

Roden's Subtractive-Catastrophic Xenophilia

Against the Digital Laruelle, *Nonstandard Philosophy*, Galloway, Mieville's *On Social Sadism*

No Horizon Colebrook's *In Praise of the Flat Earth and counterethics*; *Zoe v. Bios*

Readings

David Roden, *Subtractive-Catastrophic Xenophilia*

Claire Colebrook, *A Globe of One's Own, In Praise of the Flat Earth*

Lab *Your Project and/or Presentations*

13. May 4 Presentations