Toward an Aesthetics of Synnoetic Interactivity

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Introduction:

The Computational Roots of Aesthetic Interactivity:

" …when human atoms are knit into an organization in which they are used, not in their full right as responsible beings, but as cogs and levers and rods, it matters little that their raw material is flesh and blood. What is used as an element of a machine is in fact an element in a machine." (Wiener, p. 185)

Interactive, telematic art is the child of developments in cybernetics, electrical engineering, mathematics, and computer science; arguably as much as it is the offspring of art history. The predictions and concerns of the pioneering scientists that developed these fields facilitated radical new potentials for interactivity in artistic practice.

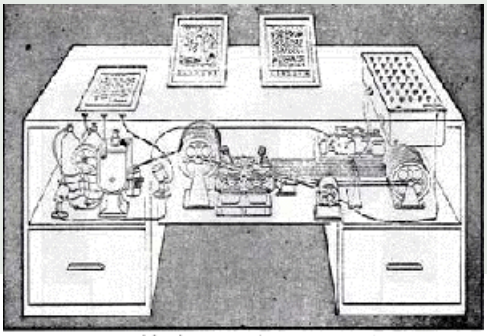
A decisive shift in the development of computational technologies that is of particular importance to art occurred with the July 1945 publication of the essay "As We May Think" by Vannevar Bush. Bush was an electrical engineer, Dean of MIT, and responsible for the development and administration of DARPA and the Manhattan Project. In "As We May Think," he made many suggestions in an effort to facilitate the redirection of post-war agendas in scientific research, but most notably was his charge that research in computational systems shifts from replacing human workers with computers to building machines to augment individual human intellect. The latter involved giving individual users an interface to access the inner workings of the computer, allowing for real-time sorting and contact with data, and forming cross-referenced, associative paths and patterns. Bush coined the term Memex to describe his proposed associative data handling technique, the precursor to Hypertext twenty years later. This concept of a human-centered agenda in computing was a radical one in government-sponsored research, especially after years of war.

In the 1960s, the visionary scientists J. P. L. Licklider and Douglas Engelbart, inspired by Memex, began to work toward the realization of a human-centered, intelligence-augmenting research model for computers. In 1960, Licklider formulated a research agenda based on the idea of a symbiosis between humans and computers, and later, in 1964, in his publication "The Computer as a Communication Device," set an agenda for interactivity as mutual action between humans and digital computers, for the purpose of human communication, creativity, and transcendence:

Our emphasis on people is deliberate… We want to emphasize something beyond one-way transfer: the increasing significance of the jointly constructive, the mutually reinforcing aspect of communication - the part that transcends… When minds interact, new ideas emerge. We want to talk about the creative aspect of communication.

As early as 1962, Douglas Engelbart realized the potentials of the computer as an intelligence-augmenting device, and wrote of using the computer for the development and augmentation of "mental and cognitive structuring in the human." (Engelbart, p. 10)

In the late 1960s, Louis Fein, in making a comprehensive projection of the growth and dynamic inter-relatedness of "computer-related sciences," includes specific mention of the enhancement of human intellect by the cooperative activity of men, mechanisms, and automata. He profoundly expanded the range of interactivity when he coined the term "synnoetics" to describe the cooperative interaction of people, mechanisms, plant or animal organisms, and automata into a system the mental power of which is greater than that of its components. Fein described synnoetics as a "meta-discipline" arising out of the symbiosis between people, machines, automata, and other life forms, and believed that it should be an academic subject taught in an integrated fashion. Synnoetics predicts the current development of biological, genetic, and transgenic art forms currently under development by artists like



Vannevar Bush's theoretical Memex machine, 1945

Vibeke Sorensen, Eduardo Kac, and Tiffany Holmes.

The post-war agendas set out by Bush, Licklider, Engelbart, and Fein emphasize the evolution of the human as the central force in cybernetics, engineering, and computer science. Their research forms a clear set of criteria for the creation of aesthetic, interactive context creation that is human-centered. The issues vital to an aesthetics of interactivity emerging from their work are the following:

The research and development of human/machine symbiotic models for interactivity focus on the augmentation of the human subject.

The synnoesis between human/machine/environment emphasizes a model of mutual exchange between interacting minds, for the purpose of emergence and transcendence.

Mutually interactive systems can facilitate the development of new patterns of cognition in people, thus confirming a dynamic of mutual (ex)change. In the process, the computer is constructed as a dynamically integrated partner in an associative synnoetic exchange; an interaction that augments human communication, creativity, transcendence, and intelligence.

These scientists mapped a path for the development of human/computational interactivity that solidly places at the center the creation of a symbiotic or synnoetic, distributed "mind" whose powers of human realization and transcendence are greater than the sum of its parts. After nearly 40 years of speculation and development in interactive art, a critical look at the genre through this synnoetic lens could help define future paths in the genre.

"How was it for you?" Interactive Art in Practice - 1965-Present:

The traditional static, contemplative art object has now, in the human-centered synnoetic-interactive paradigm, become a dynamic, responsive engine able to instantaneously tailor its processes and outcome to a unique dataset of choices and actions signified by each individual entering the input field of the aesthetic experience. In the words of visionary 'interactive artist,' theorist, and teacher Roy Ascott:

The emerging new order of art is that of interactivity, or "dispersed authorship." The canon is one of contingency and uncertainty… The culturally dominate "objet d'art" as the sole focus... is replaced by the interface... The focus of the aesthetic shifts from the observed object to the participating subject… (Ascott, p. 243)

Ascott brought to bear on art the theories and concerns of Licklider and Engelbart, especially with regard to "the creative aspect of communication," as early as 1966 when he developed his model for a "cybernetic art matrix" that functions as a

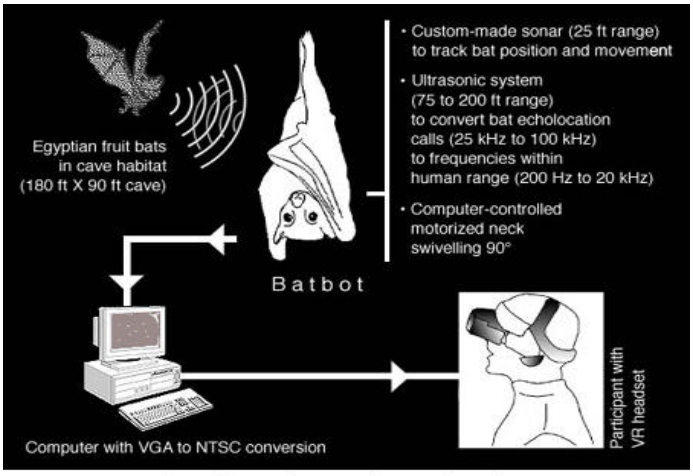


Diagram of Darker Than Night, Eduardo Kac, 1999

tool for the mind, an instrument for the magnification of thought, potentially an intelligence amplifier... [T]he interaction of artefact and computer in the context of the behavioural structure, is equally foreseeable... The computer may be linked to an artwork and the artwork may in some sense be a computer.

To understand this "aesthetic shift from the observed object to the participating subject," it is necessary to examine the observed object (static works of art) through the lens of the aesthetics of synnoeisis, as defined above. According to Webster's Second International Dictionary, there are two basic conditions definitive of interactivity: (1) that interaction implies mutual acts, and (2), that action does not necessarily imply a physical act but can be an effect, suggestion, or representation. (Webster's) Relative to the second definition, implied or suggested action is frequently a property of traditional physically static forms like painting and sculpture. Action can simply be suggested and/or represented and still reciprocate within an active dialogue with a viewer through the suggestion/representation of action, or through the stimulation of a reaction in the internal psychic life or physiological behavior of the participant. Media theorist Lev Manovich, in his essay "On Totalitarian Interactivity (notes from the enemy of the people)," maintains that classical and modern art were already interactive in that they prompted a viewer to

fill in missing information (for instance, ellipses in literary narration; "missing" parts of objects in modernist painting) as well as to move his / her eyes (composition in painting and cinema) or the whole body (in experiencing sculpture and architecture). (Manovich, 1996)

Manovich further contends that, compared to earlier genres, electronic media often takes an entirely literal attitude toward interactivity:

equating it (interactivity) with strictly physical interaction between a user and an artwork (pressing a button), at the sake of psychological interaction. The psychological processes of filling-in, hypothesis forming, recall and identification -- which are required

for us to comprehend any text or image at all -- are mistakenly identified strictly with an objectively existing structure of interactive links. (Manovich, 1996)

Manovich and others clearly argue that all works of art can be described as interactive, because there always has been a "reciprocal action," or feedback condition between the art object and the viewer. The static work depicts action, the viewer responds.

However, the first definition cited above that interaction implies mutual acts, is a definitive criterion for interactivity that eludes the traditional relationship between static works and their viewers. This aspect of mutual action was central to the research models proposed by Bush, Licklider, Engelbart and Fein and undermines Manovich's contention that all works of art can be described as interactive. Although one can obviously argue that the static work of art does act upon the viewer in a number of very profound ways, one would be hard pressed to say that the action is mutual or reciprocal. The range of physiological, emotional, spiritual, political, humanist, psychological, and moral ideologies impressed upon the viewer by artists through their work is at the core of the power of static art; however, the viewer's actions and will in the presence of a static work do not change anything about the physical structure or corporeal nature of the object itself. According to this definition, the aesthetic experience with a static work of art can be called active, but not interactive.

In practice much of the digital work called interactive offers a very limited degree of participation as the interactor is confined to basic levels of button-pushing, call and response structures, and prescribed alternatives within a fixed whole. Ascott's canon of "contingency and uncertainty" is often an illusion created by the interface, masking a logic requiring hard-coded certainty and order. These works unintentionally reveal that traditional print media can offer the same possibilities of non-linear, random-access reading as do many CD-ROMs and websites, albeit with greater accessibility, stability and compatibility. In addition, the "interactor's" physical action of pushing a button or triggering a sensor frequently seems only related to the consequence or signification of her action in a purely literal way, that is, push button, something occurs. Many interactive artworks are machine-centered, both in terms of the interface and the nature of interaction, while simultaneously surrounded by a body of discourse and expectation denying that this is so. The initial prototype of "First Order Cybernetics," the feedback loop, is the model for such interactive, electronic artworks. The feedback loop is a process frequently found in machines intended to maintain a particular state or pattern, like a governor or thermostat. A simple feedback loop is analogous to a closed system of interaction in Manovich's definition. In closed systems, we can attribute no intelligence to the interface, it does not learn from the action of the environment, simply leads the participant down an unchanging branching structure or pattern of motion, offering pre-rendered elements or pre-programmed responses. The individual interactor is not permitted to follow, in Bush's terms, an "associative trail." The path is a pattern, repeatable, and the result predictable, the internal purpose is the maintenance of a homeostatic condition for the machine. In the case of many interactive pieces, the initial pattern of machine logic conditions the interactor's behavior to keep the piece up and running.

The greatest failure of such works is that too often the interactor is manipulated by the cybernetic system into believing that the thought trajectory they are developing is their own. The inevitable realization that it is both the artist's thought trajectory and the conditions of the computational system they are following leaves many viewers with a feeling of detachment and deception. Manovich describes this experience:

Now, with interactive media, instead of looking at a painting and mentally following our own private associations to other images, memories, ideas, we are asked to click on the image on the screen in order to go to another image on the screen, and so on. Thus we are asked to follow pre-programmed, objectively existing associations. In short, in what can be read as a new updated version of Althusser's "interpolation," we are asked to mistake the structure of somebody else's mind for our own. (Manovich, p. 61)

Such efforts in interactive art can be said to actually curtail the participant's range of free association while simultaneously espousing assumptions based in democratic and utopian ideals of open process and distributed authorship. Human aesthetic, emotional and sentient experience is constructed in terms of the logic of the machine, rather than, as the developers of interactivity called for, the other way around. The goals of interactivity as previously outlined above by Bush et al. - human centeredness, associative paths, mutual action, cognitive mapping, and by Ascott - undecidability, potentiality, immateriality, transformation, mutability - are frequently at odds with the goals of machine maintenance and homeostasis.

This is certainly not to say that the enterprise of interactive art has been a failed project. Indeed, there have been works by a number of artists,

Roy Ascott, 1983, working at the TI-745 terminal/printer, (photo:Electra catalogue)

Roy Ascott probably being the first, that exploit the defining agendas of human-centered, symbiotic interactive systems to create powerful new aesthetic contexts. It would seem that, as digital systems become more powerful and ubiquitous, the number of effective works would increase incrementally, but in my judgment this is not the case.

If an interactive artwork stops running before it should, as they frequently do, then all is lost; but if the cybernetic system is conceived of as a work of art, then the facilitation and augmentation of the aesthetic experience in the human subject should prevail. There are a number of issues that make the maintenance of a human-centered, cybernetic paradigm a very difficult task. Whether considering the aesthetic experience with regard to the "objet d'art" or the interface, it is not difficult to analyze and construct numerous theorems concerning the composition, structure, and technology of what Engelbart called "the explicit-artifact," that is, the work of computational work of art. What remains illusive is the nature of the internal experience of the human subject when in dialogue with these artifacts. How is the human affected, how do we know if the "explicit human" has changed? As, according to Licklider, mutual exchange is an optimum condition of symbiotic interaction, an understanding of the dynamic, qualitative experience of the person is necessary in order to contribute to the production of optimal aesthetic experiences within interactive interfaces.

Distributed Minds, Biometrics, Cognitive Remapping, and Psi Phenomena:

In 1954, Norbert Wiener wrote, in "The Human Use of Human Beings, Cybernetics and Society":

But while the universe as a whole, if indeed there is a whole universe, tends to run down, there are local enclaves whose direction seems opposed to that of the universe at large and in which there is a limited and temporary tendency for organization to increase. Life finds its home in some of these enclaves.
(Wiener, p. 12)

There are enclaves of cybernetic activities, some within the conventional canons, and some at the fringes or entirely outside the realms of acceptable art or science that shed light into the mysteries of dynamic human subjectivity.

Distributed Mind:

Roy Ascott began exploring concepts of "distributed mind" and creative communication networks in his cybernetic experiments in education and art in the early 1960s. He created many interactive works in the 1960s and 70s where "participators" were able to shape the current state of a given work. His model for the "cybernetic art matrix" finally came to fruition in 1983 with the exhibition of his "La Plissure du Texte" at the Musée de l'Art Moderne de la Ville de Paris. Edward Shanken, In "Telematic Embrace: A Love Story? Roy Ascott's Theories of Telematic Art," offers the following description of this seminal work:

Roy Ascott's La Plissure du Texte (The Pleating of the Text), 1983, was identified by Leonardo editor Roger Malina as an unsurpassed landmark in the history of Telematic Art. This work explored the potential of computer networking for interactive creative exchange between remote participators, first theorized by Ascott in 1966. The project was produced as part of the Electra exhibition organized in 1983 by art historian Frank Popper at the Musée de l'Art Moderne de la Ville de Paris. La Plissure du Texte allowed Ascott and his collaborators at eleven locations in the US, Canada, Europe, and Australia to experiment with what the artist has termed "distributed authorship." Each remote location represented a character in the "planetary fairytale," and participated in collectively creating and contributing texts and ASCII-based images to the interactive unfolding, or distributed authorship, of the emerging story. Artist Hank Bull, who participated in the event from the Vancouver node described "the result of this intense exchange" as a "fat tome of Joycean pretensions that delved deep into the poetics of disembodied collaboration and weightless network rambling." (Shanken, 2001)

Ascott's work clearly pre-dates the internet, net art, MUDs and MOOs and is a profound realization of a distributed realization of Vannevar Bush's Memex. Anecdotal accounts from the artists that participated in "La Plissure du Texte" indicate qualitatively that their interaction was a profound experience, free associative, surreal, and full of unforeseen narrative twists. It must be pointed out however, that - unlike many of Ascott's analogue works of the 60s and 70s - visitors to the exhibition in Paris were involved primarily as spectators immersed in a textual space, unable to affect the direction of the work.

Roy Ascott's "La Plissure du Texte", 1983

Biometrics and Cognitive Mapping:

Doug Engelbart's belief that interactive systems could change cognitive structures in human participants finds its fruition in the growing number of interactive artworks involving real-time biometric data flows. The use of biometrics, especially biofeedback, as a method of interacting with aesthetic interfaces, dates back to Jean Millay's Stereo Brainwave Biofeedback Light Sculpture of 1971. The interface was based in R. Timothy Scully's portable Aquarius Electronics Alphaphone™, a brainwave analyzer that sorted brainwave frequencies into sound signals.

Jean Millay's "Brainwave Light Sculpture", 1971

The Stereo Brainwave Biofeedback Light Sculpture changes its colors and patterns with changes in thoughts… Mandela patterns are used so the visual focus is not distracted when the lights change… the feedback tones accompanied feelings of deep meditation… I wondered if it would be possible for two people to learn to synchronize their brainwaves to improve telepathic communication. (Millay, p. 9)

Millay has continued to pursue the question of the use of biofeedback to improve telepathic communications in her subsequent experiments in remote viewing, forging agendas set forth by Licklider (creative communication, interaction of minds), Engelbart (cognitive structuring), and Bush (intercepting brain transmissions).

An on-going project, "The Meditation Chamber," being developed by Chris Shaw, Larry Hodges and Diane Gromala at the Georgia Institute of Technology, is a virtual reality-based program that uses biofeedback to facilitate meditative states through video and audio guidance:

Users wear a head-mounted display with audio and video that guides them through a series of sunset and moonrise scenes and muscle relaxation exercises. The system also monitors the users' respiration, pulse rate and sweat gland activity (a measure of calmness) to provide real-time biofeedback regarding the effectiveness of the virtual experience. (Gromala, Hodges, and Shaw)

"The Meditation Chamber" augments individual users abilities for visualization, a necessary component to success in the use of meditation as a healing therapy.

In Darij Kreuh and Davide Grassi's "Brainscore: Incorporeal Communication," biofeedback devices and eye-trackers are used in a virtual reality performance environment. The biometric devices allow two performers to control virtual avatars projected for an audience in stereo on a large screen. The stated aim of "Brainscore" is

to create a controlled flow of information in terms of audio-visual messages in order to establish communication with the audience. (Grassi and Kreuh)

"Brainscore" was first performed in the Cultural and Congress Centre in Ljubljana, Slovenia, in September of 2000 and continues to tour. Kreuh and Grassi contend that "Brainscore" offers their audience a completely new point of view, "leading the audience to perceive a concrete co-existence (as a kind of promiscuous co-penetration) of two Realities at the same time." (Grassi and Kreuh)

In each of these pieces, the biometric interface sets up a reflexive cybernetic loop where the human's output, in the form of electronic impulses, alters the machine's output of images, motion, and sound. In turn, the output of the machine, as sensory stimulas, becomes the new condition of input for the human subjects. "Brainscore" creates a larger, telematic loop in that it brings an audience into the reflexive process. The response the human subject receives in biofeedback is an indication of internal dynamics related to emotional or involuntary systems of the human's body. Biofeedback encounters, like the use of virtual environments in phobia treatment (Hodges), have proven effective in creating new relationships to physiological and psychological conditions in human subjects through the process of cognitive remapping in the mind and body of the interactor. Clearly, in these interactive artworks Engelbart's goals related to the augmentation of mental and cognitive structuring in the human brain are occuring. It is clear that technologically mediated works of art that employ biofeedback interfaces can facilitate mutually interactive, quantifiable states in which all the elements of the cybernetic system - the human, the machine, and the information - are in a contingent state of dynamic, reciprocal change.

Art/Psi Phenomena:

Must we always transform to mechanical movements in order to proceed from one electrical phenomenon to another? Might not these currents be intercepted,

Darij Kreuh and Davide Grassi's "Brainscore" 2000

either in the original form in which information is conveyed to the brain, or in the marvelously metamorphosed form in which they then proceed to the hand?" (Bush, p. 107)

Danish artists Christian Skeel and Morten Skriver, in partnership with PEAR (The Princeton Engineering Anomalies Research Laboratory) have built and installed "The Trapholt Experiment" at the Trapholt Museum for Moderne Kunst in Denmark in March 3, 2001. The one-year-long installation is designed to determine whether human consciousness is capable of interacting with and affecting a microprocessor. The installation consists of a custom computer that generates a random sequence of numbers, and of a computer monitor. The monitor hangs on a wall in a small room; the computer is entirely hidden from view. The monitor displays an image that constantly changes from a depiction of a newborn child to white noise. The random number generator determines second by second whether a given pixel is part of the image of the child or part of the white noise. The system documents its decisions in real time and is extremely accurate. The laws of probability state that in this random system, the image of the child will be visible 50% of the time. The monitor is the only interface, there are no additional sensors or input devices.

If the results of the Trapholt Experiment correspond to those arrived at by the PEAR Laboratory during the previous twenty years of research, they will be yet further indication that consciousness is not a phenomenon limited to the human brain but one that can transcend physical limits, with the potential to interact with anything in the world. (Skeel and Skriver)

This experiment is the first work of art that attempts to document and measure psi phenomena. Psi research began in earnest in the 1880s through a series of experiments started by the British physicist Sir William Barrett. Psi phenomena are defined as interactions between organisms and their environment, or the environment and organisms, in which it appears that information has been passed, or that an influence has occurred that cannot be understood by conventional scientific explanations of communications and sensorial channels. (Radin, 1997) The research has shown that man is capable of using his consciousness to affect these systems to a slight but nevertheless decisive degree. The research also seems to indicate that the effect works differently with groups than individuals, backwards and forward in time, and over great geographical distances. "The Trapholt Experiment" cleverly exploits a basic human desire to see life and order rather than death and chaos, and sets out to measure whether our innate will for survival can influence our environment.

Although this work does not seem to participate in a system of mutual interaction, as outlined by Licklider, it is of great importance. This research may represent a fourth stage in the development of cybernetics, as it introduces an entirely new channel for information exchange and communication between humans and machines. The "Trapholt Experiment" uses technology in a profound and innovative way, not to augment or extend human consciousness, but to measure the extent to which the boundaries of human consciousness are not known. In Psi phenomena, consciousness only needs amplification to be measured, thus consciousness augments technology, not the other way round. Psi phenomena as a form of wireless communication may be of profound importance to the future development of interactive, synnoetic interfaces, augmented, distributed minds, as well as to a new, undefined context for aesthetic experience.
What is important to an understanding of how interactivity in art can meet its full potential is the shift from what N. Katherine Hayles describes as a focus on the silicon/information transfer side of the interactive equation to a focus on the poetic evolution of the human subject. One could argue that this factor, poetic

evolution, is the most important criterion for success in a work of art. The need for human focus comes into high relief in technologically mediated artworks, as the technological demands to maintain machine homeostatis are so great, and because information appears to have "lost its body." In the case of distributed, biometric and anomalous interactivities, information spirals through the cybernetic exchange, from organic to the inorganic and back, while remaining grounded in human intentionality and perception. The grounding of information in the human will-to-consciousness gives information back its body, and re-orients the focus of cybernetic discourse. The question becomes how can the human will-to-consciousness extend our technological systems, not how can technology be a vehicle for consciousness. Experiments co-joining late stage cybernetics, human biometrics, psi phenomena, and aesthetic interactivity represent a new vehicle for the evolution of human sentience that conditions a new outcome, or object of inquiry. This new condition is neither art nor science, but a cumulative transformation of the discourses of both; a transformation that celebrates human connectivity and the will to survive.

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