Cybernetics and the Message of Digital Media

With the potential for the message of digital media to become the medium of societal change, would Marshall McLuhan have feared becoming a cyborg produced by globalization? Should we? Let's hope not.

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In the 1960s Marshall McLuhan proclaimed the *medium is the message*. His book *Understanding Media* explained how mechanical media *cried out* for *fragmentation* during the renaissance of the 15th century, when technologies like the printing press ushered in *specialization*, *uniformity* and *nationalism*. It also described how electrical media *cried out* for *unification* at the end of the modern era, when technologies like radio called for *tribalism*, *interrelation*, and *diversity*. According to McLuhan, these media spread their messages throughout society regardless of book content or radio programming. If among us today, I believe McLuhan would hear digital media, which includes the Internet, crying out for *integration* through *feedback*. However, this digital renaissance is being both helped and hindered by globalization. The crisis lies in the potential for global integration to be something more than the mere unification of nations. Taking McLuhan's lead, I turned to the techniques of digital theory and their application to digital design, where I found the integrating message of digital media crying loud and clear.

Digital Theory

When I was a child in the 1970s the needle on the record player that my brother and I shared broke off. Inspired by my understanding of how LPs stored sound, I took a sheet of aluminum foil, rolled it into a cone, stuck a pin in the tip and held my hand-made gramophone such that it lay lightly in the groove. Although the tune sounded tinny, it was music to my ears. Little did I know at the time that an American inventor named James Russell was perfecting a technology to eliminate the needle altogether. The theory behind the compact disc, or CD as we know it today, was being developed when Russell was a teenager. In the 1940s, Claude Shannon, a researcher at Bell Laboratories, published a paper in which he described how information could be defined and quantified by breaking the content of any media into "bits" of binary 1s and 0s that in turn could be stored and transmitted without error using computers. (Shannon) At the same time, Norbert Wiener, a mathematician, coined the term "cybernetics" to denote the field of control and communication theory as applied to both machines and animals. (Wiener, 1948) Russell applied Shannon's information theory and Wiener's control theory to the problem of recording sound and invented a machine to play a CD, a digital alternative to analog LPs that made it to market in the 1980s. According to digital theory, the recording begins with analog-to-digital conversion, where the analog signal (Fig. 1) is sampled several thousand times a second and the binary values of these samples are digitally stored in a linear sequence (Fig. 2). With each music track a separate file, the data are copied to a CD using a laser that burns binary bits into pits on metal foil. The CD is played using a process known as digital-to-analog conversion, where the numeric data are read with a laser and converted back to discrete pulses at the same rate they were sampled. The result is a step wave that approximates the analog signal (Fig. 3). Since there are gaps between samples, the converted waveform is choppy. It wouldn't be very pleasing to listen to it at this point. However, by applying a feedback loop,
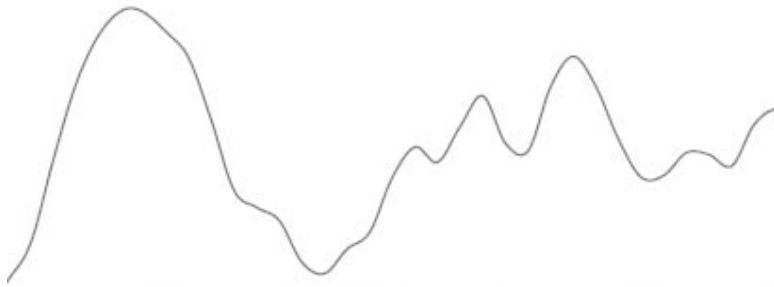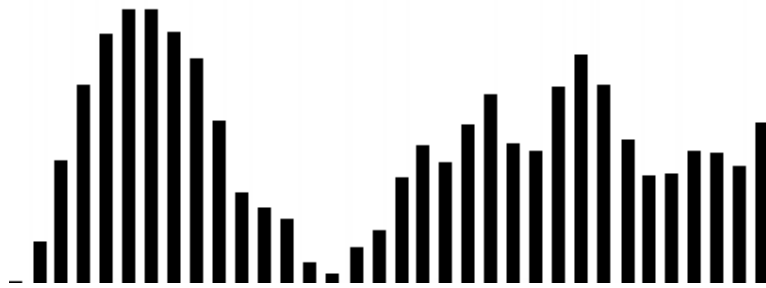
Fig. 1: Analog Signal/Organic/Medieval Society

Fig. 2: Analog-to-Digital/Fragmentation/Modern World
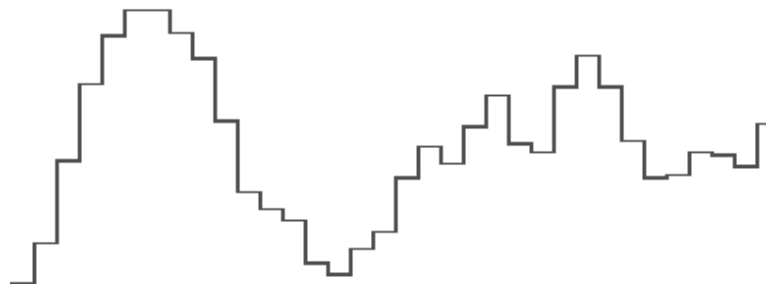
Fig. 3: Digital-to-Analog/Unification/Postmodern Global Village

Fig. 4: Feedback/Integration/World Community?

the pulses are integrated into a relatively smooth waveform that closely resembles the original signal (Fig. 4). Increasing the sampling-rate provides improved accuracy at the expense of increased use of storage space.

This same process is used to digitize other media, where only the source of the signal changes. In the same way that a microphone produces an analog signal from sound, a photocell produces an analog signal from light. Whatever the source of the original, digital copies can be stored in a computer's memory, saved on a storage device or transmitted across a network to other computers. When the stages in the process are graphically represented we see that digital media start with an *organic* signal (Fig. 1), utilize the technique of *fragmentation* during the analog-to-digital phase (Fig. 2) and employ the technique of *unification* during the digital-to-analog phase (Fig. 3). Little did McLuhan know in the 1960s that digital media of the 1990s would be a *hybrid* between mechanical and electrical media that require the technique of *integration* to fill in the gaps via *feedback* (Fig. 4). In fact, these figures depict McLuhan's vision of modernization and show us how it extends to the conversion of our postmodern present.

Mechanical Media
According to McLuhan, mechanical media fragmented the

cultural web of medieval society (Fig. 1). This cultivated fertile ground for the arts of the mechanical renaissance and made room for the social systems of the modern world (Fig. 2). The division of labour instituted specialization by task in all fields, disciplines and professions. Literacy encouraged democracy, which was both promoted by and contributed to a sense of nationality. Industrialization eventually produced uniformity with standardized consumer goods. These systems provided citizens with the social space needed to enjoy rights and freedoms. However, as fragmentation continued to *explode* social environments, the autonomous individual began to suffer a loss of cultural identity, a diminishment of agency and a weakening sense of community.

Electrical Media

Electrical media counteracted fragmentation with the message of unification, creating the networks of the postmodern *global village* (Fig. 3). Pop music elicited tribalism among youth. Multinational corporations demanded trade interrelations among countries. Marketing constructed brand names and provided consumers with a choice among a variety of artificial identities. These networks, especially radio and television, enabled mechanized individuals to feel connected to one another. However, with electrical media *reversing* the effects of fragmentation, there was a sense of powerlessness in the face of an *implosion* that required participation without interaction or negotiation.

Digital Media

Digital media are currently delivering the message of integration by creating possibilities for feedback and the conditions for a digital renaissance (Fig. 4). In the chapter "Automation: Learning a Living," McLuhan saw automation, which he also called *cybernation*, pressing for further interrelation and anticipated such trends as the shift from bricks to bits in industry and from specialization to interdisciplinarity

in education. In adherence to Wiener's notion of cybernetics, he described *feedback* as a kind of dialogue between machines and their environment. Unlike Wiener, however, he foresaw how the end of linear causality had the potential to create new roles for those replaced by robots on the assembly line. In the last two decades of the 20th century we saw the computer reverse the trend towards specialization in many areas. The office PC prompted the integration of secretary, typist, and file clerk into a single position. Digital editing in radio broadcasting has blurred the distinction between producer and technician. More recently the same blur is happening in film production with the advent of digital video hardware and editing software. However, having only caught a glimpse digital media, McLuhan failed to make a distinction between unification and integration. In fact, he tended to use the words interchangeably, probably because he saw computerization as a form of electrification. He assumed that fragmentation counteracted by unification and regulated by feedback automatically results in integration. Yet, as demonstrated by digital theory, integration is a technique in its own right, one that distinguishes digital from electrical and mechanical media. Although McLuhan may have anticipated this with his analysis of feedback in automation, he didn't witness the current digital renaissance. As a result, his portrayal of feedback is quite mechanistic. He saw feedback as a *servomechanism* that further advances control over society. In his view the manipulation of information could lead to greater certainty within the social machine he called the *matrix* of electrical and mechanical society, especially since he assumed that structural change could be understood in advance. Only now are we beginning to appreciate how digital media are different from electrical and mechanical media, especially in their potential to provide room for uncertainty and unpredictability, and therefore creative freedom, within the integration of digital society. This transition corresponds to the shift in science from

the mechanistic and deterministic worldview of classical physics to the probabilistic one presented by quantum mechanics and the random one described by chaos theory.

Integration

Understanding digital media and their impact on society requires clarification between unification and integration. If an office worker is given a computer and the result is that he or she is now doing three or four jobs instead of one, then this is no more than function unification. He or she is simply multitasking. If, however, a worker takes on new responsibilities that involve feedback to management, then integration has occurred, creating the new role of administrative assistant. Likewise, if a radio technician switches from cutting and splicing tape to digital editing with a computer, but is still taking orders from the producer, the mechanistic division of labour remains. Although the increased speed of digital editing requires that the producer work along side the technician, only when the person doing the editing is also the one making judgements about content is there an integration of producer and technician into a role that resembles a renaissance craft. Integration is more complicated than mere unification. It's closer to what McLuhan called an *organic unity*. However, he didn't fully appreciate the distinction between what is organic and what looks organic but is actually synthetic. With the development of digital media, we are better positioned to grapple with the differences between what is a natural or practical problem and what is an artificial one. If we look closely at the integrated waveform (Fig. 4) produced by feedback and compare it to the analog signal (Fig. 1), we notice that it is "organic" enough to make the digitized output look and sound like the original. To be sure, an integrated waveform is much closer to the original signal than a merely unified one (Fig. 3). Although McLuhan did discuss ways that technologies can simulate human activities, for example, how computers seem to "think," what he called an "organic unity," despite being more than just the unification of fragments, is not truly organic. Since digitization involves both electrical and mechanical techniques, it follows that digital feedback can't facilitate an integration that is organic in a cultural sense. For it to be genuinely organic it would have to occur spontaneously and independently of our prior use of techniques, such as we see in nature with the proliferation of European purple loosestrife across North American wetlands. Digital feedback is more akin to the wine maker's grafting of European grape shoots onto North America grape stalks. It provides integration that is between the extremes results of organic spontaneity and functional control. Although feedback can entail both technical and non-technical components, it may be nothing more than a servomechanism, as is the case with the CD player, where it produces something synthetic. In this functional device, "integration" is strictly a technical matter that can be completely automated. Each time I play the CD I expect to hear the same sounds over and over again. Predictability in a CD is expected. Likewise, we anticipate conformity when commands or laws go out over a network, a functional situation where to participate is to obey. However, digital feedback can facilitate human activity that is not mechanistically pre-determined. A network that incorporates non-technical feedback is transformed into a system where there is participation with the possibility that users will influence outcomes. When someone exercises judgment and makes non-technical decisions within a feedback loop, the holistic potential of integration comes to the fore. However, if the music recorded on a CD becomes popular as it is played over and over again, this doesn't make it organic. Market trends may seem natural but they are actually artificial, like the plucking of the Portia spider that turns the captor into the captivated. Although non-technical feedback within a communications loop enables interaction that is less alienating

than mechanical and electrical mediation, it is not a substitute for organic, face-to-face human relationships. Integration isn't organic, but it can be holistic, since it leaves room for truly organic culture to take root.

The Internet
At the hub of the digital revolution is the Internet, where the cry for integration has brought all other forms of media together. Newspapers, magazines, radio programs, and TV networks all have sites on the World Wide Web. However, this is only the first step. It is nothing more than unification, making the Internet a multi-media medium in cyberspace. To see signs of integration, we have to look at the ways various media have influenced each other. In recent years, magazines have become more like Web sites with a new emphasis on graphics while newspapers have become more like magazines with a new emphasis on features. Books have become more interactive with some novels offering the reader a choice of plot developments. TV programs have become more multi-media with graphical content and their own music sound tracks. DVDs partition films into "chapters" for random access like books. Yet these unifying developments among media are not integration per se. According to McLuhan, we should expect to see this kind of interplay with the introduction of any new medium. Something closer to integration begins to occur when people vary their media experiences by making choices. In the same way that the VCR was claimed to be the demise of film, the Internet was supposed to be the end of print. Nevertheless, people are going to the cinema more than ever and the popularity of the book has risen slightly as Internet access escalates. It would seem that one of the messages of the multi-media medium is the promotion of a more unified approach to mass media in general. Here we see a more balanced diet among media forms. However, for integration to occur there must be feedback.

Digital Feedback
Choosing among media and selecting content may appear to be non-technical feedback, but it is actually a technical requirement of equipment operation. Interactivity, whether channel changing with the TV remote control or Web surfing with hypertext links, is a relatively functional form of feedback. It amounts to "voting" for images in a virtual environment. Integration with technical feedback alone creates a hyperspace and provides a simulation of democratic participation. It becomes holistic only when people respond to media content with their own views, opinions and impressions. Feedback takes on this non-technical, political character when a radio listener sends an e-mail to a program host who is deciding upon next week's topic or when a music fan sends an e-mail to a band in order to arrange for a house concert. It creates a new avenue for dialogue when a magazine provides e-mail addresses for readers to contact authors or when a newspaper hosts a web-based forum. Readers can respond to content as well as comment on the views of other readers and then have the discussion published in print. The development of independent media is very important in so far as they offer alternative sources of information, but it's not enough for someone to set up a Web site that critiques the six o'clock news. Integration with non-technical feedback creates a system in which individuals and independents have some influence over the mainstream. When digital feedback enables cultural expression and social discourse, we see integration that is more organic than synthetic. These non-technical currents are generating a digital renaissance that is revitalizing the arts and empowering democracies.

Crying Out
In accordance with digital theory, the Internet is crying out for integration and all media have had to respond to this challenge. With McLuhan's analysis of mechanical and electrical media

we learned that the *medium is the message*, that is, that their impact comes not from their content but from the patterns they impose by their fragmenting or unifying nature. McLuhan himself was comfortable with the mechanical explosion caused by technologies like the printing press and feared the effects of an electrical implosion of society. In North America, he saw our fate as a societal *reversal* from nationalism to tribalism, where only the self-employed artist could establish enough autonomy to exercise agency. He lacked, however, an adequate understanding of digital theory to foresee a societal traversal. Integration will not re-generate society into a dense, organic cultural web as in medieval times, nor will it re-constitute society into an effective and stable social system as in the modern period. Unlike fragmentation and unification, integration permits us to contribute to the nature of its message through feedback, thereby dynamically changing its impact on us as individuals and giving us influence over the ways it shapes globalization.

While fragmentation isolates individuals, integration has the potential to bring them together. Online communities can be holistic if they provide opportunities for their members to meet face-to-face. As early citizens of The Well found out at their dinner gatherings, this can be socially problematic insofar as it's difficult to organize and culturally uncomfortable insofar as people don't necessarily get along when they put aside their keyboards and meet in the flesh. Online communities such as Slashdot and Metafilter go along way to counteract the effects of fragmentation. Yet they remain in the realm of the virtual unless they facilitate something that is actually social rather than simply simulating it. There are benefits to communicating in cyberspace cleansed from the prejudices associated with ethnicity, age, race and gender. However, the apparent drawbacks of "meatspace" are precisely the challenges that genuine integration must face. If online communities are going to foster something truly holistic, they must be more than just virtual. They must also be cultural and social insofar as they facilitate phenomena like the civil society movements that bring protesters and activists together from diverse parts of the globe to achieve common goals in the world.

McLuhan was a product of the mechanical explosion and felt powerless to resist the electrical implosion of society. At best, he thought that those of us who weren't artists could learn to *roll with the punches*. It was this perspective that gave his medium as message aphorism its deterministic overtones. Will digital feedback, with the integrating potential of the Internet, create a hybrid impact where medium and content shape each other, where the medium is the message and the message is the medium? McLuhan believed that electrical feedback through automation would put an end to old dichotomies like "culture" and "technology." Will digital feedback put an end to the medium and content dichotomy? The answers are not predetermined. They lie in how we choose to design our networks of participation. If a network does not incorporate feedback, then it will remain a medium of control, attempting to pacify people whose mechanically fragmented existence leaves them longing for an electrical connection. If it incorporates technical feedback, then it will create a hyperspace with integration that is synthetic. Data mining will determine marketing trends and consumer choice will offer the illusion of democratic empowerment. Participation will be limited to racking up patronage points in exchange for personality profiles. Only when a network allows for feedback that places non-technical demands upon a system will its content impart integration that is holistic.

Norbert Wiener anticipated this in his book *Cybernetics* with his emphasis on interdisciplinarity, but made the point more forcefully when he reflected over a decade later on the impact of automation on society. In his essay *Some Moral and*

Technical Consequences of Automation, he makes the case that cybernetic systems that develop by learning may operate in ways unforeseen by those who designed them. (Wiener, 1960) This places a moral responsibility on the designers, who must judge whether or not they have a sufficient enough understanding of the system to prevent unintended consequences. Moreover, he extends this concern to the development of science itself, calling for scientists to be vigilant by continually re-evaluating the impact of their achievements despite their best of intentions. Since science is limited in its technical ability to predict the risks associated with new technologies, society must also consider non-technical factors such as the acceptability of risk, which requires the input of practical judgments made by non-scientists. For example, if government regulation of new biotechnologies began with technical risk assessments and incorporated the feedback of non-technical precautionary principles, various experts and ordinary citizens would be integrated into a system whose policy decisions are not predetermined by scientific data and profit margins. Yet non-technical feedback by its very nature is not a technical requirement of societal systems. It is a political consideration, a design specification that, as McLuhan would say, is crying out to be implemented.

Globalization

According to McLuhan, all media are human extensions. Although he was a great promoter of this conceptualization of our use of technologies, he wasn't the only author to employ it. Leon Bagrit, a British engineer, included a chapter called "Automation: An Extension of Man" in his book *The Age of Automation*. (Bagrit) Yet, in his advocating that human *masters* use automated *slaves*, he doesn't appreciate, as McLuhan did, how we can become what we use. The more we depend on machines, the more machine-like we become. Bagrit proposes that automation will help us to become fully human by extending ourselves, but he doesn't think our extended slaves could make us more slave-like. He assumes that automation is a "tool" that will automatically make our lives varied and balanced. McLuhan was more cautious because he realized that our "tools" also create environments that in turn shape us in ways that we did not anticipate. Nevertheless, the integrating potential of digital media does offer us opportunities to seek integration within ourselves. The most powerful message of the Internet is that we don't have to settle for unified fragmentary lives created by a society that is exploding while at the same time imploding. My participation in digital feedback will lead me to a more holistic existence whether or not the content of my message has an impact upon society. Integrating my life means making choices that help me grow and find a balance among cultural relationships, social activities, functional demands and virtual needs. For example, I can integrate life-long learning with an ongoing career by taking online courses while working full-time. In this sense, the medium is still the message.

If, however, my message resonates with others who also provide their non-technical feedback, it will integrate individuals into a diverse community, thereby acting as a corrective to extreme fragmentation, putting society back together in a holistic manner. The digital renaissance of the 21st century can be a complement to the mechanical renaissance of the 15th century, but it must be grounded in organic culture if it is to avoid becoming just a virtual reality. Given this new opportunity for technological balance through feedback, digital societies could achieve healthier states than the alternatives of modern nationalism or postmodern tribalism envisioned by McLuhan. In this sense, the message now has the potential to become the medium of societal change.

With mega cities, merger mania, media convergence and

expanding free trade, we hear the cry for global integration. But will it be holistic? Or will the ever-increasing sampling-rate of our lives along with greater bandwidth and the proliferation of wireless devices simply create societies with synthetic cultures that look and sound organic in the same way music CDs simulate the sound of live performance? Will we become cyborgs whose integration appears holistic but is actually synthetic? The answers to these questions are not preprogrammed. We can't assume that using these new technologies will provide the message that we want to be heard. Digital media can resist change. I once took my pocketknife and scratched up the underside of a CD that I had burned with archives of e-mails and other confidential documents. After tossing it in the garbage I remembered Claude Shannon and his theories about the error-correcting codes that make digital media robust. Sure enough. When I placed the CD back into my computer, it worked just as predictably as it did before I tried to sabotage it. (Now I know that I should have scratched the metal-foil rather than the plastic.) Likewise, the integration of nationalism and tribalism could continue to combine capitalism and pop culture into a hyersociety where patriotism is reduced to shopping and options for feedback are limited to talking with telemarketers or supporting terrorism. Without negative feedback, tribalism will likely spin nationalism into unrestrained global militarism. However, the influence the Internet played in challenging the Multilateral Agreement on Investments (MAI) in 1998 indicates that contingent forces can be imbedded in the content of digital media. I believe McLuhan would rest more peacefully knowing that the Internet and the cry for globalization provide the message with the means to become the medium of societal change. Will global bodies like the United Nations and the World Bank, as well as global structures like the International Monetary Fund (IMF) and the World Trade Organization (WTO), heed the cry for holistic integration? Or will they simply construct a functional unification of fragmented nations that appears to be an organic unity? Whether democracy will spread as a social norm or just be attached to free trade as a brand name label depends upon whether or not our feedback fills in the organic gaps in the General Agreement on Tariffs and Trade (GATT.) If the message of digital media could be heard for its full, integrating potential, the anti-globalization demonstrations in Seattle, New York, Prague, Quebec City, Porto Algre, Barcelona and Monterrey, and more recently the anti-war demonstrations organized around the globe via the Internet, would be part of a new economic and democratic system. Perhaps their message is already helping to integrate McLuhan's global village into a world community? Let's hope so.

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