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General systems theory and media ecology: Parallel disciplines that animate each other

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General Systems Theory and Media Ecology: Parallel Disciplines that Inform Each Other

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Introduction - General systems theory (allgemeine systemtheorie) was pursued by a number of thinkers but its origins seems to date back to 1928 and the biological work of Ludwig von Bertalanffy's PhD thesis. There are many definitions of a general system but in essence a general system is one that is composed of interacting and interrelated components such that an understanding of it must entail considering the general system as a whole and not as a collection of individual components. The behaviour of the individual components of a general system can only be understood in the context of the whole system and not in isolation and hence general system theory is opposed to reductionism whether of a Cartesian or Newtonian origin. As is often the case by taking a systemic approach there are often unintended consequences that an analysis of individual components would yield. General systems theory therefore includes complexity theory, emergent dynamics, cybernetics, control theory, dynamic systems theory, biological ecology, and media ecology. The focus of this essay is to consider the parallels of the different forms of general systems theory with media ecology and consider how they inform each other.

The general systems approach is an ecological approach since an ecosystem is obviously a general system. From a media ecology perspective in which we consider, as first suggested by Marshall McLuhan (1964), that the medium is the message a general system is a medium and its message is the non-linear interactions of the components of the system. McLuhan wrote, "A new medium is never an addition to an old one, nor does it leave the old one in peace. It never ceases to oppress the older media until it finds new shapes and positions for them (McLuhan 1964, 174)." The same applies to a general system; each element of a general system or ecosystem impacts all the other components of the system. The message of the general system is the dynamics and cross impacts of its components and not the behavior of the individual members of the system. So the medium is the general system is the message.

General systems theory and cybernetics are very closely related and in a certain sense inform and cross-pollinate each other to such a degree that some regard them as slightly different formulations of the same interdisciplinary practice. One may also include in this mix emergent dynamics or complexity theory as this approach also consider a system as more than its components with the added

feature that it explicitly entails the notion that the supervenient system possesses properties that none of its components possess. In other words, the systems as a whole has unintended consequences that analysis of its components would not reveal. Emergent dynamics and complexity theory grew out of the general systems approach when computing techniques allowed scientists to deal with non-linear equations and hence as a result were able to model general systems in which the interactions among the components of a system were non-linear.

The connection between General System Theory and complexity theory or emergent dynamics has been traced by Peter Corning (2002). Earlier forms of emergence in the modern era date back to George Henry Lewes (1875), the scholar who first used the term 'emergence' that was picked up by a number of scholars particularly emergent evolutionists whose work went into disfavor with "the rise of the science of genetics in the 1920s and 1930s and the triumph of an analytical, experimental approach to biology (Corning 2002)." Emergence in the form of General Systems Theory began to make a comeback during the time McLuhan was beginning his research. According to Corning (ibid.):

A much broader reaffirmation of the importance of wholes in nature occurred in the 1950s with the rise of "general systems theory." Inspired especially by the writings of biologist Ludwig von Bertalanffy, the systems movement was to that era what complexity theory is today.

But it was only in the 1980s after the passing of Ludwig von Bertalanffy in 1972 and Marshall McLuhan in 1980 that the ideas of General Systems Theory evolved into complexity theory and emergent dynamics. As Corning (2002) noted: "The re-emergence of emergence as a legitimate, mainstream concept... roughly coincided with the growth of scientific interest in the phenomenon of complexity and the development of new, non-linear mathematical tools — particularly chaos theory and dynamical systems theory — which allowed scientists to model the interactions within complex, dynamic systems in new and insightful ways."

The purpose of this essay is to argue that cybernetics, general systems theory, complexity theory, emergent dynamics and media ecology are interconnected and that they inform and cross-pollinate each other. Elsewhere (Logan 2013) I have argued that Marshall McLuhan, the father of media ecology, is a systems thinker who was a forerunner of emergent dynamics or complexity theory.

Although McLuhan never discussed emergence explicitly I will argue that his field approach, his reversal of cause and effect and the non-linear interaction of figure and ground that are the trademarks of the McLuhan approach are best understood as downward and upward causation between an emergent system and the components of which it is composed and as such hints at emergence... In *Understanding Media* McLuhan (1964) developed the notion of a field associated with

electric information, which he related to the electric field. The field notion was a key concept and organizing principle for McLuhan in his understanding of the post-Gutenberg world, which he viewed as “a total field of interacting events (ibid., 248).” A field approach implies an ecological approach. An ecosystem can only be treated and described with a field approach. McLuhan without explicitly making use of complexity theory and emergence was basically applying that kind of thinking to his analysis of communications and the impact of technology. McLuhan’s recognition of the non-linear dynamic aspect of the relationship between media and society in a certain sense foreshadowed the notions of non-linear dynamics, co-evolution and complexity or strong emergence theory and to a certain extent chaos theory.

I am not suggesting that McLuhan played any role in the development of emergence and complexity theory but rather that in his non-mathematical approach to understanding media and their effects he independently developed ideas that paralleled complexity work in physics, biology and economics. There is a hint of emergence or complexity theory in a 1955 paper of McLuhan (1955) in which he wrote, “It is therefore, a simple maxim of communication study that any change in the means of communication will produce a chain of revolutionary consequences at every level of culture and politics. And because of the complexity of the components in this process, predictions and controls are not possible.” I find this passage quite prescient because one of the basic tenets of complexity theory is that complex non-linear systems have properties not possessed by the components of which they are composed and it is impossible to predict those properties in advance. (Logan 2013)

My plan is to juxtapose the work of McLuhan against a number of representatives of the general systems thinking including **Ludwig von Bertalanffy**, the father of general systems theory; **Norbert Wiener**, the father of cybernetics; Warren McCulloch, the founder of the Macy Conferences on Cybernetics, Heinz von Foerster, Ross Ashby who introduced the notion of requisite variety, Stafford Beer, father of management cybernetics, Gordon Pask, Gregory Bateson, Dennis Gabor, Kenneth Boulding, Ivan Illich, Buckminster Fuller, I. A. Richards, who coined the notion of feedforward and was one of McLuhan’s professors in Cambridge and Arthur Porter, who was a systems thinker, Chair of Industrial Engineering at the University of Toronto, one of the founding members of McLuhan’s Centre for Culture and Technology, and was the Acting Director of the Centre while McLuhan was on sabbatical in 1967 at Fordham University.

First I want to establish that McLuhan was influenced by a number of systems thinkers who he read very carefully, that he had a good grasp of general systems thinking and that he himself was a systems thinker.

Secondly, I want to establish that systems thinkers and cyberneticians read McLuhan and/or were keenly interested in media and communications and like McLuhan were more concerned with the effects of media rather than the particular content of any particular medium.

McLuhan as Systems Thinker

McLuhan had an uncanny grasp of technical matters like systems thinking, information theory and even physics. He often astounded me with his deep understanding of quantum mechanics and relativity. Arthur Porter had a similar reaction to mine when he discussed his field of expertise, information theory, with McLuhan. He is reported to have said, "When he made certain assertions, for example, I thought, that's queer. He understands information theory. How can a professor of English understand information theory—which is a highly mathematical, technical theory (Marchand 1989, 141)?" We know McLuhan read the systems theory and cybernetic literature. One explanation is that McLuhan's working library, now housed in the Fisher Rare Book Library-U of Toronto contains many general systems theory books that are heavily annotated and the reading lists for his courses also included the general systems theory literature.

Here are some samples from McLuhan's writing where he refers to cybernetics and general systems theory:

"Continued in their present patterns of fragmented unrelation, our school curricula will insure a citizenry unable to understand the cybernated world in which they live (McLuhan 1964, 374)."

In his book *War and Peace in the Global Village* (McLuhan, Fiore and Angel 1968), McLuhan refers explicitly to the general systems theory work of von Bertalanffy, which is a hint of McLuhan's interest in systems theory. We also know that McLuhan was familiar with the work of Norbert Wiener.

McLuhan made use of a field approach, which de facto rejects the notion of a linear cause and effect model that characterizes naïve "technological determinism." He wrote, "The electric age gave us the means of instant, total field-awareness." Describing the effects of electric media he wrote the following passage which parallels general system theory, "We live today in the Age of Information and Communication because electric media instantly and constantly create a total field of interacting events in which all men participate (McLuhan 1964, 248)." McLuhan adopted a "total-field-theory approach," which I believe was influenced by his understanding of modern 20th century science as the following passage suggests: "All types of linear approaches to situations past, present, or future are useless. Already in the sciences there is recognition of the need for a unified field theory,

which enable scientists to use one continuous set of terms by way of relating the various scientific universes (McLuhan 1953, 126)."

McLuhan's stress on pattern recognition is an integral part of the approach of complexity theory and general system theory. McLuhan's emphasis on a field approach rather than a linear sequential, one thing at a time, mechanistic approach translates into an anti-reductionist stance, which is at the heart of complexity theory with its focus on non-linear dynamics. McLuhan was totally opposed to the point of view or the reductionist "single vision of Newton".

An idea that McLuhan and Innis introduced into media studies was the notion that media and technology play a dynamic role in economics, politics, society, and culture. Rather than viewing media as passive conduits for carrying information or communicating ideas McLuhan asserted that media act as "living vortices of power creating hidden environments (and effects) that act abrasively and destructively on older forms of culture (McLuhan 1972, v)." This is clearly a general systems way of thinking as is his multidisciplinary style and his notion that media create new social patterns and restructure perceptions. I would also suggest that McLuhan's Laws of Media (LOM) are a general systems approach to the effects of media.

McLuhan's media ecology approach is essentially a systems thinking approach that incorporates the notion that the interactions of the media among themselves is non-linear, i.e. "causes and effects merge instantaneously." Environments, ecosystems or ecologies by the very nature of their non-linear dynamics are emergent systems. "Environments are not just containers, but are processes that change the content totally (McLuhan, E. and Zingrone 1995, 273)."

The Media and Communication Dimension of General Systems Theory and Cybernetics

- **Ludwig von Bertalanffy** was a biologist who in 1928 developed a new approach to science known as general systems theory. He believed that the reductionist approach physics was not suited to the study of biology and hence by extension they were not suited to social studies primarily because of their non-linearity. Bertalanffy stressed holism over reductionism and organism over mechanism. Marshall McLuhan's approach and that of media ecology incorporates all of these aspects of Bertalanffy's General Systems approach.

"The characteristic of the organism is first that it is more than the sum of its parts and second that the single processes are ordered for the maintenance of the whole." McLuhan's notion of figure/ground parallels this insight of Bertalanffy.

"Mechanism... provides us with no grasp of the specific characteristics of organisms, of the organization of organic processes among one another, of organic 'wholeness', of the problem of the origin of organic 'teleology', or of the historical

character of organisms... We must therefore try to establish a new standpoint which — as opposed to mechanism — takes account of organic wholeness, but... treats it in a manner which admits of scientific investigation.”-Bertalanffy

This insight of Bertalanffy translates into McLuhan’s understanding that with electric information we must think in terms of acoustic space rather than the mechanistic and linear visual space of literacy and industrialization.

“From the physical point of view the characteristic state of the living organism is that of an open system.” McLuhan parallels this insight with his thinking about communication as an open system that depends on both the content of a medium and the effects of the medium independent of its content.

“It is necessary to study not only parts and processes in isolation, but also to solve the decisive problems found in organization and order unifying them, resulting from dynamic interaction of parts, and making the behaviour of the parts different when studied in isolation or within the whole.”- Bertalanffy

McLuhan’s figure/ground and reversal of cause and effect parallels this insight of Bertalanffy.

I am not suggesting there is a direct causal relationship between Bertalanffy and McLuhan but the parallels of their thinking are interesting especially given the fact that they read each others works and cross-referenced each other. It is also the case that McLuhan was interested in systems thinking and Bertalanffy was interested in communications:

“The general notion in communication theory is that of information. In many cases, the flow of information corresponds to a flow of energy, e.g. if light waves emitted by some objects reach the eye or a photoelectric cell, elicit some reaction of the organism or some machinery, and thus convey information.” - Bertalanffy

• **Norbert Wiener’s** in his book *Cybernetics: Or Control and Communication in the Animal and the Machine* defined cybernetics as the science of “communication and control in the animal and the machine” is another link between cybernetics and media studies.

“McLuhan... was deeply influenced by the vision of the social role of communication outlined in Wiener's 1950 volume *The Human Use of Human Beings*. McLuhan began reading the work of other cyberneticians, and in 1951 he took up Jürgen Ruesch and Gregory Bateson's *Communication: The Social Matrix of Psychiatry*. According to Ruesch and Bateson, the self that was the subject of psychiatry was enmeshed in and largely shaped by a complex web of information exchange. In keeping with Wiener's cybernetics, they

viewed social life as a system of communication and the individual as both a key element within that system and a system in his or her own right." (Fred Turner, *Stewart Brand Meets the Cybernetic Counterculture*.

www.edge.org/3rd_culture/turner06/turner06_index.html)

- **Gordon Pask** was a cybernetician and psychologist whose research focused on communication and media as evidenced by the following three aspects of his research.

1. Conversation Theory
2. Interactions of Actors Theory
3. His work with educational technology that led to the publication of "Minds and Media in Education and Entertainment" (Pask 1977). He defined cybernetics as information flows "in all media" from stars to brains.

- **Gregory Bateson** was a cybernetician, anthropologist and information theorist. Communications and relations or interactions between and among people were a key part of Bateson's anthropological studies, his study of schizophrenia and his work in information theory. His definition of information as "a difference that makes a difference" is a classic. His book *Steps to an Ecology of the Mind* was in McLuhan's working library and was read and annotated by McLuhan.

- Heinz von Foerster (2002, 196) saw a connection between General System Theory and communications:

The so-called "communication channels", the "mass media" are only one-way: they talk, but nobody can talk back. The feedback loop is missing and, hence, the system is out of control. What cybernetics could supply is, of course, a universally accessible social input device. My program... is the proposal: "communication is recursion," Communication is the Eigen behavior of a recursively operating system that is doubly closed onto itself.

- **Dennis Gabor's** call to action is another link between cybernetics and media studies: "Cyberneticians of the world, unite!" Without communication there is no regulation; without regulation there is no goal; and without a goal the concept of "society" or "system" becomes void.

- **Stafford Beer** was a management cybernetician. Communication was a key element of his approach. He worked with the President of Chile, Salvador Allende, to create a decision support system for the management of Chile's national economy. The Operations Room was a physical location where economic information was to be received, stored, and made available for speedy decision-making. It was designed in accordance with Gestalt principles in order to give users a platform that would enable them to absorb information in a simple but comprehensive way. Stafford Beer was interested in McLuhan's work. His personal library contained a number of McLuhan's books. Later in his life when he moved to

Toronto he became the Distinguished Cybernetician in Residence at the University of Toronto in the McLuhan Program circa 1984. I worked with Stafford during that time and was one of the co-founders of the Stafford Beer Foundation formed to promote his work in association with McLuhan's

- **Ivan Illich** was another systems thinker and social critic who focused on the negative impacts of the education system, industrial technology and the medical system, each of which according to him made people dependent on large institutions and as a consequence impoverished them especially in the Third World. He was influenced by McLuhan, as I discovered when I spent 3 months with him in Cuernavaca Mexico in the spring of 1974 at the CIDOC Institute that he founded. When Illich visited Toronto three years later he contacted me and asked me to arrange a meeting with him and McLuhan, which I had the privilege of participating in. Illich was thrilled with the meeting as he related to me the next day.

- **Buckminster Fuller** was a systems thinker, designer, inventor and environmentalist. Although he taught at a number of universities, he was more of an activist and businessman than an academic. He is most famous for his development of geodesic domes and his environmental notion of the Spaceship Earth. McLuhan made use of Fuller's spaceship earth metaphor when he wrote, "There are no passengers on spaceship earth. We are all crew." Fuller and McLuhan were buddies spending much time together on the famous summer ship cruises organized by Constantine Dioxides. Fuller claimed that on their first cruise together McLuhan told him that he was a Fuller disciple. The story maybe true or perhaps Fuller would like to think that McLuhan was his disciple. In my opinion McLuhan was his disciple in the same way he was the disciple of all the thinkers that influenced him.

- **Kenneth Boulding** was a systems thinker who focused on economics and sociology. In his book *Ecodynamics: A New Theory of Societal Evolution* (Boulding 1978) he developed a general systems approach in which he underscored the necessity to study economic and general behaviour in both the spiritual and material domains. One of Boulding's concepts that McLuhan made great use of was the idea of a break boundary that Boulding described as the boundaries between two technological orders and their subsequent social patterns. He wrote, "*break boundaries* [are the point] at which [a] system suddenly changes into another or passes some point of no return in its dynamic processes (Boulding 1961)." McLuhan has identified two major break boundaries, namely the one between the oral pre-literate society and literate culture and a second between literate culture and the electric age. In addition he regarded a number of other significant shifts as break boundaries including the introduction of phonetic writing, the phonetic alphabet, deductive logic, and the printing press. In terms of electric media each new medium such as the telegraph, the telephone, the phonograph, radio, television and computers was also treated in *Understanding Media* as significant break boundaries each creating its own unique break in culture and social

patterns. The emergence of today's digital media represents another break boundary.

I. A. Richards, one of McLuhan's literary criticism professors at Cambridge was not a card caring cybernetician but he contributed a key concept that was picked up by both Marshall McLuhan and the general field of cybernetics, namely the notion of feedforward. I. A. Richards in a paper he presented to the 1951 Macy Conference on Cybernetics suggested that for speakers to communicate their thoughts accurately they had to feedforward the context of what they were about the talk about.

Richards considered his formulation of feedforward to have been one of his most important accomplishments. In an article entitled *The Secret of "Feedforward"* he was invited to write for the *Saturday Review* summing up his life's work, he wrote,

The process by which any venture of [a] creative sort finds itself, and so pursues its end, is something I have learned, I hope, something about. Indeed, I am not sure I have learned anything else as important... I realize now what a prime role belongs to what I called "feedforward" in all our doings. Feedforward, as I see it, is the reciprocal, the necessary condition of what the cybernetics and automation people call "feedback."

The coining of the term by Richards was no doubt influenced by the term feedback used by cyberneticians and according to the OED first introduced into the English language in 1920. But as Richards pointed out feedforward stands in superficial opposition to feedback. Feedback is basically reactive whereas feedforward is proactive. Feedforward anticipates where one is headed and sets one's goals. Feedback allows one to see how close one gets to their goals. Richards who stressed the importance of providing the context of what one wanted to communicate might have coined the term feedforward to complement the term feedback used by cyberneticians precisely because the audience that he was addressing at the Macy Conference included the man who coined the term cybernetics, namely Norbert Wiener.

The term feedforward was picked up by the cybernetics community and is in common use. It was also used by McLuhan especially in his book *War and Peace in the Global Village: An Inventory of Some of the Current Spastic Situations That Could be Eliminated by More **Feedforward*** (McLuhan 1968).

Poets and artists live on frontiers. They have no feedback, only **feedforward**. They have no identities. They are probes.' (McLuhan 1970, 44).

At instant speeds in our resonant Echoland, it is fatal to "wait and see". Feedback" relying on experience is now too slow. We must know in advance of action. The "**feedforward**" of knowledge based on pattern recognition of process is essential for reprogramming

beyond ideologies. What had always appeared inevitable can thus be bypassed (E. McLuhan and Zingrone 1995, 77).

The technique of cliché-as-probe, by contrast, 'is always at the "interface" of discourse': **'feed[ing]-forward** ... but always engaged in retrieving old clichés from every sphere of human activity' (McLuhan and Watson 1970, 164).

Conclusion: It is obvious from these short vignettes that there was much traffic between the fields of communications and media ecology and the field of general systems theory. In fact we may conclude that general system theory, cybernetics, emergent dynamics, complexity theory and media ecology form a general system of thinking.

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calibrating note that Chapter 1 The Medium is the Message begins on page 7 in the edition I have referenced.)

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