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Inside Out, Outside In: Recursive Dynamics in Posthumanism and in Nam June Paik's Artworks

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ARTWORKS

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Among the many admirable qualities of Nam June Paik's artistic vision — its creativity, playfulness, and visionary reach — two are particularly important for the emerging field of posthumanist studies. From the beginning, Paik presented media and computational technologies as deeply enmeshed with our evolving sense of what being human means. But he did not present this simply as a cultural fact; rather, he sought to position humans in relation to media technologies as active agents capable not only of representing but also of intervening (as Ian Hacking put it), modifying, changing, and transforming the technology even as it transforms us. This recursive dynamic, explicit in several of his works, has deep connections with current models of human consciousness. It is also highlighted in contemporary theories about the posthuman and in theoretical and empirical scientific work that undergird much posthumanist thought. We might say that Nam June Paik's art was posthumanist *avant la lettre*, performing a symbiotic dance between artificial and human bodies that reveal their interrelationships.

What is posthumanism?

A founding assumption of posthumanism is that “the human” has been understood in various ways in different historical periods and cultures; it is thus historically, culturally, and linguistically specific. In the West, a dominant understanding of the “human” was inherited from the European Enlightenment, which understood the defining characteristics of the human to be rationality (in contrast to animals), free will, autonomy (understood in liberal political economy as the right to own oneself and thus one's labor, the source of economy value) and, above all, to be a conscious being capable of thought, reflection, and ethical action. Together, these characteristics have been labeled the “liberal humanist subject.”

By mid-twentieth century, this constellation began to come under fire, as cybernetics, robotics, artificial intelligence, artificial life, and virtual reality in different ways challenged these assumptions. This opened the door for new configurations to be proposed, often by theorists who believed that the liberal humanist subject, under the guise of a false universalism, was complicit in the oppressive practices that imperialist and colonial powers had wrecked upon less technologically developed societies. The “post” in these configurations typically had a double meaning, functioning

both as a successor ideology that displaced its predecessor, and as a historical marker meaning “that which comes after,” without necessarily displacing the prior constellation in part for full.

Similarly, the “post” was also interpreted as pointing to two very different futures for humans. In one, humans were envisioned as riding a wave of a technoscientific development in which the conditions of human life would be radically altered (for example, by uploading consciousness into a computer or by developing artificial intelligences so powerful they would take over human society), a position often called “transhumanism.” In contrast, another kind of interpretation envisioned a future in which “human rights” were separated from the “liberal humanist subject” and extended to decolonial subjects, nonhuman animals, and other kinds of subjects that had been historically marginalized or considered less than human. In short, posthumanism functioned as a kind of intellectual free-for-all in which contrasting visions of different human futures and competing political and social ideologies were wrestling for the meaning of the term and using it to further both utopian and dystopian arguments about its significance.

Understanding the complexities of these different vectors makes clear that “posthuman” cannot simply be taken to mean “against the human.” Indeed, in the new millennium, the posthumanities have more often been taken to signify liberatory potentials that were suppressed or ignored in Enlightenment versions of the human. It is with these more optimistic versions of the posthumanities that Paik’s artwork has the strongest connections.

Like the transhumanists, Paik saw that technologies, especially TV and video, were not merely neutral conveyors of information but were deeply involved in changing the underlying conditions of human life and thus of what the “human” means. Like the more utopian visions, he saw in media technologies new possibilities for creativity, self-fashioning, and joyful participation. On a deep level, he intuitively realized that both of these possibilities — being affected by the technologies on the one hand, and artfully appropriating them to different ends on the other — were not separate projects but were in fact entwined. Each fed into the other, so that having a self being changed by the technologies and using the self to change the technologies, were both part of the same recursive dynamic. As we will see, this vision has profound affinities

with the posthumanities as they have evolved in the twenty-first century.

Recursive Dynamics in Paik's Artworks

Two works — one early, the other mid-career — illustrate aspects of Paik's vision that connect strongly with posthumanism. The latter is a photograph entitled *Portrait of Nam June Paik*, shot in 1981 by Lim Youngkyun in New York City. The image is framed by a television set, from which the cathode ray tube has been removed and replaced by a torn black plastic sheet with Paik's face peering through; his hands and arms can be seen grasping the TV set from the outside. The image gestures toward the interaction through which we are formed by the TV we watch (culturally, linguistically, neurologically), but at the same time, the alterations done on the object indicate we have the power to alter this dynamic, transforming it from the one-to-many model typical of broadcast TV to a more complex recursive practice. This implication is reinforced by Paik's ambiguous location, with his face inside but his arms and hands outside, as if to occupy the positions of subject and object simultaneously.

The artwork with which I want to pair this image is *Magnet TV* [1], an installation from 1965. A powerful magnet sits on top of a TV, showing a display created through the interaction of the TV's electronics with the magnet's electromagnetic field. The installation appears simple, but here appearances are deceiving, because the pattern is not a regular TV program but rather a custom image



[1] Nam June Paik, *Magnet TV*, 1969, Nam June Paik Art Center Collection

created by the artist and then fed into the TV. The implication is clear: although the TV of the 1980s was often depicted as a (literal) black box highly resistant to consumer modifications, the installation showed that it could be hacked for artistic purposes very different from those that the broadcast corporations envisioned. In a sense, this early work foreshadowed Paik's later work with a video synthesizer and his invention of video art as a new form of artistic practice.

Recursive Dynamics in Models of Consciousness

As far back as 1980, Humberto Maturana and Francisco Varela in *Autopoiesis and Cognition* suggested a deep link between recursive dynamics and cognition. That intuition has been brought up to date by Nobel-Prize winner neurologist Gerald Edelman and his collaborator, Giulio Tonino. They have developed a model of human cognition in which neuronal recursivity is central. They argue that synaptic networks develop in relation to environmental inputs in a process they call "Neural Darwinism," in which networks stimulated by the environment grow and expand, while those not so stimulated shrink and eventually disappear. This process, highlighting the brain's neural plasticity, is called synaptogenesis, and Edelman and Tonino argue it is analogous to natural selection operating at the species level, but now within the individual through a selective winnowing of synaptic networks in relation to environmental stimuli.

In a broader sense, synaptogenesis can be seen as a non-genetic adaptive mechanism that works to increase the fit between an infant and his/her environment. The number of neurons in a baby's brain is of the order of 100 billion cells, and those that survive the synaptogenetic winnowing will make about 100 trillion connections with each other. Calculating the possible permutations of these connections yields a number many orders of magnitude larger than the number of atoms in the universe (the universe contains about 10 to the 70 th power atoms).

Edelman and Tonino have further proposed that the synaptic networks form neuronal clusters, in which neurons in different parts of the brain, and different kinds of neurons, interact much more strongly with each other than with other neurons active at the time. Thus the clusters, which they suggest are the fundamental basis for cognition, are distributed and differential. Moreover, each cluster

operates recursively, with information flowing from synaptic networks up to the cluster, and down from the cluster to different synaptic networks. Each cluster also sends and receives information from other clusters, so that a second level of recursivity is introduced between the meta-cluster networks and the networks within each cluster.

The resulting information loops are so massive and interconnected that Edelman and Tonino chose not to use the term “feedback” but rather invented their own term, “re-entry” (or “reentrant connections”) to describe these multi-leveled recursive processes. Here a clarification may be useful. “Feedback” was originally developed as a concept in mid-century cybernetics, when the emphasis was on an organism’s ability to maintain a stable state, or homeostasis. Feedback mechanisms had been known since classical Greece, but in the twentieth century, the ancient idea of feedback was joined with the new idea of information. It was feedback, twentieth-century cyberneticians proposed, that enabled living organisms to maintain their temperature, blood pressure, etc. in the ranges consistent with life, and these feedback mechanisms could be simulated in mechanical devices such as the Bedbug (a machine that avoided light) and the Moth (a device that sought out light).

Edelman and Tonino’s idea of recursion differs from feedback in the massive amounts of information involved, and more crucially because the recursive dynamics do not merely maintain a steady state. On the contrary, in recursion, the feedback effect operates so as to change the structure of the neuronal circuits and thus allow the brain to adapt and evolve beyond what a steady state could do. These recursive dynamics are what allow a brain to learn. The brain’s recursive potential is clearly on display in the case of stroke victims, who over time can partially recover part of their lost functionality with carefully directed physical therapy. In these instances, the brain is using the power of recursion to develop new neuronal pathways to perform some of the functions previously done by the damaged pathways.

Fully recognizing the remarkable potential of recursion, Edelman and Tonino also relate it to the emergence of consciousness. They postulate that the brain’s recursive architecture, with its trillions and trillions of possible combinations, is why humans have a more extensive and highly developed form of consciousness than other



species. Edelman concludes, “there is no other object in the known universe so completely distinguished by reentrant circuitry as the human brain.”¹ In this view consciousness, the putative seat of human identity, is possible only because of massive recursivity with the brain’s neuronal architecture.

Representing Cognitive Recursivity:
Paik’s *TV Buddha* and *TV Rodin*

In Paik’s *TV Buddha* (1974) [21], a statue of Buddha sits facing a closed circuit TV set, on which is displayed an image of the same sitting Buddha. The statue, in a meditative pose, is positioned so as to appear to regard its mediated representation. But this is repetition with a difference, because technical media have now become co-presenters with the statue itself. Insofar as the pose suggests cognitive activity, that cognition is blended with the electrodynamics of the TV circuit and camera. Moreover, since the screen is refreshed at regular intervals, the interaction between statue, image, and TV circuit can be seen as a continuous dynamic in which the Buddha contemplates its image, which changes its contemplation, which

1 Gerald Edelman: “From Brain Dynamics to Consciousness: A Prelude to the Future of Brain-Based Devices”, Video,

IBM Lecture on Cognitive Computing, June 2006.

generates a new image, and so forth. Of course, since the Buddha is an inanimate object rather than a living being, this is a gesture toward cognitive recursion rather than the thing itself, which is to say, it is art commenting on life as a recursive cycle of meditation/reflection.

The conjunction of traditional Eastern thought and Western technology in this installation is not as unusual as it may seem. R. John Williams, in *The Buddha in the Machine: Art, Technology, and the Meeting of East and West*, documents that throughout the twentieth century, starting with the 1893 Chicago World's Fair, artists, poets and writers turned to Eastern ideals, signified by the Buddha, as an antidote for fears of Western runaway technologies. Their purpose was not so much to abandon modernity, Williams argues, as to invoke Eastern *technê* as a mode that made living with technology bearable. Robert M. Pirsig's *Zen and the Art of Motorcycle Maintenance* (an important book for me personally) made a slightly different argument in proposing that both technological rationality and Zen-like intuition were necessary for what Phaedrus, his protagonist, calls "Quality."

A similar recursive dynamic is instantiated in Paik's *TV Rodin* (1976–78). A small reproduction of Rodin's famous sculpture *The Thinker*, head in palm, sits on a on a small white cube, staring slightly down into a closed circuit TV displaying his image. The relative sizes here are important; whereas Rodin's seated original was 73 inches high (and thus more than life-size), here the statue is only slightly larger than the small TV, with both the statue's white cube and the TV sitting on the same much larger white cube. Moreover, the closed circuit camera is clearly visible, located on a tripod to bring it up to the statue's level and occupying about the same floor space volume as the large white cube. The spatial arrangement makes clear that statue, TV and camera are all part of the same circuit, continuously interacting in an imaginary space in which *The Thinker* thinks the thoughts that the camera records and the TV displays, which leads to new thoughts, in a recursive cycle that never ends. Already highly mediated as a result of its instantiations in different cultures, various sizes, different reproductive materials, and diverse contexts, *The Thinker* in this version is inextricably bound together with the mediatized commodity it has always already become.

Recursivity in Systems Theory

We have seen that Edelman's model of consciousness connects it

strongly with recursive dynamics; we have also explored the ways in which Paik plays on cognitive recursivity in his artworks. The other major site in posthumanist theory where recursivity plays a critical role is in systems theory. Almost all versions of systems theory, from Ludwig Bertalanfy's formulation of General Systems Theory in the 1930s to Niklas Luhmann's theory of social systems in the 1980s and 1990s, recognize that systems exist in the context of environments, and that the first gesture in analyzing a system is making a "cut" (as Luhmann calls it) that distinguishes between the system and its environment. The other founding principle of any systems theory is that all the components of a system interact with one another, exchanging information and communication as well as energetic and material resources. Bertalanfy was interested in applying systems theory to individuals; he also thought it had applications to social systems, but his work in this direction did not progress very far because of the complex issues involved. Building on his research but also departing from it, Luhmann developed a theory of social systems that started from the premise that a system is informationally closed. He then developed a model in which a system is situated with an environment many orders of magnitude more complex than the system itself. Confronted with this complexity, the system strives to recreate, within itself, some of this complexity to avoid being overwhelmed and breaking down. As a result, the environmental complexity has the effect of stimulating an increase in the system's internal complexity. However, it is important to recognize that this effect is indirect; it is precisely because the system strives to preserve its boundaries intact, thus preserving its informational closure, that it engages in increasing its internal complexity. It does this, according to Luhmann, through multi-levelled acts of differentiation, dividing its interior space into sub-systems which in turn divide into more sub-systems, each of which interacts with other components on its level as well as with components above and below its level. The resulting recursive dynamics can be modeled as part/whole relations, in which the whole interacts with the parts while simultaneously the parts interact with and constitute the whole. With a focus on social systems such as law, economics, and so forth, Luhmann's systems theory barely takes note of individuals at all.

From a different perspective, however, we may recognize that the kind of recursive dynamics at work here bears a family

resemblance to the dynamics responsible for the generation of consciousness in Edelman and Tonino's model. There too, the recursive dynamics of reentrant connections emerge in response to environmental complexity always much greater than the individual organism. Thus the brain's development of synaptic networks and neuronal clusters can be seen as an attempt by the organism to deal with this greater complexity by re-creating, in a different mode, some of that complexity in the brain's internal structure.

Cary Wolfe, in *What Is Posthumanism?*, has proposed a novel synthesis of Luhmann's systems theory with Derrida's grammatology. The details of this synthesis are beyond the scope of this essay's purview, but the important point for our purposes is that Wolfe identifies the recursive dynamics of the Luhmannian system as the essence of the posthuman. From this platform, he launches a wide-ranging critique showing that the recursive dynamics of Derridean deconstruction and Luhmann's systems theory work together to challenge binaries crucial to the formation of the liberal humanist subject, including human/animal, rational/intuitive, language-using/non-language-using, and so forth.

A limitation of Wolfe's approach, both in my view and in relation to Paik's artwork, is its erasure of technology as an active force challenging the liberal humanist subject and catalyzing the formation of a new and different version of the "human." For Wolfe, cultural and historical specificity enters into posthuman recursive dynamics only in a secondary sense, by influencing the kind of sub-systems that develop. The main mechanism of recursive dynamics, however, is for him transhistorical, presumably existing virtually unchanged since the beginning of the human species. This view leaves out of account the possibility that new cultural and technological conditions can affect the recursive processes themselves, changing not only what emerges but how the process of emergence operates in itself.

Paik's Electronic Superhighway:
Recursion as Transformation

Electronic Superhighway: Continental U.S., Alaska, Hawaii illustrates how recursion performs within one of Paik's artworks, setting up a dynamic between increasing complexities and flattening simplifications. This is perhaps the most technologically elaborate

of Paik's installations, comprising fifty-one channel videos, custom electronics, steel and wood underlying structures, and accompanying audio. The work stands a monumental 15 high, 40 feet wide and four feet deep. It is in the shape of a map of the U.S., with state boundaries lines outlined in glowing white light; within each state perimeter, multiple video screens play clips from historically and politically significant moments as well as banalities typical of broadcast TV. The first impression is of enormous complexity, and in this sense, the artwork as system can be understood as reproducing within itself a reflection of the greater complexity of the U.S. as its exterior environment, an impression reinforced by the cacophony of sound as each monitor plays its accompanying audio. Moreover, the clips on the TVs gesture toward the invisible electromagnetic waves mediating their contents, a perception underscored by the work's title.

One of the advantages of a systems theory perspective is that one can always change what counts as the system and environment, thus creating new insights into the systemic dynamics. Performing such a reversal, we can consider the work as the environment observed by the viewer, who now counts as the system. What the viewer sees is a very complex installation containing videos in which these complexities are flattened into sound bites. As William Burroughs observed of heroin, "The junk merchant doesn't sell his product to the consumer, he sells the consumer to his product. He does not improve and simplify his merchandise. He degrades and simplifies the client."² In similar fashion, broadcast television can be said to simplify the viewer so that the viewer will be more likely to become addicted to TV's simplifications. By incorporating this dynamic into its larger complexities, the installation reverses this procedure, building complexities within the viewer's cognitions through the multiple recursive processes through which the active viewer interacts with the work.

Given the relatively early date of the work (1995), most contemporary viewers would be likely to have only a vague sense of what the term "electronic superhighway" might mean, with little

² "Letter from a Master Addict to Dangerous Drugs", written in 1956, first published in *The British Journal of Addiction*, Vol. 52,

No. 2 (January 1957), p. 1 and later used as footnotes in *Naked Lunch*.

sense of how the internet would explode exponentially over the next two decades to become a major technological force within the emerging global culture that it was largely responsible for creating. In its prescient vision, *Electronic Superhighway* prepares the viewer for this future, seeking to create internal complexities adequate to deal with the issues of control, surveillance and freedom that inevitably arise as technical mediation grows more intense, sophisticated, and pervasive.

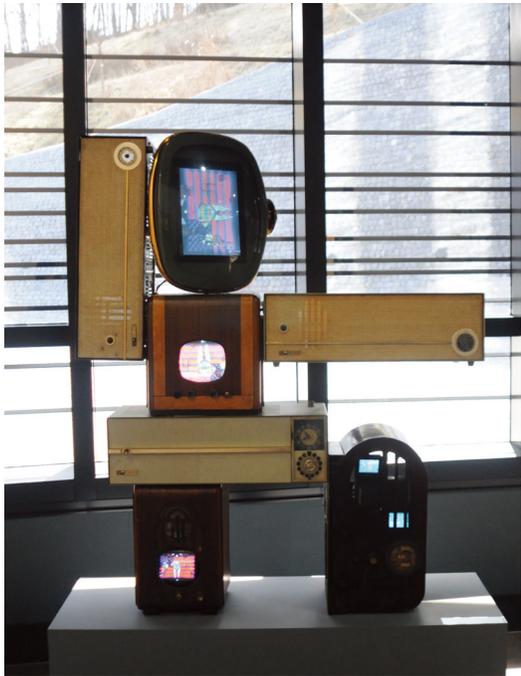
Recursive Dynamics, Artificial Intelligence, and Family of Robot

One of the great achievements of the twentieth century is the exteriorization of cognition. Prior to the nineteenth century, cognition only existed in biological lifeforms. Building on such early attempts at artificial intelligence as Charles Babbage's Analytical Engine, ambitious programs to build artificial intelligences at mid-twentieth century flourished at MIT, Stanford University, and elsewhere. A leap forward occurred with the development of neural networks, which use a system of nodes communicating with each other to mimic synaptic networks in human and animal brains. Unlike earlier versions of artificial intelligence, neural networks are engineered to use recursive dynamics in processes that not only use the output of a previous trial as input for the next (that is, feedback), but in addition change the various "weights" of the nodes, resulting to changes in the structure of the network itself. Neural nets are now used in many artificial intelligence systems, including machine translations, speech recognition, computer vision, and social networks. A stunning recent example is AlphaGo, the neural net that recently beat the human Go champions, Lee Sedol in 2016 and Ke Jie in 2017. Now DeepMind, the company that developed AlphaGo (recently acquired by Google), has developed a new version that "learns from scratch," AlphaGoZero.

Whereas AlphaGo was trained on many human-played games as examples, its successor uses no human input at all, starting only with the basic rules of the game. Then it plays against itself and learns strategies through trial and error. At three hours, AlphaGoZero was at the level of a beginning player, focusing on immediate advances rather than long-term strategies; at 19 hours it had advanced to an intermediate level, able to evolve and pursue long-term goals; and at 70 hours, it was playing at a superhuman



[3] Nam June Paik, *Charlie Chaplin*, 2002, Nam June Paik Art Center Collection



[4] Nam June Paik, *Bob Hope*, 2001, Nam June Paik Art Center Collection

level, able to beat AlphaGo 100 games to 0, and arguably becoming the best Go player on the planet.

Working at a time when neural nets were in their infancy, Paik nevertheless understood with uncanny prescience how artificial intelligences would participate in the same recursive dynamics as human brains. The artwork that perhaps shows this most clearly is *Family of Robot*, sculptures of a “robot family” including parents, grandparents, and a baby. The sculptures are similar to anthropomorphic and zoomorphic sculptures Paik also developed such as *Charlie Chaplin* [3] and *Bob Hope* [4] but rather than suggesting a human form, the robot family uses inset TV monitors and other media objects to suggest robotic architectures. Moreover, the kind of media used to create the form follow the same age trajectory as the robots themselves; for the grandparents, large wood cabinets are used, while for the baby, plastic encased TV sets of modern design. The implication is that media, like bodies, become obsolete and show their age.

Thinking about the role of cognition in these sculptures, we can say that first cognition moves outward from humans into artificial life forms, during which it is transformed through its mediation by many technical media, including networked and programmable machines. Once externalized, the mediated forms of cognition move back inward to affect human cognition (neurologically through brain plasticity and synaptogenesis, culturally through memes, etc.). We can call this dynamic “inward out, outward in.” At the same time, recursive processes also deeply affect sites of externalized cognition, here signified by *Family of Robot*, not only penetrating their bodies but actually comprising the bodies themselves.

When the installation is seen by human viewers, they react in ways that further change their own internal neurological structures. Thus the process is recursively repeated in a dizzying cycles of mutual influences until the boundaries that once seemed so secure between “natural” and “artificial” cognition are destabilized. We can call this dynamic “in/out/out/in/in/out/out/in...,” like a Möbius strip in which the inner surface becomes the outer surface becomes the inner... Posthuman studies and Paik’s artwork thus mutually illuminate one another, connecting most strongly through the recursive dynamics that both rely on to achieve and express their deepest insight.