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Flows and nodes: The financial markets as new media environment [1]

“New media are not bridges between man and nature: they are nature.”

Marshall McLuhan

Electronic media provide integral environments that are neither deterministic nor neutral but are influenced by characteristic internal dynamics. However, media are still often thought of as communication channels. These channels transport, faithfully, messages. The telephone system, for example, carries voice from the sender to the receiver. What media add to the message is nothing but noise, which, in an ideal world, could be eliminated resulting in perfect transmission. The classic formulation of such a “transportation theory” of communication was developed by Claude Shannon and Warren Weaver.[2] However, a different approach to communication media, one that could be called a “transformation theory”, has also been developed, most prominently by Marshall McLuhan. One of his central but most misunderstood arguments was that the most important aspect of communication media is that they provide integral cultural environments.[3] An environment is a set of processes that affect virtually everything – people, machines, content – of which it is composed.

Consequently, different media create different environments. They are never neutral. Each medium has specific biases.[4] Media do much more than add noise to the message that is communicated. They create distinct communication patterns, and thereby deeply influence the culture that communicates through them. Harold Innis, in a comparative study of pharaonic Egypt and ancient Greece, observed that writing in stone favours the administration of time through religious elites, while writing on paper

favours the administrations of space through secular elites.[5] This shift, in which the time scale of human cultures became more compressed and their spatial extensions became more expanded, was accelerated and deepened with the proliferation of literacy engendered by the spread of the printing press.

This essay aims to extend this formal approach to media as environments with specific characteristics to computer networks or, as Manuel Castells calls them, “the space of flows.”[6] Does the space of flows exhibit characteristic patterns that are related to the communication media that make up this space? I will approach this question by looking at the global financial markets, the most developed new media environment to date: the foreign exchange markets, for example, quadrupled their volume to \$1.3 trillion per day from 1986-1995. It is in the financial market with their relative lack of content – numbers that represent everything and nothing – that the characteristics of the new media environment can be seen most clearly.

The space of flows

The new electronic media build an integrated environment based on flows of data. With the spread of interactive media – proprietary and open computer networks – this environment provides an increasingly important setting for human action, not just for the few working in the (old) media but for everyone using the (new) media. While this environment has an important material base – skilled people, computers, communication links, the electricity grid – seen from the inside, this materiality slides into the (invisible) background. Intangible flows of data emerge as one of the basic elements of the environment. These flows are produced and processed by a combination of human and machine efforts that can be difficult to distinguish from one another. Flows of data are heterogeneous in their functions: they can serve for communication among people, for control of processes across time and distance, for managing existing information and

for adding value by producing more and new data. Data flows are shaped by nodes, the other basic element of the environment.

Flows tend to be immaterial, nodes tend to be material. Nodes are structures built at the recurrent intersection of different flows of data which they, at the same time, process and (re)direct. Nodes can be machines organized into neural networks or expert systems that process and interpret flows of data. Nodes can also be individual people using their cognitive and expressive abilities or they can consist of combinations of both human and non-human elements, growing into institutions of any size. Financial institutions are classic examples of institutional nodes depending on the constant input of data which they process and feed back into the flow as new data. Nodes are intensifications and consolidations of flows. Thus, they create patterns in the information flow. By doing so nodes maintain themselves and the continuity of the flows. Seen from the outside, nodes are part of the material basis of the environment, seen from the inside, nodes give shape to the flows.

These two elements, flows and nodes, are mutually constitutive, they build upon one another. [7] Flows without elements of structure would be data noise and nodes without flows would dry up. Patterns of flows and nodes provide the stabilization within a potentially fluid environment, which enables navigation and the building of social relationships that rely on a certain degree of predictability and routinization. While the nodes stabilize the flows of data and endow the environment with continuity, they are themselves subject to the dynamics of the environment. These dynamics, however, are not random but specific to each type of environment. They are its bias. In the electronic environment, we can discern, at least, four typical dynamics.

[-] interdependence

[-] change

[-] time-dependence

[-] differentiation

[-] Interdependence

Each node is connected to other nodes through flows of data, that is, through some kind of exchange process. Whereas mechanical machines are isolated from one another, the very nature of the new media environment is its connectedness. The uniqueness of each node is the fact that every node relies on a singular combination of connections to other nodes. This ties them into one large shared environment in which all elements are interdependent. What makes this interdependence so vital is the “material” of the flow: data. Data by itself is useless. It is the node that turns data into information. Information is the relation among pieces of data that arises within the environment. As Gregory Bateson famously put it, information is the difference that makes a difference.[8] Information results from relationships between two otherwise meaningless pieces of data. “The ‘meaning of meaning’ is relationship,” as Marshall McLuhan once said.[9] It is the nodes that process data into information, and feed it back as new data for further nodes to process it. Data and information – one self-contained, the other relational – constitute the same flow, at different stages of processing.

The stock market, arguably the most highly developed electronic environment, illustrates this point daily. Huge amounts of isolated data are turned continuously into relational information. Companies are evaluated in relation to one another, rather than on their independent merits. A change in relationships, for example, a new strategic alliance, or a merger, fundamentally affects how a company is evaluated long before it changes any of its actual behaviour. While this has always been the case to a certain extent, this tendency has recently been greatly amplified, not only by the creation of an environment that can process ever more data ever more quickly, but also by the connection of the stock market to other

informational environments such as the Internet (independent day traders) and TV (specialty channels such as CNNfn). One consequence of this greater interdependence is the financial markets become subject to an ever-increasing number of very complex influences, including psychological ones, whose combination is very unpredictable and increasingly volatile. Hence, volatility becomes a structural feature, rather than an anomaly. [10]

[-] Change

The flow of data does not simply connect two nodes. By connecting they change what they relate. A bridge does not simply couple two independent villages across a river, it creates a new city. Immaterial, flows of data are infinitely malleable. It is their intrinsic property to change direction and quality and can only be partially stabilized by nodes. This characteristic is becoming more visible as the electronic media environment supersedes the environment of paper-based (print) media. Out of changes new relationships arise, bringing into a sudden interdependence what once seemed to be independent and separating what was once closely related. The current wave of mergers and out-sourcing reflects the reorganization of institutional nodes as they struggle to adapt to the changes in data flows.

Change, however, is neither additive nor subtractive in an integrated environment. It is *ecological*. [11] A single change can accelerate into dynamics that lead to total change. If one removes a species from a given habitat, one is not left with the same environment minus that one species: one has created a new environment and reconstituted the conditions of survival. In a similar way, change ripples through an environment of electronic information. New flows of information can change everything. [12] The interdependence of the nodes creates a world in which flows can travel through the entire environment and, according to

the way it is reshaped in each node, they increase or decrease in size or velocity.

In an environment where change is ubiquitous and sudden, the mode of survival is adaptation instead of optimization, which has been the key strategy under linear development in the industrial age. The newest version of a software product is not better because it has fewer bugs, indeed, often it has more bugs, but it is better because it incorporates new capabilities adapting to the fast-paced changes of the environment.

[-] Time-dependence

In an environment where data flows very quickly, at the speed of light through computer networks, and the new interrelations arise as fast as old connections die, time is a central factor in the process. Nothing is fixed, unless it is continuously supported. A server that is no longer maintained disappears with the next crash, which is usually not far away. But this fragility is not primarily on the level of the infrastructure, which has proven to be, overall, quite stable, despite viruses and various kinds of attacks. The fragility of the electronic environment from the speed at which the flows change within the environment. Sometimes this change comes with such a force that entire nodes are unable to adapt and are destroyed. Quick moves in the capital markets can wipe out institutions that were once the foundation of global empires, as the fall of the oldest British merchant bank, Barings Plc., dramatically demonstrated in 1995. In this particular case, the volatility of financial markets was, in part, caused by the volatility of the earth's crust (the Kobe earthquake), a rare coincidence of virtual and natural phenomena.

Data can be turned into valuable information only as long as it is timely. The time span in which information really makes a difference is not intrinsic to the data itself, but is determined by the relation between the node and flow. For the dealer (node) in the capital markets 15 minutes old

quotes (flow) are worthless, for the journalist (node) who prepares the daily summary for a newspaper they (flow) are valid, and for the analyst (node) who tries to develop models for predicting the future movements the quotes of the last couple of years (flow) may be of crucial importance as a testing-ground for his models.

[-] Differentiation

Flows arise between differences, much in the same manner as electricity flows between two poles (+/-), a river flows along differences in height, and wind flows from high to low pressure. In order to shape flows nodes differentiate themselves from the flows upon which they are built.

Information is difference and the nodes are able to attract flows if they can make a difference, that is, as long as they can produce information that is useful for others and in some ways unique. In the electronic environment, differentiation is more important than similarity. There is, theoretically, little need for two companies which provide the exactly same service on the web. Chain stores, identical shops replicated across space, are a concept alien to the electronic environment, even though economies of scale are more influential than ever in markets of increasing returns. [13] Differentiation is the basis for competition and for co-operation. Highly differentiated nodes can group together in order to respond to newly arising opportunities, dissolving their alliance after their common mission is achieved.

Differentiation is reduction of complexity. Data are turned into information according to the inner structure of the node: a bank will process customer data in a different way than a grocery store. The result of that reduction of data, somewhat paradoxically, is more information. This new information, however, is not simply more of the same, it is very specific and customized information. This new and enhanced information is the means through which the flows are redirected, new connections established and old ones maintained. Napster, the service that lets users share music files over the

Internet, is a typical example of differentiation as reduction of complexity. To remedy the difficulty of finding music files on distributed, often outdated servers, Napster lets users share files directly with one another by providing a continuously updated central database of the currently available music. In the most literal sense, this new node (the Napster server) is redirecting massive information flows (the transfer of music files is bandwidth intensive) and threatening the traditional nodes in the flow of music information, the record companies.

The financial markets as a new media environment

These four interlocking characteristics create dynamics that resemble more closely the feedback loops of an organic environment than the linear chain of cause and effect of a mechanical system. The environment of electronic networks – the people, institutions and machinery who are shaped by dependence on the data flows – can be viewed as a gigantic ecological system, a kind of hyper-organism, that holds itself in a fluid balance and changes along its inherent dynamics. And, indeed, applying such a view to financial networks – the most global and complex network currently running – can be very profitable. A growing number of companies are trying to decipher these markets in the same way that meteorologists try to predict the weather, another highly complex system without a center. To understand market behaviour these companies feed massive amounts of information into computer models that make extrapolations of future development based on a purely internal network logic derived from past experience. These models exploit the autonomy that the complex networks have gained from individual actions and that, in turn, allows them to develop their own internal dynamics. Such complex, highly interdependent systems connect a large number of nodes around the globe instantaneously and integrate them into an entity that acts in a quasi-coordinated manner, but without a central control.

The emergence of such a complex integrated global system that appears to act as a unit in real time is directly related to the expansion of information technology and the creation of a new environment. Around the financial markets there is an entire industry that produces and analyzes information. Reuters, for example, produces roughly ten times more data for the financial markets than on political or economic events around the globe. A vast number of nodes analyzes this stream of data and brings it into a form that enables action in the financial markets where one can do only two things: buy and sell, which means moving financial flows either in one direction or the other.

Reuters, among others, supplies the data on the incredible diversity of decisions and motivations, political as well as economical, regional as well as national, which is then translated into information to answer one question: does this hurt or help a certain financial product? The answer is provided by the nodes, in this case the traders and money managers, as they shape flows of money through the system. The action of one node immediately becomes new data for other nodes, as the network coordinates itself in endless feedback loops. It is the nodes that transform data, for example, that a new government policy has been enacted, into information, such as, this is good for the economy: buy assets. This can be observed daily when financial flows are redirected reacting to this or that policy statement. However, the path that the new direction takes is often difficult to predict because the way the nodes interpret the incoming data is far from stable. The same input can, under different conditions, lead to entirely different outputs. Because the system is so complex and integrated that it cannot be fully controlled, the characteristics of the environment become more visible.

Beyond determinism

It must be stressed that such an organic view of the media environment extends only to the *formal* analysis of the characteristics of change and

stability. It does not apply to the *normative* questions of what directions this change should take, nor does it free us from moral dilemmas, conundrums and the social disputes that such questions entails. We cannot avoid making choices, because, even if we understand the new environment as a quasi-ecological system, “the Internet [or any other network] does not take care of itself.”[14] The bias of media is too fundamental to be deterministic. Furthermore, media environments are built environments and building is a social effort. Nor does the fact that there is no single center of control, no over-arching master plan, mean that influence in a political sense is equally distributed. The recent series of court cases over copyright and national legislation regarding identification on-line (France) and extending the reach of law enforcement (England) shows that very clearly. An analysis, though, of the dynamics that shape the electronic environment as we build it can help us to better comprehend the available choices and their consequences of action in an environment that is substantially different from the one in which our cultures and institutions have historically developed.

Notes:

[1] An earlier version of this essay has been published as:

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[2] Shannon, Claude E.; Weaver, Warren (1963). *The Mathematical Theory of Communication* (5th ed.). Chicago: University of Illinois Press

[3] This is often misunderstood, even by those friendly to his work. The German version, for examples, translated Understanding Media as "Die magischen Kanäle" (The magic channels).

[4] Innis, Harold, A. [1951] (1995). *The Bias of Communication*. Toronto: University of Toronto Press

[5] Innis, Harold, A. (1950). *Empire and Communications*. Oxford: Clarendon Press

[6] Castells, Manuel (1996). *The Rise of the Network Society, The Information Age: Economy, Society and Culture, Vol. I*. Cambridge, MA; Oxford, UK: Blackwell

[7] Manuel DeLanda argued that all of history can be viewed as "flows of matter-energy". However, to make these flows visible, it is necessary to condense time, in DeLanda's case, one thousand years into 350 pages. In the electronic environment, these flows operate in real time, and consequently, they are no longer an analytical abstraction but an experiential reality of daily life.

DeLanda, Manuel (1997). *A Thousand Years of Nonlinear History*. New York: Swerve

[8] Bateson, Gregory (1972). *Steps to an Ecology of Mind*. New York: Ballentine Books

[9] McLuhan, Marshall; Nevitt, Barrington (1972). *Take Today: The Executive as Dropout*. Don Mills, Ont.: Longman Canada Ltd

[10] Shiller, Robert J. (2000). *Irrational Exuberance*. Princeton: Princeton University Press.

[11] Postman, Neil (1992). *Technopoly: The Surrender of Culture to Technology*. New York: Alfred A. Knopf

[12] Jane Jacobs makes a similar argument for economic processes in general. The difference, again, is that in the environment of electronic media this type of change can be witnessed in real time rather than through analytic abstraction only. Jacobs, Jane (2000). *The Nature of Economies*. New York, Toronto: Random House

[13] Arthur, Brian W. (1996). Increasing Returns and the New World of Business. *Harvard Business Review* (July-August)

[14] Lessig, Lawrence (1999). *Code and Other Laws of Cyberspace*. New York: Basic Books