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ISSUE

A Media Ecology Review

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From the Editor

Lance Strate's excellent report on "media ecology" studies approaches the subject from a literary and philosophical perspective, with some input from anthropological and psychiatric sources. Many communication researchers explore the same territory using sociological and psychological methods that often are quantitative. For example, media effects research, including much important work on media and children (cf., N. Pecora, "Children and Television," *Communication Research Trends*, Volume 19 (1999), Nos. 1 and 2) really deals with the cultural environment in which we live and the ecological relationships it involves. The approaches may use different methods, but they can and should support each other, in the quest for a broader understanding of the role of the media in our lives.

—W. E. Biernatzki, S.J.
General Editor

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1. Introduction

…our first thinking about the subject was guided by a biological metaphor. You will remember from the time when you first became acquainted with a Petri dish, that a medium was defined as a substance within which a culture grows. If you replace the word "substance" with the word "technology," the definition would stand as a fundamental principle of media ecology: A medium is a technology within which a culture grows; that is to say, it gives form to a culture's politics, social organization, and habitual ways of thinking. Beginning with that idea, we invoked still another biological metaphor, that of ecology. . . . We put the word "media" in the front of the word "ecology" to suggest that we were not simply interested in media, but in the ways in which the interaction between media and human beings gives a culture its character and, one might say, helps a culture to maintain symbolic balance. (Postman, 2000, pp. 10-11)

Our present fascination with ecology of all kinds is tied in with the information explosion that has marked our age. . . . With the information explosion, we have become more and more conscious of the interrelationships of all the life and structures in the universe around us, and, with our more and more detailed knowledge of cosmic and organic evolution, ultimately of interrelationships as building up to and centering on life, and eventually human life. The human environment is of course not just the earth but the entire universe, with its still incalculable expanse and an age of around some 12 to 14 billion years. This is the real cosmos within which human beings appeared and still exist. (Ong, 2002b, p. 6)

I would like to dedicate this essay to the memories of Walter J. Ong, S.J. and Neil Postman, who passed away within two months of each other, Ong on August 12th and Postman on October 5th of 2003. Through their careers and the body of work they have left us, these two educators, both of whom achieved the highest possible academic rank, University Professor, at their respective institutions, Saint Louis and New York Universities, were instrumental in establishing the foundations of media ecology as a field of inquiry. Moreover, Walter Ong set the standard and demonstrated the possibilities for scholarship in the media ecology intellectual tradition, and Neil Postman exemplified the practice of media ecology analysis by a public intellectual engaged in social criticism. Working parallel to one another, Ong and Postman built upon an intellectual tradition that has its roots in the ancient world, a tradition that coalesced in response to the revolutions in communication, media, and technology of the 19th and 20th centuries, and brought it into the 21st century.

In viewing Ong and Postman as twin pillars of media ecology, I do not mean to deny that there are significant differences between them. Certainly, it would be possible to contrast their midwest and east coast backgrounds and their Roman Catholic and Reform Jewish faiths. We could also differentiate Ong's historical focus from Postman's emphasis on current affairs, Ong's phenomenological approach from Postman's grounding in linguistics, and Ong's dialectic of the oral and the literate from Postman's of the word and the image. But what separates the two scholars is overshadowed by what they hold in common: a shared perspective and sensibility, and a strong connection to the most celebrated of all media ecology scholars, Marshall McLuhan. In fact, media ecology can be understood as an intellectual network in which McLuhan, Ong, and Postman constitute the prime nodes (corresponding geographically to Toronto, St. Louis, and New York City).

Media ecology is a perspective that embodies what Ong (1977) refers to as "ecological concern," which he describes as "a new state of consciousness, the ultimate in open-system awareness. Its thrust is the dialectical opposite of the isolating thrust of writing and print" (p. 324). Ong goes on to suggest that contemporary questions of ecological concern

echoed earlier thinking culminating in Darwin's work, which has shown how species themselves,

earlier thought of as the closed-system bases of life and taken to be major elements in philosophical thinking, are not fixed but develop through natural selection brought about by open interaction between individuals and environment. The new philosophical attention to openness appears not unrelated to the opening of previously isolated human groups to one another fostered by electronic communications media, telephone, radio, and ultimately television. (p. 324)

Such ecological concern is central to McLuhan's approach to studying media, as he explains in the introduction to the second edition of *Understanding Media* (2003a):

> "The medium is the message" means, in terms of the electronic age, that a totally new environment has been created. The "content" of this new environment is the old mechanized environment of the industrial age. The new environment reprocesses the old one as radically as TV is reprocessing the film. For the "content" of TV is the movie. TV is environmental and imperceptible, like all environments. We are aware only of the "content" or the old environment. When machine production was new, it gradually created an environment whose content was the old environment of agrarian life and the arts and crafts. This older environment was elevated to an art form by the new mechanical environment. The machine turned Nature into an art form. (p. 13)

Inspired by McLuhan, Postman formally introduced the term "media ecology" in 1968, in an address delivered at the annual meeting of the National Council of Teachers of English (published under the title of "The Reformed English Curriculum" in 1970). He told his audience that "the first thing to be said about media ecology is that I am not inventing it. I am only naming it" (p. 161). By not claiming the role of founder of a discipline, and not naming anyone else as the inventor, Postman left open the origins of the field, and implied that media ecology has been in existence in one form or another since antiquity. It follows that individuals need not use the term "media ecology" in order to have their work categorized as such. Indeed, they need not have been alive when the term was coined in order to have it identified as media ecological. Postman did, however, provide a definition of media ecology as "the study of media as environments" (Postman, 1970, p. 161), explaining that the main concern is "how media of communication affect human perception, understanding, feeling, and value; and how our interaction with media facilitates or impedes our chances of survival. The word ecology implies the study of environments: their structure, content, and impact on people" (p. 161). These environments consist of techniques as well as technologies, symbols as well as tools, information systems as well as machines. They are made up of modes of communication as well as what is commonly thought of as media (although the term "media" is used to encompass all of these things). Thus, Postman also describes media ecology as "the study of transactions among people, their messages, and their message systems" in *The Soft Revolution* (1971, p. 139), which he co-authored with Charles Weingartner.

Where Postman defines media ecology as a field of inquiry, McLuhan places greater emphasis on praxis when he uses the term. For example, in a 1977 television interview, in response to the question, "what now, briefly, is this thing called media ecology," McLuhan answers:

> It means arranging various media to help each other so they won't cancel each other out, to buttress one medium with another. You might say, for example, that radio is a bigger help to literacy than television, but television might be a very wonderful aid to teaching languages. And so you can do some things on some media that you cannot do on others. And, therefore, if you watch the whole field, you can prevent this waste that comes by one canceling the other out. (McLuhan, 2003b, p. 271)

And in a letter to Claire Booth Luce published in *The Letters of Marshall McLuhan* (1987), he writes: "As for restricting the use of TV, it surely should be a part of a media ecology program" (p. 534). For Postman, praxis first took the form of pedagogy. In "The Reformed English Curriculum" (Postman, 1970) he went so far as to argue for media ecology as an alternative to standard high school English education, a "modest proposal" that did not catch on. In *The Soft Revolution* (Postman & Weingartner, 1971) he reproduced the prospectus for a Ph.D. program in media ecology, stating that "such a program is being contemplated at one university" and extending the invitation, "local catalogues please copy" (p. 138). In point of fact, by the time the book was actually published, New York University had already approved the program, which in 1973 produced the first major treatise to examine media ecology as a formal field of study, Christine Nystrom's doctoral dissertation entitled: *Towards a Science of Media Ecology: The Formulation of Integrated Conceptual Paradigms for the Study of*

Human Communication Systems. There she characterizes media ecology as a "perspective, or emerging metadiscipline . . . broadly defined as the study of complex communication systems as *environments*" and concerned with "the interactions of communications media, technology, technique, and processes with human feeling, thought, value, and behavior" (p. 3).

The first major survey of media ecology as a field was produced by William Kuhns under the title of *The Post-Industrial Prophets* (1971). Although he does not use the term "media ecology," Kuhns makes frequent use of environmental, ecological, and systems terminology as he discusses the work of technology scholars Lewis Mumford, Siegfried Giedion, and Jacques Ellul; media theorists Harold Innis and Marshall McLuhan; and systems pioneers Buckminster Fuller and Norbert Wiener. Kuhns also wrote a short book about technology and contemporary culture, addressed to Christian readers, under the title of *Environmental Man* (1969). While *The Post-Industrial Prophets* emphasizes futurism, media ecology is also concerned with understanding media in a historical context, Ong's area of emphasis. Hence, for example, the four editions of the anthology *Communication in History* edited by David Crowley and Paul Heyer (1991, 1995, 1999, 2003), which represent a somewhat different and more recent attempt at surveying the field as compared to *The Post-Industrial Prophets*. Presenting a sampling of media ecological historical scholarship, Crowley and Heyer emphasize the impact or effects of media, but like Kuhns do not use the term "media ecology." Another anthology in press, edited by Casey Man Kong Lum, entitled *Perspectives on Culture, Technology, and Communication: The Media Ecology Tradition*, covers a good portion of the theories, key concepts, and development of the field.

Over the past 36 years, use of the term "media ecology" has diffused slowly outside of New York and Toronto, and in some instances was adopted with its original meanings lost or distorted (e.g., ADILKNO, 1994; Tabbi & Wutz, 1997). At the same time, other terms were introduced to refer to the same type of perspective and intellectual tradition, such as "Toronto School" (Goody, 1968, 1977), "medium theory" (Meyrowitz, 1985), "American cultural studies" (Carey, 1989), and "mediology" (Debray, 1996). Also, due to its strong association with Ong (1982), "orality-literacy studies" has sometimes been used as a synonym for media ecology. In recent years, however, "media ecology" has come to be widely accepted as the term of choice, especially since the establishment of the Media Ecology Association in 1998. Aptly, Postman (2000) gave the keynote address at the MEA's inaugural convention ("The Humanism of Media Ecology") and Ong (2002b) wrote the lead article for the first issue of the MEA's journal, *Explorations in Media Ecology* ("Ecology and Some of Its Future"). Since the introduction of the term in 1968, "media ecology" has been understood as a perspective or approach, as a field of inquiry or study, and a curriculum. It has also been understood in very basic and concrete terms as a reading list, bibliography, or pattern of citation. Indeed, one way to recognize media ecology scholarship is by the presence of certain sources in the author's reference list (e.g., McLuhan, Ong, and/or Postman).

Media ecology has also come to be understood as an intellectual tradition, one that Camille Paglia (2000) characterizes as particularly North American, as that is the locus of media ecology's historical development in the 20th century. This is not to say that media ecology is only associated with North Americans, or necessarily so, but that the evolution of the field has been influenced by North American pragmatism and openness. Thus, media ecology is a tradition of independent thinkers who "creatively reshaped traditions and cross-fertilized disciplines, juxtaposing the old and the new to make unexpected connections that remain fresh" (Paglia, 2000, p. 22), thinkers such as McLuhan, Ong, and Postman. It is an intellectual tradition based on what Ong (1977) refers to as "open-system awareness" (p. 324).

An open system enhances creativity, freedom, and the process of exploration and discovery, but it is particularly challenging when the goal is to map the system itself. Media ecology is a network of ideas, individuals, and publications, and it is possible to follow the links of the network in any number of different directions. Some links may bring us closer to the core ideas of the field, and others take us further and further away from them, but there is no definitive boundary line or border to cross, just as there is no single point of origination. It is tempting to claim that only the medium of hypertext could adequately represent such an open network, but the benefits of hypertext are traded off against a certain loss of coherence and order, however much that coherence and order may be artificially produced and arbitrary in nature. I will therefore proceed to present a linear journey through the media ecology network, with the understanding that it represents one of many possible pathways, and that at times I may wander into territory that others would consider outside the network, while overlooking points of interest within the network. This review essay will take as its navigational markers the three prime nodes of media ecology: McLuhan, Ong, and Postman.

2. McLuhan

To begin with McLuhan is not to begin at the beginning of media ecology, but to plunge *in medias res*. Given that the field has no founder and inventor, making it difficult to determine just what constitutes the beginning of the media ecology intellectual tradition, it makes sense to start at the center of the field and work our way outward. Whether McLuhan firmly occupies the center, or is positioned slightly off-center, may be debated, but his importance in establishing the field is generally accepted. As Paul Levinson (2000) puts it

> What did Marshall McLuhan contribute to Media Ecology?
> You might well ask what hydrogen and oxygen contribute to the existence of water.
> Without those elements, there would be no water. Of course, other factors are necessary. Hydrogen and oxygen on their own, in a vacuum, are not sufficient to create water. They are profoundly necessary, but not sufficient.
> Which describes McLuhan's contribution to Media Ecology to a tee. Without his work in the 1950s and '60s, there would be no field of study that sought to explain how the nuances and great sweeps of human history are made possible by media of communication—how media determine the thoughts and actions of people and society. (p. 17)

McLuhan's first book, *The Mechanical Bride: Folklore of Industrial Man*, originally published in 1951, has been reissued by Gingko Press in 2002 after being out of print for many years. Although it is sometimes viewed as a "content book" in contrast to his later emphasis on media, *The Mechanical Bride* is in fact an analysis of how popular culture reflects and promotes the attitudes, beliefs, and values of technological society. Technological man is either a specialist-savant like Sherlock Holmes or an emasculated drone like Dagwood Bumstead, according to McLuhan. Technological woman is mass produced (from the assembly line to the chorus line) with the help of industrial products such as girdles, soaps, and domestic gadgets (or she is replaced by products such as the automobile). Technological children are given baby formula instead of being breast fed (setting up an oral fixation that will later be satisfied by Coca-Cola) and provided a technical education that will allow them to fit into the machine-like organizations of corporate America. Even in death, we are ruled by technology

through the sale of coffins that are weather-resistant. In this highly accessible and concrete way, McLuhan provides a multitude of examples of what Jacques Ellul (1964) calls "la technique" and Postman (1992) "technopoly." The new edition of *The Mechanical Bride* is notable for its high quality reproductions of the numerous advertisements, comics, and newspaper and magazine items that are the subject of McLuhan's commentary. As these "exhibits" are over half a century old, they have gained historical value in the place of currency. The distance of time makes it easier to recognize the values, beliefs, and attitudes that they carry, as opposed to contemporary culture, and this makes McLuhan's analysis easier to follow than it might have been in the past.

Insofar as a field is produced by a community of scholars, McLuhan established the interdisciplinary study of media ecology when he joined together with his colleague, the anthropologist Edmund Carpenter, to publish a journal entitled *Explorations*, funded by a grant from the Ford Foundation. Nine issues were produced between 1953 and 1959, followed by an anthology of the journal's best material, entitled *Explorations in Communication* (Carpenter & McLuhan, 1960). Among the contributors were Dorothy Lee, Ray L. Birdwhistell, Siegfried Giedion, David Riesman, H. J. Chaytor, and Gilbert Seldes, in addition to McLuhan and Carpenter themselves. In 1962, McLuhan published what is generally considered his most scholarly work, *The Gutenberg Galaxy: The Making of Typographic Man*. The word "galaxy" in the title functions as a synonym for system, environment, or ecology (or constellation, for that matter). In this book, McLuhan focuses on the role of the alphabet as the foundation of Western civilization, and of the printing press as the agent that shifted the west from medievalism to modernity. He also emphasizes sense perception and the phenomenology of communication, exploring the historical shift from an acoustic orientation in the scribal era to the visual stress that accompanied the printing revolution. At the close of the book McLuhan discusses the transition from a print media environment to an electronic one, and introduces the term "global village," stating, "the new electronic interdependence recreates the world in the image of a global village" (p. 43). This is one of McLuhan's most enduring ideas.

In 1964, McLuhan published his most influential work, *Understanding Media: The Extensions of Man*,

which has appeared in several different editions, and most recently in a critical edition (McLuhan, 2003a) edited by McLuhan biographer W. Terrence Gordon. The critical edition introduces a much needed index to the work, as well as a glossary, a list of publications by McLuhan, a discussion of the critical response to *Understanding Media*, and excerpts from McLuhan's 1960 *Report on Project in Understanding New Media*. (Sponsored by the National Association of Educational Broadcasters and the U.S. Department of Health, the report became the basis of both *The Gutenberg Galaxy* and *Understanding Media*). Beginning where *The Gutenberg Galaxy* left off, *Understanding Media* focuses on the contemporary media environment, and in particular, on the transformative powers of television. As in *The Gutenberg Galaxy*, McLuhan considers sense perception primary, and discusses the interplay among the senses in terms of sense ratios and the sensorium. No doubt part of the reason that this book won great popular acclaim for McLuhan during the '60s is the fact that he offers an explanation for the turmoil and upheaval of that era: the changing media environment.

It is in *Understanding Media* that McLuhan settles on, and in turn establishes "media" and "medium" as the field's primary terms, which he presents as synonymous with technology. Media may be most commonly associated with communication technologies, but for McLuhan, all human inventions and innovations are media. His broadening of the meaning of "medium" becomes apparent in the second part of the book, where he devotes chapters to media such as the spoken word, roads, numbers, clothing, housing, money, clocks, the automobile, games, and weapons, in addition to the major mass media and communication technologies. And it is in *Understanding Media* that McLuhan brings together some of his most important themes: that media or technologies extend human beings, human capabilities, and the human body; that such extensions are also amputations, numbing us to the effects of technology; that some media require more sensory processing on the part of the audience than others (hence the categories of hot and cool media); that media function as metaphors, languages, and translators of experience. And it is here that McLuhan introduces his famous aphorism, which is generally considered axial in media ecology: "the medium is the message" (pp. 17 ff.). Simply put, it is the idea that the media or technologies that we use play a leading role in how and what we communicate, how we think, feel, and use our senses, and in our social organization, way of life, and world view.

McLuhan's writing style may be characterized as challenging, especially for new readers, which perhaps explains the success of *The Medium is the Massage*, the 1967 bestseller illustrated by Quentin Fiore and produced by New York writer Jerome Agel. Effective because it summarizes McLuhan's key concepts and shows as well as tells the reader what McLuhan is referring to, *The Medium is the Massage* remains a good introduction to McLuhan's approach. *War and Peace in the Global Village*, again illustrated by Fiore and produced by Agel, was published in 1968 as a follow-up to *The Medium is the Massage*. As a sequel, it is a much more substantial book, advancing McLuhan's probes about perception, communication, and technology into new terrain. Paying particular attention to the interactions between technological innovation and warfare, *War and Peace in the Global Village* has become especially relevant in the post-9/11 era. The late 60s and early 70s were a busy time for McLuhan, as he also collaborated with the artist Harley Parker to produce *Through the Vanishing Point: Space in Poetry and Painting* (1968) and *Counterblast* (1969). The literary essays written earlier in his career were collected in a volume entitled *The Interior Landscape* (1969), and he returned to literary theory in a collaborative effort with the writer Wilfred Watson, *From Cliché to Archetype* (1970). And he produced a sequel to *The Mechanical Bride* with the title, *Culture is Our Business* (1970), and joined together with Barrington Nevitt to write *Take Today: The Executive as Dropout* (1972).Through the remainder of the '70s, McLuhan was working on a new version of *Understanding Media*, and this culminating work was published posthumously as *Laws of Media*, co-authored by his son Eric (McLuhan & McLuhan, 1988). The book introduces the tetrad or four laws of media, which are framed as four questions: What does the medium enhance or extend? What does it obsolesce? What does it retrieve that an earlier medium obsolesced? And what does it reverse or flip into when pushed to its extreme? The tetrad can be used to analyze the effects of any innovation, and in *Laws of Media* the term "medium" is further expanded to include any invention, new ideas, philosophies, and linguistic and rhetorical inventions. (An alternate way to understand the four laws is that they represent the dynamics of a system or ecology as it reacts to disturbances in its equilibrium.) The book also presents McLuhan's thinking on the relationship between brain hemispheres and media (literacy is left-brained, orality/electricity is right-brained). A second introduction to McLuhan's tetrad was completed by Bruce R. Powers and published under the title *The Global Village:*

Transformations in World Life and Media in the Twenty-First Century (McLuhan & Powers, 1989).

Several collections of McLuhan's work have also appeared over the past two decades. In *McLuhan: The Man and his Message* (1989) George Sanderson and Frank Macdonald bring together a number of McLuhan's journal articles with contributions from McLuhan's associates, including an essay by Walter Ong on McLuhan as a teacher, and a memoir by John Culkin, the former Jesuit who brought McLuhan to Fordham, on McLuhan's year in New York City. *The Essential McLuhan* (McLuhan, 1995), edited by Eric McLuhan and Frank Zingrone, provides a representative sample of McLuhan's media ecology scholarship from *The Mechanical Bride* to *Laws of Media*, and reprints his famous *Playboy* interview. *Media Research: Technology, Art, Communication* (McLuhan, 1997), edited by Michel A. Moos, brings together many of McLuhan's most important early articles. *The Medium and the Light: Reflections on Religion* (McLuhan, 1999), edited by Eric McLuhan and Jacek Szklarek, collects McLuhan's writing on Catholicism. *The Book of Probes* (2004), designed and illustrated by David Carson and edited by Eric McLuhan, William Kuhns, and Mo Cohen, draws on McLuhan's talent for aphorism and represents the most attractive of many attempts to revisit the style of *The Medium of the Massage*; it includes a section on media ecology and supplemental essays by W. Terrence Gordon, as well as Eric McLuhan and Kuhns. *Understanding Me: Lectures and Interviews* (McLuhan, 2003b), edited by his daughter, Stephanie McLuhan, and David Staines, puts into print for the first time some of McLuhan's most interesting lectures and interviews, including lectures from his year at Fordham.

Understanding Me is based on source material used in the documentary, *The Video McLuhan* (McLuhan-Ortved & Wolfe, 1996). *The Video McLuhan*, a three-part documentary written and narrated by Tom Wolfe, includes a great deal of archival material, including videotaped lectures, interviews, and media appearances, that effectively present McLuhan's personality, career, and ideas. The 2002 documentary *McLuhan's Wake*, directed by Kevin McMahon and written by David Sobelman, provides a stylistic and moving introduction to McLuhan's life and work, emphasizing the relevance of his laws of media in the 21st century; the DVD release contains much supplementary material of interest, including additional interviews with McLuhan's wife, Corinne, his son, Eric, and others such as Neil Postman, Lewis Lapham, and Frank Zingrone.

McLuhan has been the subject of biographies by Phillip Marchand (1989) and W. Terrence Gordon (1997), and numerous books devoted to explaining and/or criticizing his ideas. For example, in *Digital McLuhan*, Paul Levinson (1999) discusses McLuhan's major ideas, indicating how they anticipate and accurately describe the characteristics of digital technology and online communications. Paul Grosswiler (1998), in *Method is the Message*, outlines the common ground between the dialectics of McLuhan and those of Marx, the Frankfurt School, cultural studies scholars, and the postmodernists. Richard Cavell (2002) situates McLuhan within cultural geography in *McLuhan in Space*. And in critical assessments written 30 years apart, *The Medium is the Rear View Mirror* (1971) and *The Virtual Marshall McLuhan* (2001), Donald F. Theall contextualizes McLuhan based on the arts and literature of mid-20th century. McLuhan's influence on French poststructuralism is documented by Gary Genosko's *McLuhan and Baudrillard* (1999), and on the Greenpeace organization by Stephen Dale's *McLuhan's Children* (1996). And an anthology examining the lasting impact of McLuhan on the mass media, new media, journalism, communication studies, cultural studies, literary theory, the arts, history, theology, law, and politics, entitled *The Legacy of McLuhan*, will be published next winter (Strate & Wachtel, in press).

3. Innis and American Cultural Studies

McLuhan (1962) acknowledged that his work was strongly influenced by Harold A. Innis, his colleague at the University of Toronto until Innis's untimely death in 1952. Innis was an economist who earned his Ph.D. at the University of Chicago, and turned to the study of communication late in his career. He is sometimes considered the first media ecology scholar, and certainly is the first to focus on what is commonly referred to as media, as opposed to technology, language, or symbolic form. McLuhan followed Innis's example in adopting the term "media," albeit broadening its meaning and moving away from Innis's purely materialistic sense of the word. For

example, Innis (1951) distinguishes between heavy media, which are durable but difficult to transport, and light media, which are portable but also perishable. Thus, the clay tablets used as writing surfaces in ancient Mesopotamia are heavy media while the papyrus sheets and scrolls used in ancient Egypt are light media. This way of understanding media is derived from Innis's earlier research on economic staples such as fur, fish, and timber.

Between 1948 and 1952, Innis produced a series of essays, addresses, and articles outlining a sweeping theory about the role of media in world history, in which as he put it, "sudden extensions of communication are reflected in cultural disturbances" (1951, p. 31). His most important and best known work is collected in *The Bias of Communication*, originally published in 1951, reissued in 1964 with an introduction written by McLuhan, and in 1991 with a new introduction written by Paul Heyer and David Crowley. In this book, Innis argues that media are used to communicate over time as well as over space, and that the physical properties of different media (e.g., heavy or light) determine their effectiveness at preserving knowledge or transmitting information over distances. Depending on the type of media that a given society has at its disposal, it may remain time-biased, as all traditional societies are, or become space-biased, and driven towards territorial expansion and empire. It follows that the empires of the ancient world struggled to maintain control of papyrus supplies, while modern colonial empires were built on paper, printing, and later telecommunications. On rare occasions a balance between time and space is found, which Innis associated with the flexibility of oral tradition. He also argued that media differ in terms of their scarcity or abundance, the complexity of the symbol systems employed, and the degree to which they make information accessible, and all of these factors may contribute to the development of a monopoly of knowledge. Typically, when a ruling class develops a monopoly of knowledge, those on the margins seek out and eventually find an alternate medium that allows them to break the monopoly, leading to political reform or revolution.

In 1950 Innis published *Empire and Communications*, and a revised edition appeared in 1972 with another introduction by McLuhan. This book makes a chapter by chapter survey of media in the ancient world, covering Mesopotamia, Egypt, Israel, Greece, and Rome. Another set of essays, *Changing Concepts of Time*, was completed shortly before his death in 1952, and has been reissued in 2004 with an introduction by James Carey. This volume represents Innis's attempt, "to elaborate the thesis developed in *The Bias of Communication* and

Empire and Communications in relation to immediate problems" (p. xxv), with Innis very much concerned with the relationship between intellectuals and politicians. *Changing Concepts of Time* incorporates *The Press: A Neglected Factor in the Economic History of the Twentieth Century*, which was previously published separately (Innis, 1949). Also of interest to media ecology scholars is the posthumous publication of his notes as *The Idea File of Harold Adams Innis* (1980). In all of these works, Innis points to the interrelationships between a variety of factors, including communication, language and culture, knowledge and education, transportation, time-keeping, political economy, military operations, and science and technology, all of which interact to produce both unique historical circumstances and discernible historical patterns. In this, he is both true to his economic roots, and points the way to an ecological approach to understanding human civilization. Innis has been the subject of a brief memoir by Eric Havelock (1982a), who was Innis's University of Toronto colleague before moving on to Yale University. Moreover, Paul Heyer has recently published a definitive biographical study, *Harold Innis* (2003).

Apart from McLuhan's own recognition of his debt to Innis, others tend to connect the two based on their common media ecology perspective. For example, in *History and Communications* Graeme Patterson (1990) presents an innovative integration of Innis's political economy with McLuhan's cliché-archetype dichotomy. In the similarly titled *Communications and History* Paul Heyer (1988) brings together Innis and McLuhan with the French post-structuralist Michel Foucault. Along the same lines, Judith Stamps, in *Unthinking Modernity* (1995), compares and attempts to integrate the Toronto School of Innis and McLuhan with the Frankfurt School as represented by Theodor Adorno and Walter Benjamin. In *Technology and the Canadian Mind* the postmodernist Arthur Kroker (1984) focuses on the common Canadian ground among McLuhan, Innis, and George Grant. And as previously noted, in *The Post-Industrial Prophets* William Kuhns (1971) links McLuhan and Innis together, along with Lewis Mumford, Siegfried Giedion, Jacques Ellul, Buckminster Fuller, and Norbert Wiener.

Against this trend, James Carey cautions against too close an identification between Innis and McLuhan in his influential work, *Communication as Culture* (1989), and a second collection of essays edited by his students and published under the title *James Carey: A Critical Reader* (1997). Favoring Innis's sociological approach, Carey has been particularly concerned with the political and eco-

nomic consequences of the communications revolution that began in 19th century America. Innovations in telecommunications, starting with the introduction of the telegraph, have resulted in increased control of space, enhancing nationalism, the homogenization of time (in the form of time zones), and social disturbances such as were experienced in the United States during the 1890s. Like Innis (and most other media ecology scholars), Carey is concerned with the preservation of community, which requires greater balance between time and space. Carey refers to a time-oriented (and cultural) perspective as a ritual view, which he contrasts to the transportation view that dominates in the field of mass communication (the transportation view has also been criticized by McLuhan, 1995; Nevitt, 1982; Ong, 1982; and Schwartz, 1974). Carey has referred to his brand of media ecology as American cultural studies, although a recent anthology with the title *American Cultural Studies* (Warren & Vavrus, 2002) indicates that this area is developing a different, albeit closely related identity. Carey's students have followed his lead in producing cultural analyses that emphasize the particular characteristics of specific media environments rather than the larger generalizations put forth by McLuhan, and Innis in the early essays in *The Bias of Communication*. For example, there is Carolyn Marvin's *When Old Technologies Were New* (1988), Kevin Barnhurst and John Nerone's *The Form of News* (2001), Steve Jones's *Rock Formation: Music, Technology, and Mass Communication* (1992), and Fredrick Wasser's *Veni, Vidi, Video: The Hollywood Empire and the VCR* (2001). Others have extended Carey's work on intellectual history, notably Daniel Czitrom who compares Innis favorably to McLuhan in *Media and the American Mind* (1983), and Joli Jensen who critques Neil Postman, Daniel Boorstin, Dwight Macdonald, and Stuart Ewen in *Redeeming Modernity* (1990).

4. The Toronto School

However the relationship between Innis and McLuhan is viewed, they are generally considered the two key members of the Toronto School, a group that encompasses a number of other significant scholars who have been associated with McLuhan. For example, the anthropologist Edmund Carpenter worked with McLuhan on the *Explorations* journal during the '50s, which for the first time indicated that an interdisciplinary field of study had been identified; together they also published the *Explorations in Communication* anthology (Carpenter & McLuhan, 1960). Carpenter added an intercultural dimension to McLuhan's media ecology, as can be seen in *They Became What They Beheld* (Carpenter & Heyman, 1970), an experimental book along the lines of *The Medium is the Massage*, and *Oh, What a Blow That Phantom Gave Me!* (Carpenter, 1973). The entire text of the latter book is included along with other supplementary material such as an interview with Carpenter on the DVD release of the documentary by John Bishop and Harald Prins also entitled *Oh, What a Blow That Phantom Gave Me!* (2003); the film incorporates footage shot by Carpenter circa 1969 showing the reaction of tribal peoples in New Guinea to their first experience with media such as photography, sound recording, and film.

Carpenter left the University of Toronto and McLuhan in 1957, but rejoined McLuhan for his year at Fordham University (1967-1968). While in New York City, they met media producer Tony Schwartz, famous for producing the Daisy commercial for Lyndon Johnson's presidential campaign. Schwartz would go on to write two books combining McLuhan's perspective with the experience of a media professional, *The Responsive Chord* (1974) and *Media: The Second God* (1981). Like McLuhan, Carpenter, and other media ecology scholars, Schwartz was interested in the acoustic sensibility of electronic media, and put forth the concept of resonance as an alternative metaphor to transportation. Rather than transferring information, Schwartz believed that media are most effective when they stimulate the recall of what audience members already have stored in their memories. This emphasis on meaning making on the part of the receiver all but removes content from the equation, leaving the medium as the most significant component in communication. Paul Ryan, who worked as McLuhan's assistant at Fordham and went on to become a well known video artist, published *Cybernetics of the Sacred* (1974), combining McLuhan and Norbert Wiener, and *Video Mind, Earth Mind: Art, Communications, and Ecology* (1993), which also incorporates the semiotics of Charles Saunders Peirce.

Another of McLuhan's University of Toronto colleagues, the physicist Robert K. Logan, published *The Alphabet Effect: The Impact of the Phonetic Alphabet on the Development of Western Civilization* in 1986, based on work that began in collaboration with McLuhan. A new version of the study, under the title *The Alphabet Effect: A Media Ecology Understanding of the Making of*

media ecology, and therefore has something in common with postmodernists influenced by McLuhan such as Jean Baudrillard (1981, 1983), Paul Virilo (1986, 1991, 1997), and Arthur Kroker, who combines McLuhan and Baudrillard in works such as *The Postmodern Scene* (Kroker & Cook, 1987), *Spasm* (Kroker, 1993), and *Digital Delirium* (Kroker & Kroker, 1997).

5. Ong

As a graduate student at Saint Louis University, Walter Ong was one of McLuhan's students, and McLuhan's influence on Ong is reflected in Ong's M.A. thesis on the Jesuit poet Gerard Manley Hopkins (included in Ong, 2002a; see also Ong, 1986), and his Ph.D. dissertation on the early modern French educational reformer, Peter Ramus, which was completed at Harvard University under the direction of Perry Miller. Ong's Ramus study, published in book form as *Ramus, Method, and the Decay of Dialogue* (1958), established Ong's reputation as an impeccable scholar, and serves as a model for research in media ecology and cultural history; it also influenced McLuhan's own thinking, as reflected in *The Gutenberg Galaxy* (1962). *Ramus, Method, and the Decay of Dialogue* provides a case study documenting the impact of print media on modes of thought, knowledge, and education. Ong documents the shift from the largely oral/aural modes of communication, consciousness, and culture associated with scribal culture, and towards an increasingly more dominant visualism. Like McLuhan, Ong calls our attention to the differences between the visual and the acoustic, and the role of media in altering the balance of the senses.

Ong developed a more sophisticated theoretical framework in *The Presence of the Word* (1967b), which in many ways complements McLuhan's *Understanding Media* (1964). In this book, Ong establishes the primacy of sound and speech in human life, introducing the concepts of primary orality as the orality that existed before writing, and secondary orality as the orality associated with the electronic media (and generally shaped by writing as well). In doing so, he traces the cultural transformations that have accompanied the shift from orality to literacy, from chirography to typography, and from print media to electronic communications. In contrast to McLuhan, who tends to emphasize the revolutionary impact that may accompany the introduction of new technologies, Ong presents an evolutionary model where oral/aural biases persist in residual form in literate cultures. Emphasizing how different media work in the establishment of stable cultures, *The Presence of the Word* helps us to understand media as evolving environments and homeostatic ecologies.

Four collections of essays supplement *The Presence of the Word*. The two earlier ones, *The Barbarian Within* (1962) and *In the Human Grain* (1967a) establish some of Ong's basic themes, such as personalism, the contrast between interior and exterior, and of course the distinctions between various media and modes of communication; many of the chapters in these works are better known through reprints in later collections (i.e., Ong, 1992-1999, 2002a). The later pair, *Rhetoric, Romance, and Technology* (1971) and *Interfaces of the Word* (1977), have been highly influential, bringing together discussions of communication, rhetoric, literary theory, systems theory, and media ecology. Also of interest is Ong's edited anthology, *Knowledge and the Future of Man* (1968), based on a symposium held at Saint Louis University, which includes contributions from both Ong and McLuhan, as well as comparative religion scholar Mircea Eliade.

Orality and Literacy (1982) has been Ong's most popular book, and it stands with *Understanding Media* (McLuhan, 1964) as one of the most frequently cited works in the media ecology literature. Written specifically to review, synthesize, and in many ways establish the field of orality-literacy studies, *Orality and Literacy* downplays the phenomenological approach that Ong employs in his previous works. Instead, the book places greater emphasis on the psychodynamics of orality and literacy, the characteristics of oral and literate communication and cognitive styles, and the vital role that memory and mnemonics play in oral societies. While the focus is clearly on the contrast between oral and literate cultures, Ong also discusses the universality of speech and language, the distinction between the alphabet and other writing systems, the shift from scribal copying to mechanical printing, and the secondary orality of electronic media. The publication of *Orality and Literacy* follows *Fighting for Life* (1981), Ong's media ecological study of masculinity, and precedes *Hopkins, the Self, and God* (1986), Ong's return to the topic of his M.A. thesis; his analysis of Hopkins is based on the orality-literacy perspective, as he shows how his poetry combines a literate mindset and sense of individualism with a romantic retrieval of oral poetic elements. As do other media ecology scholars from a variety of religious

backgrounds, Ong examines religion and spirituality on their own terms in a number of these books, and focuses on this topic in early works such as *Frontiers in American Catholicism* (1957) and *American Catholic Crossroads* (1959). His edited volume, *Darwin's Vision and Christian Perspectives* (1960) brings together his interest in theology and cosmology with his focus on evolution and evolutionary processes. In general, Ong's work on the history of culture, consciousness, and communication is informed by an evolutionary and biological perspective.

Many of Ong's essays have been reprinted in the four volumes of *Faith and Contexts* (1992-1999), and more recently in *An Ong Reader* (2002a), all of which have been edited by Thomas J. Farrell and Paul A. Soukup. *An Ong Reader* is particularly relevant for media ecology scholars as it includes many of Ong's key short works in this area, his later essays on the computer, information, and digital media, as well as his M.A. thesis and the "Why Talk?" interview conducted by Wayne Altree.

Farrell and Soukup also join together with Bruce Gronbeck to edit the first anthology about Ong, *Media, Consciousness, and Culture: Explorations of Walter Ong's Thought* (Gronbeck, Farrell, & Soukup, 1991). A second anthology has since appeared under the title *Time, Memory, and the Verbal Arts: Essays on Walter Ong's Thought* (Weeks & Hoogestraat, 1998). Farrell has also written the first full length study of Walter Ong's scholarship, *Walter Ong's Contribution to Cultural Studies: Phenomenology and I-Thou Communication* (2000), a detailed and definitive discussion of Ong's intellectual career. In this work, Farrell identifies Martin Buber as an important influence on Ong, in that Buber discussed the orality of Hebraic culture in contrast to the highly visual literacy of Hellenic culture; he also discusses the Jungian resonances in Ong's work. A more limited analysis, one that highlights Ong's role as a cultural historian and his use of the interface metaphor, can be found in Betty Youngkin's 1995 work, *The Contributions of Walter J. Ong to the Study of Rhetoric*.

6. Orality-Literacy Studies

While most discussions of the Toronto School focus on Innis and McLuhan, Eric Havelock was another foundational media ecology scholar who taught at the University of Toronto. While technically a colleague of Innis, the two had little or no interaction before Havelock left for Yale University, around the time that McLuhan arrived. Havelock's scholarship did influence Innis, McLuhan, Ong, and Postman, and he has frequently been closely linked to Ong as a specialist in orality-literacy studies. As a classics scholar, Havelock explained the transition from Homer to Plato as reflecting a shift from oral to literate culture. He maintains that the introduction of the Greek alphabet was the single most important event in human history, and the basis of western civilization, a position he shared with Innis and McLuhan, having in some ways influenced their thinking on the matter. (Ong, on the other hand, credits the Semites with the invention of the alphabet.)

Havelock's best known work is *Preface to Plato* (1963), much of which is devoted to a discussion of the orality of Homeric epic poetry. He explains how the *Iliad* and the *Odyssey* originated as songs produced and preserved without the benefit of writing, and how the epics' distinctive characteristics, such as use of formulas, meter, concrete imagery, anthropomorphic representations, emphasis on human action, and frequent repetition function as a means to preserve knowledge within collective memory. Thus, he describes Homeric diction as "a total technology of the preserved word," (p. 44), and the epics themselves as a tribal encyclopedia, a means of storing knowledge for the community, functioning in effect as the dominant medium of ancient Greek oral culture. Education, therefore, amounted to the memorization of the songs of Homer and other elements of the oral tradition, as it served as both a record of the past and a set of recommendations for future conduct. And Plato's attack on the poets can thus be understood as involving something much more vital than mere aesthetics: According to Havelock, Plato was advocating a change in the media environment of ancient Greece, from one dominated by oral poetry to one firmly rooted in literacy.

Havelock's *The Greek Concept of Justice* (1978) constitutes an important sequel to *Preface to Plato*, as well as a model of media ecology scholarship. Using the idea of justice as a case study, Havelock engages in philological analysis to trace the transition from the concrete, situational, and personified notion of justice associated with the oral mindset of Homer, to its increasing abstraction as we move through Hesiod and the pre-Socratics, to Plato. Havelock provides a more general discussion of writing and literacy in *Origins of Western Literacy* (1976), based on a series of lectures given at the University of Toronto. In this short book he presents a

concise and effective discussion of the differences between orality and literacy, and among the three main types of writing systems (logographic, syllabic, and alphabetic). He also explains that there are different types of literacies, and distinguishes between craft literacy, in which only a select minority know how to read and write, and only use literacy for utilitarian and generally vocational purposes, and social literacy. Social literacy requires a literature (not just written records, but the culture itself encoded in writing), a readership (reading for education and pleasure), an economic writing system (e.g., relatively few characters, like the alphabet, so that it is easy to learn), legible writing style (as opposed to the elaborate writing found in hieroglyphics or the calligraphy of the medieval manuscript), and schools (providing literacy education at an early age).

The four chapters that comprise *Origins of Western Literacy* are incorporated into *The Literate Revolution in Greece and Its Cultural Consequences* (1982b), along with a number of other previously published articles by Havelock on subjects such as Greek oral poetry, philosophy, and the Attic playwrights. Following Ong's publication of *Orality and Literacy*, Havelock summarized his own perspective on the special case of ancient Greece, and on orality and literacy in general in *The Muse Learns to Write* (1986). Also of interest to media ecology scholars is the anthology Havelock co-edited, *Communication Arts in the Ancient World* (Havelock & Hershbell,1978), and his translation of Aeschylus' *Prometheus Bound*, coupled with his commentary and published under the title of *The Crucifixion of Intellectual Man* (1950). Identified with writing, knowledge, and science, the myth of Prometheus speaks to the dialectic between nature and culture as well as orality and literacy. For Havelock, it raised issues concerning the relationship between the intellectual and the production of knowledge on the one hand, and the political leader and the exercise of power on the other. Innis, in *Changing Concepts of Time* (2004) cites *The Crucifixion of Intellectual Man* as an inspiration for his final work.

It should be noted that Havelock was not the first to write about oral cultures: Milman Parry is generally credited with the discovery of primary orality, as Havelock and Ong make clear; moreover, McLuhan begins *The Gutenberg Galaxy* by acknowledging his debt to Parry. Following his premature death, Parry's research was completed by his student Albert Lord, who published *The Singer of Tales* in 1960; Parry's own papers, edited by his son Adam, were published posthumously under the title of *The Making of Homeric Verse* (1971). Parry and Lord's research included textual analysis of the diction and style of the Homeric poems, and field work studying the contemporary oral singers in Serbo-Croatia, which provided a working example of oral composition. Observing that the use of meter in oral poetry influences the content of the poetry, Parry states that

> Homer . . . assigned to his characters divinity, horsemanship, power, and even blond hair, according to the metrical value of their names, with no regard to their birth, their character, their rank, or their legend: except in so far as these things were common to all heroes. Except, that is to say, in so far as these things are interchangeable. If being 'divine', for example, has about the same value as being 'king' or 'horseman' or 'blameless' or 'strong' or any of the other qualities indicated by the generic epithet, then the poet was led by considerations of metre to stress one of these qualities for a given hero more than another. (p. 150)

In other words, Parry was essentially saying that the meter is the message. Havelock in turn used Parry and Lord's understanding of oral composition to establish a broader understanding of primary oral cultures, of how oral poetry functions within oral societies, and therefore of the effects of primary orality on consciousness and culture.

Jack Goody (1968) is generally considered to be the first to make reference to the Toronto School. As an anthropologist, he brings a cross cultural approach to orality-literacy studies, confirming and complementing the historical and literary research of Ong and Havelock. In his 1968 anthology, *Literacy in Traditional Societies* (1968), Goody follows McLuhan and Havelock in emphasizing the invention of the Greek alphabet, but in his best known work, *The Domestication of the Savage Mind* (1976) he broadens his scope to consider the impact of writing in general. He also proposes that orality-literacy makes for a better point of comparison than Claude Lévi-Strauss's traditional dichotomy of the savage or primitive and the civilized, as the latter only labels, while the former provides an explanation for cultural differences rooted in technology, not biology. Goody points to one of the most basic activities associated with writing, the making of lists, as a means of moving thought in the direction of greater abstraction through decontextualization. As writing takes language out of the context of physical presence and interaction, lists take words out of the context of sentences, separating subject from predicate, noun from verb and adjective.

In *The Logic of Writing and the Organization of Society* (1986), Goody mostly draws on historical data in

discussing the impact of writing on social institutions. He explains the role of writing in religion, and the shift from oral spirituality that is local and immanent in nature to the transcendence and universalism of literate religions, which also introduce the either/or thinking that goes along with dogma, orthodoxy, conversion, and heresy. Goody also discusses how the invention of writing was associated with the first medium of exchange, the activity of accounting, and the development of the first economic systems; how it made possible the development of centralized government and the state; and how it was necessary for the development of laws and legal systems. In *The Interface Between the Written and the Oral* (1987), Goody reviews the historical development of writing and the gradual shift between orality and literacy, distinguishing between media and modes of communication. Also of relevance to media ecology scholarship is Goody's most recent collection, *The Power of the Written Tradition* (2000).

One of the first anthropologists to discuss the role of orality and literacy across cultures was Dorothy Lee. In her highly influential *Freedom and Culture* (1959), she connects literacy to lineality in thought and perception; she also considers the impact of literacy in *Valuing the Self* (1976). Psychologist David R. Olson emphasizes the cognitive effects of writing and especially reading in *The World on Paper* (1994), and in his co-edited anthology, *Literacy and Orality* (Olson & Torrance 1991). Philosopher David Abram combines orality and literacy with phenomenology in *The Spell of the Sensuous* (1996). Communication scholar Catherine Kaha Waite draws on Ong and McLuhan and applies the phenomenology of orality-literacy to contemporary media in *Mediation and the Communication Matrix* (2003); her particular focus is on the role of the screen in the continuing transformation of the self. Media arts researcher Robert Albrecht explores the shift from primary to secondary orality in musical

experience in *Mediating the Muse* (in press). Rhetorician Kathleen Welch considers the transformations of the word as we move from orality to literacy to electricity in *Electric Rhetoric: Classical Rhetoric, Oralism, and a New Literacy* (1999). And legal expert Ethan Katsh has employed the orality-literacy perspective to explore the impact of electronic communication and digital media on the legal profession and the judicial system in *The Electronic Media and the Transformation of Law* (1989) and *Law in a Digital World* (1995).

The orality-literacy approach has proven particularly relevant to investigations into the nature of computer-mediated communication. For example, Jay David Bolter, a classics scholar who turned to the study of new media, incorporates the orality-literacy perspective into his study of hypertext, *Writing Space: The Computer, Hypertext, and the History of Writing* (1991), now in a second edition under the title *Writing Space: Computers, Hypertext, and the Remediation of Print* (2001). Orality-literacy also informs Bolter and Grusin's *Remediation* (1999). Likewise, literary theorist George Landow interprets hypertextuality through orality-literacy and deconstruction in *Hypertext* (1992) and *Hypertext 2.0* (1997). Similarly, English professor Richard Lanham combines Ong's perspective with postmodernism (while critiquing Postman's *Amusing Ourselves to Death*, 1985) in *The Electronic Word* (1993). Michael Heim brings Ong and Havelock together with Heidegger in his study of word processing, *Electric Language* (1987), which he follows up with *The Metaphysics of Virtual Reality* (1993). Brenda Danet draws on the orality-literacy perspective in her research on play and art in online communications in *Cyberpl@y* (2001), concluding that creative expression through e-mail, chat, and websites constitutes a new form of folk art. Orality-literacy perspectives also inform the anthology *The Emerging Cyberculture* (Gibson & Oviedo, 2000).

7. Media History

While orality-literacy studies cuts across different cultures and time periods, it does not include the full range of possibilities of human communication and mediation. For example, Merlin Donald posits a stage of media evolution prior to orality in *Origins of the Modern Mind* (1991); in this mimetic stage, body movement served as the major mode of communication. Speculation about the origins of language and symbolic communication, for example, Robin Dunbar's *Grooming, Gossip, and the Evolution of Language* (1996) also has its place in the field

of media ecology, as there is no absolute distinction between the evolution of media, of language, or that of the human species. Certainly, while orality-literacy studies generally begin with antiquity, they can be extended backwards into the prehistoric world, as John Pfeiffer does in *The Creative Explosion* (1982). His title refers to the sudden appearance of cave art and other forms of visual expression and technological innovation some 20-30,000 years ago. Pfeiffer argues that this marks the first appearance of mnemonics, and that the cave paintings represent

the first form of memory theater. Pfeiffer draws on Frances Yates's book, *The Art of Memory* (1966), an important work that presents the cultural history of visual mnemonic systems from ancient Greece to early modern Europe.

The history of writing is also a subject of great relevance for media ecology, and this includes the groundbreaking work of archeologist Denise Schmandt-Besserat, who unearthed the origins of writing in ancient Mesopotamia. Schmandt-Besserat has explained how writing developed through a series of innovations involving accounting procedures used by the ancient Sumerians, from clay tokens to clay envelopes to cuneiform, in a series of books and articles: *An Archaic Recording System and the Origin of Writing* (1978), *Early Technologies* (1979), "The Origins of Writing" (1986), the impressive two volume set *Before Writing* (1992), and the abridged version, *How Writing Came About* (1996). In demonstrating the common origins of writing, numerals, and coins, Schmandt-Besserat also confirms the arguments of Dorothy Lee, McLuhan, Carpenter, and others about the inherent linearity of writing.

Other scholars have produced surveys and taxonomies of the various writing systems that have been developed and evolved over the past 6,000 years. I. J. Gelb's classic work, *A Study of Writing* (1963), adds a developmental theory of writing that suggests a natural progression from logographic to phonetic writing, and from syllabic to alphabetic writing systems. Gelb coins the term "grammatology" to refer to the study of writing, which in turn inspires the deconstruction of writing initiated by Jacques Derrida, hence *Of Grammatology* (1976). Henri-Jean Martin has produced the definitive work on the subject, *The History and Power of Writing* (1994), which covers the impact of printing as well as writing. As noted above, Robert Logan's *The Alphabet Effect* (in press) traces the diffusion of alphabetic writing from ancient Israel, Greece, and Rome to India, Arabia, and the modern western world. Logan is particularly interested in the connection between the alphabet and the historical development of law and science.

Along with the study of writing systems, scholars such as Innis, McLuhan, and Ong have been interested in the unique characteristics of handwritten documents, scribal copying, and manuscript culture, as contrasted with the familiar world of print media. H. J. Chaytor set the mark for scholarship in this area with *From Script to Print* (1950), which emphasizes the study of scribal culture. Research on the printing press and print media generally incorporates some discussion of chirography for purposes of comparison, for example Lucien Febvre and Henri-Jean

Martin's key contribution, *The Coming of the Book* (1976). S. H. Steinberg's *Five Hundred Years of Printing*, originally published in 1955, has gone through a series of new editions and revisions, some posthumous, the most recent in 1996. Steinberg's study is particularly valuable for its account of the technological development of the Gutenberg press, its survey of the varieties of print media, and the role of print in establishing vernacular literature and fostering nationalism.

Elizabeth Eisenstein provides an exhaustive study of the printing revolution in her two volume *The Printing Press as an Agent of Change* (1979), in which she grapples with McLuhan's arguments about the effects of typography, moving from a skeptical position to one that ultimately confirms McLuhan's insights. Eisenstein details the development of printing and its effects in early modern Europe, and includes major case studies of the role of printing in preserving the Renaissance (which immediately precedes Gutenberg and is encoded and in effect enshrined in print) as a permanent historical break, in promoting the Protestant Reformation and establishing a permanent schism in western Christianity, and in allowing for the development of modern science (for example, the Copernican revolution began before the invention of the telescope, and was based on the new availability of printed astronomical records). Eisenstein's research has also been published in an abridged form under the title *The Printing Revolution in Early Modern Europe* (1983). David Kaufer and Kathleen Carley offer a communication and media ecology perspective on printing in *Communication at a Distance* (1993), arguing that the changes discussed by Eisenstein were more evolutionary than revolutionary.

Print media and literacy are not just a matter of historical research, as can be seen from Jonathan Kozol's study, *Illiterate America* (1986), and Daniel Boorstin's report, *Books in Our Future* (1984), in which he identifies a growing problem of aliteracy (referring to literates who choose not to read, an option made possible by the presence of electronic alternatives to print media). Certainly news and journalism are topics that once were exclusively associated with print media, and now cut across all manner of electronic media. Mitchell Stephens considers the entire range from orality to electricity in *A History of News* (1988), while Michael O'Neill discusses the impact of television news in promoting democracy in *The Roar of the Crowd* (1993). Friedrich Kittler addresses media history in a series of books, *Discourse Networks 1800/1900* (1990); *Literature, Media, Information Systems* (1997); and *Gramophone, Film, Typewriter*

(1999). Anthony Smith considers how the development of mass communications in the west dominates global news coverage in *The Geopolitics of Information* (1980a), and discusses the impact of the computer on newspapers in *Goodbye, Gutenberg* (1980b), on knowledge in *Books to Bytes* (1993), and on identity in *Software for the Self* (1996). Similarly, Argentinian theorist Alejandro Piscitelli draws on the historical perspectives of Ong, Innis, McLuhan, Goody, and Eisenstein in arguing that the television era has come to a close, rendered obsolescent by the Internet, in *Post/Televisión: Ecología de Los Medios en la Era de Internet* (1998). One of the most significant recent studies of the changing media environment has been produced by Ronald Deibert, a political scientist specializing in international relations. Deibert's *Parchment, Printing, and Hypermedia: Communication in World Order Transformation* (1997) is very much in the tradition of Harold Innis's studies of social organization, empire, and nationalism. Deibert use the terms medium theory and ecological holism to describe his media ecology of world order, tracing the changes as we move from medieval scribal theocracy to modern print-based nationalism to our emerging postmodern, electronically mediated world order.

Walter Benjamin is often associated with the Frankfurt School (see, for example, Stamps, 1995), although he was very much on the margins of that group, socially and politically. His own brand of Marxist criticism contains numerous media ecology insights, such as the following:

> During long periods of history, the mode of human sense perception changes with humanity's entire mode of existence. The manner in which human sense perception is organized, the medium in which it is accomplished, is determined not only by nature but by historical circumstances as well. (Benjamin, 1968, p. 222)

This quote is taken from Benjamin's often cited essay, "The Work of Art in the Age of Mechanical Reproduction," which was originally published in 1936 and is frequently reprinted. In this article, Benjamin's main concern is with printing, but specifically with lithography rather than typography. The mechanical reproduction of art, he argues, calls into question the concept of authenticity; continued innovations in image technology, i.e., photography and film, blur the distinction between original and copy, making authenticity even more problematic. He uses the term "aura" to refer to the sense of authenticity that is lost through the media of reproduction, at the same time maintaining that mass reproduction is ultimately democratizing.

Daniel Boorstin provides a conservative spin on Benjamin's argument in *The Image: A Guide to Pseudo-Events in America* (1978a), a revised edition of *The Image: Or What Happened to the American Dream* (1962). Rather than mechanical reproduction alone, Boorstin's agent of change is what he calls the Graphic Revolution, the series of innovations in communications that begins in the 19th century with the steam powered printing press and photography, and includes the invention of sound recording, the motion picture, radio, and television. According to Boorstin, our technologies have given us extravagant expectations about the world, and led us to replace reality with our now easily manufactured illusions. For example, in journalism the emphasis shifts from the gathering of news, based on real events, to the manufacture of news by journalists and public relations specialists, through interviews, publicity stunts, press releases, leaks, and other forms of pseudo-events (otherwise known as media events). Along the same lines, Boorstin argues that genuine heroes have been replaced by celebrities whose fame is artificially produced; this idea is further explored in Susan Drucker and Robert Cathcart's anthology, *American Heroes in a Media Age* (1994). He also discusses the distinction between the traditional activity of travel and the modern notion of tourism, and the dissolution of forms (a line of argument that anticipates such current phenomena as docudrama and edutainment). A similar critique is put forth by Christopher Lasch in *The Culture of Narcissism* (1978), where he diagnoses image culture as a psychoanalytic symptom denoting a surfeit of self-love; Lasch follows this with critical discussions of progress and liberalism in *The True and Only Heaven* (1991) and *The Revolt of the Elites* (1995). Kevin DeLuca's *Image Politics* (1999) provides a more sympathetic view of the use of publicity in the service of media activism, specifically environmentalism. Drawing on rhetorical criticism as well as McLuhan's media ecology, DeLuca details how groups like Greenpeace learned from McLuhan how to generate media coverage.

Jean Baudrillard gives Benjamin and McLuhan a postmodern turn in publications such as *Simulations* (1983) and *Simulacra and Simulation* (1994), arguing that our technologies have progressed so far that we now are able to create hyperreal simulations, artificial creations that are more real than real. Gary Gumpert provides a more concrete discussion in *Talking Tombstones and Other Tales of the Media Age* (1987), where he analyzes the ambiguities of electronic media in regard to the perception of time and space, and of perfection. Similarly, Steve Jones examines the question of authenticity in relation to sound

recording technology, digital sampling, and computer-generated music in *Rock Formation* (1992). Susan Sontag also draws on Benjamin and McLuhan in *On Photography* (1997), a meditation on the effects of the medium in which she comes to the following conclusion:

> Images are more real than anyone could have supposed. And just because they are an unlimited resource, one that cannot be exhausted by consumerist waste, there is all the more reason to apply the conservationist remedy. If there can be a better way for the real world to include the one of images, it will require an ecology not only of real things but of images as well. (p. 158)

Sontag's call for an ecology of images has been answered by Julianne Newton in her wide-ranging work,

The Burden of Visual Truth (2000), which considers the new technology of digital photography, in Ann Barry's *Visual Intelligence* (1997), and in Scott McCloud's *Understanding Comics* (1993) and *Reinventing Comics* (2000). Sontag herself has recently returned to the subject with *Regarding the Pain of Others* (2003). The issues originally raised by Benjamin are also reflected in critques such as Postman's *Amusing Ourselves to Death* (1985), Ian Mitroff and Warren Bennis's *The Unreality Industry* (1989), Mitchell Stephen's *The Rise of the Image, the Fall of the Word* (1998), Neal Gabler's *Life the Movie* (1998), and Arthur Hunt III's *The Vanishing Word* (2003). Finally, it is important to note that media history in turn influences the study of history itself, a point made by media ecologists such as Innis (1951), Eisenstein (1979), and Terence Ripmaster in *The Ecology of History* (1978).

8. Postman

As a doctoral student in the 1950s, studying about language and communication under Louis Forsdale at Columbia University's Teachers College, Neil Postman was introduced to Marshall McLuhan, who Forsdale frequently invited down to New York City to lecture. Postman wrote about McLuhan's relevance for English education as early as 1961 in a book commissioned by the National Council of Teachers of English, entitled *Television and the Teaching of English*. He also advocated language education as an alternative to traditional approaches to grade school English, the latter prescribing proper grammar, spelling, and elite culture, the former emphasizing the communication process or medium over content. Collaborating with his classmate from Teachers College, Charles Weingartner, Postman elaborated on this argument in *Linguistics: A Revolution in Teaching* (Postman & Weingartner, 1966). With the understanding that media constitute our new languages (Carpenter & McLuhan, 1960), Postman and Weingartner integrated the two arguments to produce their highly successful *Teaching as a Subversive Activity* (1969), which was particularly popular within the educational reform movement of the '60s. This book reflects McLuhan's criticism of print-based schools as outmoded and obsolescent, and calls for new modes of education better suited to the age of electronic media. In particular, Postman and Weingartner call for a curriculum based on the "Sapir-Whorf-Korzybski-Ames-Einstein-Heisenberg-Wittgenstein-McLuhan-Et Al. Hypothesis . . . that language is not merely a vehicle of expression, it is also the driver; and

that what we perceive, and therefore can learn, is a function of our languaging processes" (p. 101). *Teaching as a Subversive Activity* had a dramatic impact on the educational reform movement during the early '70s, and remains influential to this day. Postman and Weingartner produced two additional books on education, *The Soft Revolution* in 1971 (which included a prospectus for a graduate program in media ecology) and *The School Book* (which includes a discussion of McLuhan's relevance for educational reform) in 1973.

In addition to education, Postman emphasizes linguistics, semantics, and the study of interpersonal communication to a much greater extent than either McLuhan or Ong, as can be seen from his 1976 book, *Crazy Talk, Stupid Talk*. That same year, he began a 10 year term as editor of *ETC.: A Journal of General Semantics*, publishing a number of significant pieces on media ecology by scholars such as McLuhan, Eric Havelock, Gary Gumpert, Joshua Meyrowitz, and Paul Levinson. Postman's reputation as a media critic was established after 1979, the year he published *Teaching as a Conserving Activity*. Reversing himself from the position he had taken with Weingartner in *Teaching as a Subversive Activity* (1969), Postman concludes that schools need to counter the effects of television and the electronic media by preserving the values and methods associated with print-based literacy. His primary point of comparison is the school as opposed to television, arguing that they are competing forms of education. But it is in this book that Postman also identifies the key opposition between the word (both oral and literate, but reaching

its highest form in print culture) and the image (which television makes predominant). This argument can be contrasted to McLuhan and Ong's emphasis on sense perception and the contrast between the ear and eye, as Postman instead stresses language and symbolic form. This line of inquiry is then continued in *The Disappearance of Childhood* (1982), in which Postman argues that the concept of an extended childhood is a construction of print culture that has been destroyed by the leveling effect of the televised image. Postman opens *The Disappearance of Childhood* with a memorable remark on the human medium: "Children are the living messages that we send to a time we will not see" (p. 1). The same line of inquiry culminates in *Amusing Ourselves to Death* (1985), which is one of the most frequently cited works in the media ecology literature, along with McLuhan's *Understanding Media* (2003a) and Ong's *Orality and Literacy* (1982). In *Amusing Ourselves to Death* Postman argues that our image culture trivializes serious discourse, e.g., news, politics, religion, and education. Each of these three books contains basic summaries of the media ecology perspective (although usually without using the term), under headings such as "the medium is the metaphor" and "media epistemology."

For the remainder of his career, Postman continued to be an outspoken critic of television (e.g., Postman, Nystrom, Strate, & Weingartner, 1987; Postman, 1988; Postman & Powers, 1992), but he also became known as a neo-Luddite after the publication of *Technopoly* in 1992. In this book, Postman distinguishes between three different types of culture, tool-using where technology is limited, technocracy where technology is on the rise but still in competition with other social institutions, and technopoly where technology monopolizes the culture. Although he does not make the connection here, these three cultures roughly correspond to the oral, print, and electronic media environments. Criticizing the uncritical acceptance and worship of technology in contemporary America, Postman argues that we tend to consider only what innovations are supposed to do, and never take into account what they will undo, that is, their negative effects. And noting that the problem that we face today is not scarcity of information but information overload, he suggests that we think about whether the "problem" that a new technology is supposed to solve is really a problem in the first place. If not, he believes that we ought to consider that the innovation, whose full effects will not be known until after it is widely adopted, may in fact be unnecessary. The reason why it is hard to say no to technology is that in a technopoly there are no other values, no competing system of beliefs, no ruling idea to set against the technological imperative. In *The End of Education* (1995), Postman suggests that without such values, beliefs, ideas, myths, or narratives, there is no basis for a public school system. He provides suggestions for new narratives, one being the history of communication, media, and technology. In his final book, *Building a Bridge to the Eighteenth Century* (1999), Postman advocates the retrieval of another narrative and set of values, that of the Enlightenment and print culture. In her book, *Redeeming Modernity*, Joli Jensen (1990) has criticized Postman as being an anti-modernist. It would be more accurate, however, to view him as opposing the postmodern and in favor of the conservation of the modern (Strate, 1994, 2003; see also Gencarelli, 2000).

9. The New York School and Communication Studies

It is possible to refer to a New York School both in the specific terms of Postman and his New York University colleagues and students, and in the more general terms of the New York City area academics and intellectuals who have been influenced by McLuhan. This more general and geographic notion of a New York School might begin with Louis Forsdale at Columbia University's Teachers College during the 1950s. (We could reach even further back to include Susanne Langer and Lewis Mumford, but they are discussed in other sections instead). One of the distinguishing characteristics of the New York School is its strong connection to the field of communication, either by way of adoption, as was the case for Postman, Forsdale, and many others, or by specialization.

Henry Perkinson, a colleague of Neil Postman at New York University, was introduced to media ecology and communication studies through his interactions with Postman. Taking issue with Postman's pessimism about media and technology, Perkinson developed an approach to media history that placed greater emphasis on human agency and defended the notion of human progress. Best known for his work on the history and philosophy of education, Perkinson emphasizes Karl Popper's philosophy of fallibalism, which stresses that we improve our situations through criticism, which leads to the recognition and correction of error. In his three books on communication, Perkinson argues that the introduction of a new medium provides new ways of encoding reality, which in turn

the important contrast is drawn between digital and analogic codes of communication, a binary opposition derived from computing that allows for a broad division between means or media of communication: digital would include most forms of language as well as all forms of number, while analogic encompasses most types of nonverbal communication, including pictures and music. Moreover, the authors distinguish between two levels of communication, the content level, on which plain communication occurs, and the relationship level, which involves communication about communication. The distinction between content, which we generally pay attention to, and relationship, which we tend to ignore and therefore becomes an invisible environment, can be understood as another aspect of the distinction between content and medium. In other words, relationships are a type or aspect of media, and different media represent different types of relationships. Experimental psychologist Stanley Milgram's famous obedience to authority experiments illustrate the power of the relationship level. Along with the book *Obedience to Authority* (1974), the Milgram anthology *The Individual in a Social World* (1992) is relevant to the field of media ecology, as is his collaboration with R. Lance Shotland, *Television and Antisocial Behavior* (1973). For Watzlawick, the study of relationships is based on systems theory, and he presents his perspective on systems, which he associates with group theory in mathematics, in *Change* (1974), co-authored by John Weakland and Richard Fisch. Watzlawick also argues for the social construction of reality in *How Real is Real?* (1976), and has returned to many of these same themes in subsequent works, *The Situation is Hopeless, But Not Serious* (1983), *Ultra-Solutions* (1988), and *Münchhausen's Pigtail* (1990).

In *Towards a Science of Media Ecology* (1973), Chistine Nystrom draws a parallel between the development of media ecology on the one hand, and cybernetics and systems theory on the other, as both represent holistic, ecological approaches. Joshua Meyrowitz, who studied under Gumpert, Postman, and Nystrom, uses the concept of information systems to bridge the media ecology of McLuhan and the symbolic interactionism of Goffman in his influential work in theory building, *No Sense of Place* (1985). Meyrowitz explains that media of communication and face-to-face situations in real physical places are both information systems that can be analyzed in terms of patterns of access to information, and barriers that prevent information from being disseminated. Concentrating on the shift from the typographic to the electronic media environment, Meyrowitz argues that whereas print media requires varying degrees of literacy, and therefore impos-es various barriers to information access, television and other electronic media have broken down the barriers and created a vast shared information environment. This in turn has led to changes in social roles and relationships that were based on particular pattern of access. Thus, while barriers to information about the opposite sex helped differentiate gender roles during the print era, the high degree of access to such information in the electronic age has led to a blurring of the boundaries in a variety of ways. It has also resulted in the paradox of all sorts of minority groups demanding the equal right to be recognized as a minority. Along the same lines, the strong distinction between childhood and adulthood that developed within print culture has been undermined by the electronic media, and the inability to maintain an effective back region has broken down hierarchies and undermined political leadership and authority as we move from typography to television. Meyrowitz introduces the term medium theory here, which can be understood as referring to the theory that the medium is the message. Medium theory is therefore best understood as the adaptation of media ecology to a social scientific framework.

Meyrowitz is not alone in combining symbolic interaction with media ecology. Other sociologists trained in the symbolic interactionist tradition have explored the areas of communication and media, notably Carl Couch in *Constructing Civilizations* (1984), *Social Processes and Relationships* (1989), and *Information Technologies and Social Orders* (1996); David Altheide in *Creating Reality* (1976), *Media Power* (1985), *An Ecology of Communication* (1995), and *Creating Fear* (2002); Robert Snow in *Creating Media Culture* (1983); and Altheide and Snow together in *Media Logic* (1979) and *Media Worlds in the Postjournalism Era* (1991). Mark Poster adapts medium theory to poststructuralism, applying Baudrillard, Derrida, Lyotard, and Foucault to computers and television in *The Mode of Information* (1990), and following up with *The Second Media Age* (1995). Psychologist Kenneth Gergen focuses on the impact of interpersonal media such as the telephone and e-mail in *The Saturated Self* (1991). Following Watzlawick, Gergen argues that we define ourselves through our relationships, and within each relationship we form a distinct role or self. As electronic technologies have led to a sharp rise in the number of interpersonal contacts we make and keep up with, and the frequency of our interactions, the number of roles and selves that we maintain increases as well. This results, Gergen argues, in the postmodern breakdown of the self or decentering of the subject (a development that Poster emphasizes as well).

al tradition, Mumford's importance is clear; as noted above, he influenced McLuhan's thought in significant ways (e.g., 2002, 2003a), and the same is true for Innis (1950, 1972) and Postman (e.g., 1979, 1982, 1985, 1992). Mumford's influence also can be seen in the works of Siegfried Giedion (another one of Kuhn's post-industrial prophets), in books such as *Space, Time and Architecture* (1947) and *Mechanization Takes Command: A Contribution to Anonymous History* (1948). Similarly, there is Lynn White, Jr.'s historical study of technics, *Medieval Technology and Social Change* (1962) and *Medieval Religion and Technology* (1978). Mumford's ecological approach to technology is also reflected in the historical studies produced by the late Librarian of Congress Emeritus Daniel Boorstin, such as *The Republic of Technology* (1978b), and his trilogy, *The Discoverers* (1983), *The Creators* (1992), and *The Seekers* (1998). Jay David Bolter's *Turing's Man* (1984)

picks up on Mumford's historical approach in its argument that each era has a particular "defining technology," and Bolter extends Mumford's analysis by discussing the clock as a technological ancestor of the computer. David Landes' book, *Revolution in Time: Clocks and the Making of the Modern World* (2000) expands on Mumford's analysis of the clock. William Mitchell addresses the familiar Mumfordian themes of technology and the city in his trilogy, *City of Bits* (1995), *e-topia* (1999), and *Me++: The Cyborg Self and the Networked City* (2003); he also discusses art and visual communication in *The Reconfigured Eye: Visual Truth in the Post-Photographic Era* (1992). And Scott Eastham combines Mumford and McLuhan, along with Buckminster Fuller, in *The Media Matrix* (1990), emphasizing the concept of container technology; recently he has also come out with a critical analysis of genetic engineering entitled *The Biotech Time-Bomb* (2003).

11. Ellul and Technology Studies

The most radical of Kuhns's (1971) post-industrial prophets is the French social critic Jacques Ellul. Ellul rarely addresses the effects of individual technologies, instead focusing on technology at the highest level of abstraction, as a system, worldview, and way of life; the term he uses in this context is *la technique*. In what many consider his major work, *The Technological Society* (1964), Ellul argues that we have entered a historical phase in which we have given up control over human affairs to technology and the technological imperative. According to Ellul, technology has become autonomous and automatic, self-augmenting or expanding at an ever increasing rate, and encompassing every sector of human society. It dominates the natural world and has replaced religion and even science as our governing ideology. Except that technology is not really an ideology, he argues, in that it represents no set of ideas or values other that itself. Efficiency is the only thing that matters in a technological system, so all other considerations are subordinated to efficiency, if not eliminated outright. Ellul continues his argument in *The Technological System* (1980), where he refers to technology as an environment and ecology, and like Mumford (1970) is critical of McLuhan's stance on technology. And he returns to it once again in *The Technological Bluff* (1990), where he critiques computers and technological networks.

Apart from his three major technology books, Ellul also followed up *The Technological Society* with *Propaganda: The Formation of Men's Attitudes* (1965), focusing on propaganda as a particular type of technology

or technique, one whose aim is to control human behavior so that we are integrated into the technological system. Here he discusses different categories of propaganda, including the propaganda of integration (which aims at keeping the individual satisfied with the status quo) and agitation (whose purpose is to move the individual to action); sociological propaganda (a subtle form that works through entertainment, advertising, schools, the arts, religion, etc.) and political propaganda (the most obvious type of propaganda); and horizontal propaganda (through peer groups) and vertical propaganda (coming from authorities). Ellul notes that literacy and mass communications technologies are vital for propaganda, for without a means of delivering the messages, there is no way for propaganda techniques to influence populations. This line of inquiry continues into *The Political Illusion* (1967), where Ellul discusses the need to maintain the illusion that public opinion controls political decision making in order to maintain legitmacy. He argues that this illusion is used to counter the reality that government decisions need to be based on the technical criterion of efficiency, which in turn requires the use of propaganda techniques to direct public opinion to support those decisions and maintain the illusion of popular support and sovereignty.

In *The Humiliation of the Word* (1985), Ellul argues that our audiovisual technologies and the image culture they have given rise to also contribute to the technological society and the degradation of the human condition by undermining the role of verbal communication. Much like

Postman, Ellul defends the word against the image, and criticizes the loss of rational discourse. But Ellul also combines sociology here with theology, as he works from a Christian perspective as a member of the French Reformed Church. Ellul has published numerous works on theology and ethics in addition to being a religious activist. Among the most significant theological works translated into English are *The Presence of the Kingdom* (1951), *The Meaning of the City* (1970), *The Ethics of Freedom* (1976), and *Anarchy and Christianity* (1991). Moreover, several interview books have been published where Ellul explains his sociological and religious perspectives, *Perspectives on Our Age* (1981), *In Season, Out of Season: An Introduction to the Thought of Jacques Ellul* (1982), and the posthumously published *Jacques Ellul on Religion, Technology, and Politics* (1998). Also posthumously published is a collection of articles entitled *Sources and Trajectories: Eight Early Articles by Jacques Ellul that Set the Stage* (1997). Clifford Christians, who is associated with James Carey and American cultural studies, has written about Jacques Ellul from a communication perspective in *Jacques Ellul and Democracy's "Vital Information" Premise* (1976) and is co-editor of, *Jacques Ellul: Interpretive Essays* (Christians & Van Hook, 1981).

Along with Mumford, Giedion, Ellul, Innis, and McLuhan, Kuhns (1971) also includes two other post-industrial prophets, Buckminster Fuller and Norbert Wiener. Fuller was an inventor and architect as well as a scholar and critic, and unlike Mumford was generally a proponent of technology. He coined terms such as "synergy," which refers to the systems theory concept that the whole is greater than the sum of its parts, and "tensegrity," a contraction of tension and integrity. Tensegrity represents the combination of push and pull forces that serve as an alternative to typical methods of construction, and Fuller's geodesic dome is an example of tensegrity at work. These concepts are discussed in *Synergetics: The Geometry of Thinking* (Fuller & Applewhite, 1975). Fuller also coined the term "spaceship earth," often used as a synonym for McLuhan's "global village," and devoted a book to the topic, *Operating Manual for Spaceship Earth* (1971). And following McLuhan, Fuller joined with Jerome Agel and Quentin Fiore to produce a book along the lines of *The Medium is the Massage*, entitled *I Seem to Be a Verb* (Fuller, Agel, & Fiore, 1970).

Wiener, who coined the term cybernetics as the science of control, finds common ground between electronic technology and biology in that both can be viewed as information systems based on feedback loops. He has written about cybernetics in a more technical volume entitled *Cybernetics: Or Control and Communication in the Machine and Animal* (1961), and a more popular variation, *The Human Use of Human Beings: Cybernetics and Society* (1950); he also takes up the subject of science and religion in *God and Golem, Inc.: A Comment on Certain Points Where Cybernetics Impinges on Religion* (1964). Wiener and his fellow pioneers in information theory, Claude Shannon and Warren Weaver (1949), form the basis of James Beniger's history of 19th and early 20th century technology and techniques, *The Control Revolution* (1986). Beniger argues that the increasing complexity of industrialization led to the development of numerous information technologies to control and coordinate human and machine activity, long before the current information age began. N. Katherine Hayles has also drawn on information theory to examine *How We Became Posthuman* (1999), as well as how writing has been transformed in *Writing Machines* (2002), another book patterned after *The Medium is the Massage*.

Along with Mumford and Ellul, Peter F. Drucker is one of the most prolific media ecology scholars, whose work ranges across philosophy, political science, economics, sociology, and management, the latter a field he invented. Although Kuhns (1971) does not include him in his survey, Drucker is most certainly a futurist and post-industrial prophet. For example, he was one of the first to identify the fact that assembly line production was being obsolesced by electronic technologies, in works such as *The Future of Industrial Man* (1942), and *Landmarks of Tomorrow* (1959). He continued to discuss the impact of new technologies and identify effects such as the creation of knowledge industries and knowledge workers in *The Age of Discontinuity* (1968), and later in *The New Realities* (1989) and *Post-Capitalist Society* (1993). Drucker considers the impact of technology on business in *Technology, Management & Society* (1970), but looks at the corporation as essentially a technology in its own right in *The Concept of the Corporation* (1946). He refers to his approach as social ecology in *The Ecological Vision* (2000), a collection of essays on technology, business, economics, government, and culture. And Drucker discusses his relationship to McLuhan in *Adventures of a Bystander* (1979), a semi-autobiographical work.

Ivan Illich represents one of the more critical voices in technology studies in works such as *Tools for Conviviality* (1973) and *H2O and the Waters of Forgetfulness: Reflections on the Historicity of "Stuff"* (1985). Like Postman and Weingartner, Illich was part of the educational reform movement of the '60s and '70s, through works such as *Deschooling Society* (1971), and he