The Emergence Project: A Machine of Expression

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"The interesting emergent events that involve artificial life simulations reside not in the simulations themselves, but in the ways that they change the way we think and interact with the world"

- P. Cariani in *Emergence and artificial life*, 1992

How does collective behavior arise out of a multiplicity of 'simple' interactions? What kind of patterns can emerge when hundreds of 'ideas', concerted into one dynamic visual assemblage, interact with each other? Emergence, "generally understood to be a process that leads to the appearance of structure not directly described by the defining constraints and instantaneous forces that control a system,"[1] has become one of the liveliest areas of research in philosophy and science. Examples of apparent emergent phenomena range from colonies of ants to the popularity of a particular hairstyle, and life itself. To interrogate this phenomenon, the author[2] has collaborated with Mark Hereld[3] to create *The Emergence Project*, a contemporary art installation, commissioned by the 2008 Chicago Humanities Festival, and exhibited from October 11, 2008 until Jan. 2, 2009 at the Hyde Park Art Center. Based on simple morphological rules, the work is driven by the presentations and panel discussions of the Humanities Festival, culminating in an artificial life simulation that evolves from minute to minute to express "big ideas", in resonance with the Festival's theme: Thinking Big.

In the work, hundreds of digital creatures, or idea clusters, interact with each other, continuously evaluating qualitative proximity in regards to their individual meaning and frequency. These octopus-like entities represent the contributions from panelists at the 2008 Chicago Humanities Festival, each sentence transformed into a 'tentacle-like' system. The creatures 'flock'[4] over the digital facade (80' x 12', Fig. 1), their perception allowing only for local interaction with their immediate neighbors. A relatively short lifespan allows inheritance of the ideas only for a limited time span. Once a the meaning of a particular sentence is ranked high in relation to other sentences, it creates a derivative idea. The digital creatures continuously interact and mutually compare, noun by noun, adjective by adjective, verb by verb, visually indicated by a colored line (Fig. 2). A lexical database of English language is used to interpret the qualitative proximity of synonyms, holonyms, and hyponyms, grouped into sets of cognitive synonyms, or synsets. An internal score monitors the significance of

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[1] Crutchfield 269.

[2] Daniel Sauter is an artist who creates interactive installations and site-specific interventions dealing with the cultural and social implications of emergent technologies. His current projects focus on mobile interventions exploring the phenomenon of projection in urban spaces. Currently Sauter is an Assistant Professor at the School of Art and Design at the University of Illinois at Chicago (UIC).

[3] Mark Hereld is an astrophysicist/computer scientist at the University of Chicago and Argonne National Laboratory and a multimedia artist. He has worked on other digital projects on the Art Center's façade such as Random Sky (2006) with Iñigo Manglano Ovalle and Rick Gribenas and was the lead consultant determining the software and technology for the Jackman Goldwasser Catwalk Gallery.

[4] Craig Reynold's Boids, implemented by Daniel Shiffman in Processing

each word, manifested by an increased font size within individual word clusters. Thousands of interactions between the clusters, in conjunction with the autonomous creation of derivative clusters, implicate the emergence of contextual patterns, denoting 'big ideas'. In this way, the piece continues to shift and evolve throughout the duration of the exhibition.

The Emergence Project was launched on Oct. 11 at Hyde Park Art Center, as part of the 2008 Chicago Humanities Festival. The contents of the presentations and panel discussions, specifically *Emergence: Philosophy Meets Science*[5], and *Towering Ambition: Babel-ing On*[6], were captured[7], submitted online to *The Emergence Project* database[8], and visualized as idea clusters at Hyde Park Art Center's digital facade. After the project launch, museum visitors and the public were invited to submit contributions in form of comments and blog posts to *The Emergence Project* blog[9], designated as a platform to facilitate discourse, and as a gateway to relay new contributions directly into the piece, instantaneously creating new digital creatures.

The Jackman Goldwasser catwalk gallery at Hyde Park Art Center consists of a projection system that spans 80-feet of the art center's facade (Figure 1). The work exhibited on the facade was both visible from the inside and the outside, projected onto retractable rear-projection screens by ten video projectors[10] located in the main gallery. Museum visitors were able to see the work closely from the adjacent catwalk, at times becoming part of the images by casting shadows onto the work. Five personal computers parallel-computed each individual frame of the computer-generated animation in real-time, synchronized by a server[11]. Throughout the duration *The Emergence Project*, the server communicated with the project database, adding meta data in form of synonyms, holonyms, and hyponyms as they were submitted. This meta information served as the basis for a qualitative evaluation process, determining the mutual proximity of the contributions through Wordnet[12], a large lexical database of English, analyzing nouns, verbs, and adjectives, grouped into sets of cognitive synonyms (synsets), each expressing a distinct concept (Figure 3). The resulting network of meaningfully related words was integrated into *The Emergence Project* using RiTa.Wordnet[13], a Wordnet

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[5] Chicago Humanities Festival, "Emergence: Philosophy Meets Science", Thinking Big: the 19th Annual Chicago Humanities Festival, http://www.chfestival.org/index.cfm?fa=fallfest.progdtl&pid=2817

[6] Chicago Humanities Festival, "Emergence: Philosophy Meets Science", Thinking Big: the 19th Annual Chicago Humanities Festival, http://www.chfestival.org/index.cfm?fa=fallfest.progdtl&pid=2764

[7] Via MacSpeech Dictate, based on Dragon® speech recognition engine by Nuance. The software has been trained prior to the festival to improve the quality of the recognition process.

[8] A custom PHP script has been designed to detect sentence structure, and add the digitized content into a MySQL database. Meta information, such as author, submission format, time, have been added during the process.

[9] Daniel Sauter and Mark Hereld, "The Emergence Project", The Emergence Project, http://emergenceproject.org.

[10] At 10 000 Lumens brightness, and an individual resolution of 1024 x 768 pixels XGA (totaling 7.86 MegaPixels).

[11] Daniel Shiffman, "Most Pixels Ever: Multi-Screen Library for Processing", Google Code, http://code.google.com/p/mostpixelsever/.

[12] Wordnet®, Cognitive Science Laboratory, Princeton University.

[13] RiTa.Wordnet by Daniel C. Howe, a WordNet® implementation for Processing.

library for Processing.[14] The central aim of this process was to interrogate the very concept of emergence, by seeding emergence in form of an artificial life simulation and physics model, and reflexively applying it to contemporary discourse on emergence.

The documentation photographs and screen captures of *The Emergence Project*, shown in Figure 1 and 2[15], reveal clusters of organically shaped blue lines in gradients, each representing a particular sentence, with nouns (green), and adjectives/verbs (white) attached to every vector of the curvature. Each word is attached in sequence to 'tentacles', to form and maintain the lowest level of aggregate meaning in the individual idea cluster. As the cluster intermittently propels, similar to an octopus, the 'tentacles' redistribute according to their inherent particle system dynamic, creating new juxtapositions and new meaning. Anthropomorphized due to the quality of their octopus-like movement, the creatures actively move and steer, with red and purple lines appearing as they approximate. Geometric patterns emerge when hundreds of connections are drawn, straight lines between the different words embedded in the creatures, suggesting that they perceive and intercommunicate. The creatures, are in constant flux, leaving trails as they seek and flee, pursue and evade, avoid and follow, striving for an equilibrium within the ecosystem. The red and blue traces, intermitted by clusters of green and white text, represent the macro perspective onto the digital ecosystem, with different facets of the simulation emerging over time. Many deliberate decisions have been made to avoid top-down programming, allow macro and micro perspectives, show internal and external states, retain contrast and performance over weeks, while trying to keep the underlying models simple and comprehensible.

Surprise!

Ant biologist Deborah M. Gordon states: "A harvester ant colony has a life cycle of about fifteen years – it is born, matures, and dies. But the individual ants that inhabit the colony live only one year. How does this system of tunnels and cave in the dirt become so much more than the sum of its parts?"[16] Mitchel Resnick, designer of *StarLogo*, a programmable modeling environment for exploring the behaviors of decentralized, massively parallel micro systems, explains: "In decentralized systems, orderly patterns can arise without centralized control. Increasingly, researchers are choosing decentralized models for the organizations and technologies that they construct in the world, and for the theories that they construct about the world. But many people continue to resist these ideas, assuming centralized control where none exists–for example, assuming (incorrectly) that

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[14] Processing is an open source cross-platform programming language, used by students, artists,designers, researchers, and hobbyists for learning, prototyping, and production.Casey Reas and Ben Fry, "Download Processing", Processing, http://processing.org/download/index.html.

[15] Daniel Sauter and Mark Hereld, "Movie Clips | The Emergence Project", The Emergence Project, http://emergenceproject.org/blog/?page_id=180.

[16] Gordon 192.

bird flocks have leaders. *StarLogo* is designed to help students (as well as researchers) develop new ways of thinking about and understanding decentralized systems."[17]

When observing (simulated) natural phenomena, the mere discovery of patterns and emergent features implies the existence of an observer. Ronald, Sipper, and Capcarrère establish that without an observer, the issue of emergence could not arise at all.[18] Following this line of thought, they refer to an article by Bonabeau, Desalles, and Grumbach, stating "the emergent aspect of a phenomenon is related to the point of view of an observer of this phenomenon: it is not intrinsic to the phenomenon, but related to the global system (phenomenon + observer)."[19]

The supposition – the whole is more than the sum of its parts – has promoted a widespread popular interest into the philosophical and scientific studies of complexity and (more recently) emergence. Perplexing natural phenomena such as a flock of birds flying in formation, schools of fish abruptly turning in synchrony, colonies of ants self-organizing without explicit top-down instructions, traffic jams spontaneously forming when exceeding the critical traffic density, have fueled curiosity about the underlying models. How can these phenomena be explained or reduced to models that can be deciphered by an observer, can they be reduced at all? Crutchfield poses the question: "But for whom has the emergence occurred? More particularly, to whom are the emergent features 'new'?... The newness in both cases is the in the eye of the observer...."[20] The inherent subjectivity of this observation, similar to the subjectivity of the notion of "beauty", is significant here. It points to the inseparability of the emergent feature and its observer. Crutchfield distinguishes in this context three notions of emergence: 1) The intuitive definition of emergence: "something new appears" 2) Pattern formation: an observer identifies "organization" in a dynamic system 3) Intrinsic emergence: the system itself capitalizes on patterns that appear.[21] In *The Emergence Project*, museum visitors operate as intuitive and subjective analysts, determining whether something new, or a pattern form appears. Intrinsic emergence takes place through an internal score that monitors the qualitative proximity, prominence, and 'fitness' of all ideas. Once this score reaches a certain threshold, the simulation initiates the creation of a derivative idea (cluster).

Réda Bensmaïa states: "It is impossible to separate the tool from the artisan, the reader as lexeograph (Barthes) from the scriptor as subscriptor: they are together as machine and rhizome, a network, an entangled knot of movements and stops, of impulsions and immobilizations to experience interminably.", reflecting on Walter Benjamin's notion of "gesture" in Kafka's literary

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[17] Mitchell Resnick, "Welcome to StarLogo", StarLogo on the Web, http://education.mit.edu/starlogo/.Resnick, Director of the expansive Lifelong Kindergarten Project, has promoted the creative use of computers in education since the beginning of his career. His "active essay" Exploring Emergence,available at http://llk.media.mit.edu/projects/emergence/index.html, is one example of his approach how to make the concept of emergence accessible, explaining the Conway's Life rules from 1970.

[18] Ronald 299.

[19] Ibid.

[20] Crutchfield 299.

[21] 272.

work.[22] How Bensmaïa's readings relate to reflections in the context of *The Emergence Project*, will be illustrated in the next section of this article.

It is a contested issue in contemporary discourse on emergence whether there are *any* genuine examples of emergence, given that "identifying the genuine examples of emergence is possible only given an appropriate definition of emergence."[23] It needs to be stated that *The Emergence Project* does not attempt to demonstrate a *genuine* example of emergence, or to feature in an artwork a variety of the leading concepts used for the definition of emergence, such as: irreducibility, unpredictability, conceptual novelty, ontological novelty, and supervenience.[24] Rather (referring back to the beginning of the article), *The Emergence Project* wishes to affirm that "the interesting emergent events that involve artificial life simulations reside not in the simulations themselves, but in the ways that they change the way we think and interact with the world."[25]

A Machine of Expression

The experimental machine for effects, "as in physics", proposed by Réda Bensmaïa in his introduction to Deleuze's and Guattari's book *Kafka: Toward a Minor Literature*,[26] is a reading of Kafka's literary work, that represents a resourceful (terminological) parallel to the conceptual unhinging of *The Emergence Project*. Bensmaïa begins by crediting Walter Benjamin's 1934 reading of Kafka: "There are two ways to miss the point of Kafka's works. One is to interpret them naturally, the other is the supernatural interpretation. Both the psychoanalytic and the theological interpretations equally miss the essential points"[27] and goes on: "Benjamin was one of the first 'readers' of Kafka to see and then try to show–to demonstrate–that Kafka's work was, from a certain point of view, to be taken literally: in a word, that it functioned on the surface of its signs and that the issue was not–at least, not *only*– to try to interpret it but, above all, to practice it as an experimental machine, a machine for effects, as in physics."[28]

He continues: "With Kafka we are no longer confronted by a "dialectic" or a "structural" correspondence between two kinds of 'forms'–forms of content, on the one hand, and readymade forms of expressions, on the other–but, in the author's word, by a machine of expression that is capable of disorganizing its own forms, of disorganizing the forms of content, so as to free up an intense material of expression that is then made of pure content that can no longer be separated from its expression."[29] In the context of the context of *The Emergence Project*, this statement implies

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[22] 2, p. xii.

[23] Bedau 3.

[24] Ibid.

[25] Ibid.

[26] 2.

[27] 2, p. ix.

[28] Ibid.

[29] Ibid.

that the correspondence between topologies of individual words (form of content), and the artificial life-form (ready-made forms expression), become a machine of expression that is inextricably interconnected. Bensmaïa summarizes: "Thus, the art (modern art in this sense) that Kafka tried to introduce is effectively no longer an art that proposes to 'express' (a meaning), to 'represent' (a thing, a being), or to 'imitate' (a nature). It is rather a method (of writing) ... that consists in propelling the most diverse contents on the basis of (nonsignifying) ruptures and intertwinings of the most heterogeneous orders of signs and powers."[30] The relationship between the reader as *lexeograph* and the scriptor as *subscriptor*, or, the museum visitor as *analyst/observer* and the artificial life-form as expression machine, represents a main correlation stipulated in *The Emergence Project*.

This article proposes parallels between in the attempt to decipher Kafka's literary work, and the attempt to observe (and test) features of emergence. There is on the one hand Benjamin's notion of *gesture*: where the subject of the statement and the subject of enunciation can no longer be separated.[31] It finds it equivalent in the notion of the emergent *pattern*, where the emergent feature remains intrinsically connected to the underlying model (observed by the subjective observer). Both *gesture* and *pattern* can be understood as *machines of expression*, not reducible to a binary structure, or a dominant or transcendental signifier,[32] or in Deleuze words: "'Machine, machinism, *machinic*': it is neither mechanical nor organic. The mechanical is a system of gradual connections between dependent terms. The machine, on the other hand, is a clustered 'proximity' between independent terms (topological proximity is itself independent of distance or contiguity). A machinic assemblage is defined by the displacement of a center of gravity onto an abstract line."[33]
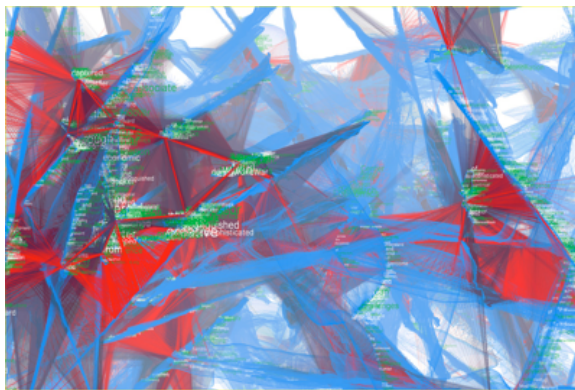

Fig. 1. C-Print (excerpt): Idea clusters. The different font sizes of individual words illustrate the difference in significance relative to other idea clusters.

Fig. 2. View from catwalk, Jackman Goldwasser Facade Gallery, Hyde Park Art December, 2008 Center,

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[30] 2, p. xvii.

[31] 2, p. xii.

[32] 2, p. xi.

[33] 2, p. xv.

<item content="to gain control of the world" time="" id="2">

After adding synonyms, holonymns, and hyponyms using Wordnet:

<word holonyms="experiment, experimentation" synonyms="powerfulness, effectuality, persuasiveness, jurisdiction, valency, power, veto, sway, valence, disposal, repellent, throttlehold, effectiveness, effectivity, puissance, chokehold, interest, stranglehold, irresistibility, preponderance, interestingness, discretion, effectualness, influence, strength, repellant, irresistibleness, potency" hyponyms="authority, authorization, authorization, potency, dominance, corporatism, hold, rein, repression, federalization, federalization, imperialism, regulation, regulating, regularization, regularization, possession, ownership, grasping, seizing, prehension, steering, steerage, guidance, direction, restraint, ascendant, ascendent, domination, mastery, supremacy, predominance, predomination, prepotency, dominion, rule, absolutism, tyranny, despotism, monopoly, temperateness, temperance, moderation, inhibition, continence, dial, governor, regulator, hand-wheel, joystick, switch, valve, ceiling, roof, cap, floor, base" is="control" isNoun="1" isVerb="1"/>

Fig. 3. XML data structure

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