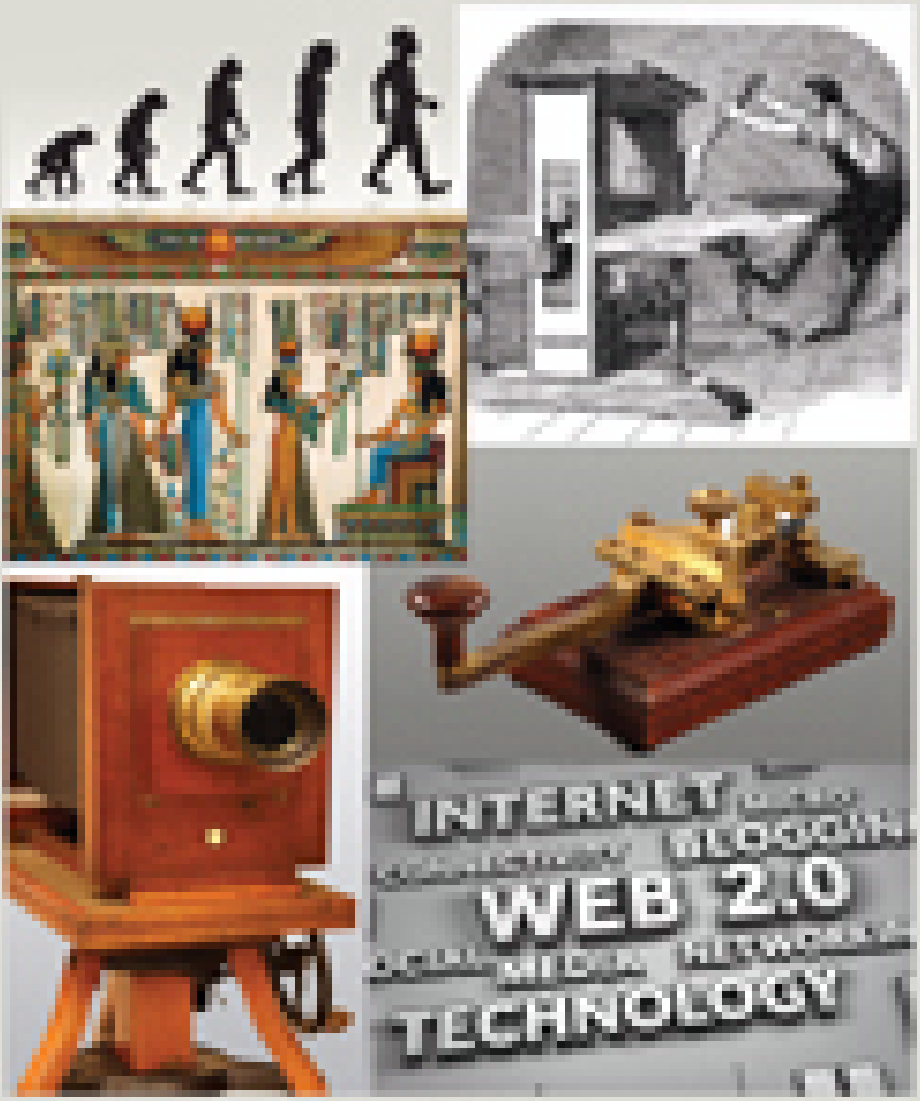
Introduction to the History of Communication

EVOLUTIONS & REVOLUTIONS



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UNDERSTANDING EVOLUTIONS AND REVOLUTIONS IN HUMAN COMMUNICATION

Perhaps the most basic questions in life are these: Why is there something rather than nothing? Why is there a universe, our solar system, our earth? Why is there life on earth? Why is there a life form on earth capable of asking such questions? The simple answer to all of these questions is: That's the way it is. But the way *it* is, is dependent upon our perception of the ways that things appear to be to our limited human senses and upon the conceptions we are able to frame because of our species-specific ability to engage in symbolic thinking and communicating that is both reactive to our environment and reflective about our thinking and behaving. All human communication is founded upon our language-structured ability to stretch the boundaries of our senses by inferring how the realities of time/space and energy/matter operate, and to imagine, design, and construct techniques and technologies of communication that are able to provide and share more information than is naturally available through our sensory receptors. The French mathematician and philosopher, widely regarded as the father of modern scientific inquiry, Rene Descartes (1596–1650), famously summed up this point with his pithy epigram: "*Cogito, ergo sum*" (I think, therefore I am). But we humans do more than just think; we communicate our thoughts with other humans, thereby sharing information about our experiences, our ideas, our hopes, and our fears. In addition to the biological inheritance that made us human, we have added cultural her-

itages that make us users of techniques and technologies that extend our command and control over ourselves and our world through communication. In sum: We communicate; therefore, we are.

Given the profusion of the techniques and technologies that structure the many media of communication that are so central and essential to our lives in the modern Global Technological Society, we face a media environment today unlike any other in the history of human communication. For all of recorded history since the invention of writing in Egypt and Sumer some 5,000 years ago, and from what we can discover about the prehistory of communication since we became human some 200,000 to 50,000 years ago, the basic problem faced by most people and most societies was trying to survive with too little information from too few sources carried by too few media. Today, we face a present and a future in which our survival is challenged by too much information from too many sources carried by too many media. The key value here is survival. In the work of Charles Darwin (1809–1882), the English scientist who proposed the theory of evolution of all species by natural selection, we find an idea that may be summarized as follows: It is not the strongest of the species that survive, nor the most intelligent, but the ones most responsive to change.

Evolution by natural selection provided humans with a symbolic communication system we call language. It is language which allows us to think conceptually and to extend our thinking through media that extend our senses. All information comes to us and is transferred by us through our five physical senses of sight and sound, smell and taste, and touch. These senses shape the limitations of our interactions with our fellow human beings and with our environments. These five senses provide us with survival strategies and tactics that we share with many of our fellow creatures, especially with our closest relatives among the great apes—the bonobos, the chimpanzees, the gorillas, and the orangutans. But our hominid ancestors' responsiveness to change allowed for the development of human language that facilitated our ability to extend the natural limits of our senses in time and space through the manipulation of energy and matter. The history of human communication is a story of change, of slow evolutions and abrupt revolutions that altered how we acquired, stored, and shared information.

Conduct a brief survey of the communication techniques and technologies available to you right now. How has your sense of *sight* been extended? Do you wear contact lenses or eyeglasses? Do you have access to a magnifying glass, telescope, microscope, camera, television set, computer screen, video game player, cell phone with visual imaging, or binoculars? Have you been examined by

X-ray, CAT scan, or MRI? Reading and writing provide a wide range of sight extensions, not only of basic human language but of such specialized systems as mathematics and scientific formulae. Do you have a watch or a clock? These extend not only our sense of sight but also our conception of time by making concrete the abstractions we call seconds, minutes, and hours.

The modern digital electronic computer with its connection to the Internet and the World Wide Web operates as a kind of mega-medium that connects all of these and other extensions of sight and reaches out across time and space to connect us to databases of information from the past and present across the globe. With each of these extensions of sight, we are enhancing our ability to control the generation, storage, and sharing of information needed for our symbolic thinking and communicating. The limits of human sight have been expanded by techniques and technologies made possible by our language instinct, that special gift that is the synthesis of natural processes and cultural practices.

To comprehend the extent of our developments in communication by extending sight, close your eyes and consider all of the techniques and technologies of communication now unavailable to you. Now open your eyes and consider all of the extensions of sight made possible not by nature but by culture. Nature endowed us with sight but human culture is responsible for all of the media we use to see beyond the limits of the here and now. Without human intervention, there are no drawings, no paintings, no statues, no writing, no reading, no photographs, no moving pictures, no television, no computer-generated graphics, no text-messaging.

In terms of human communication, the sense of *sound* plays a key role in that speech and hearing are dependent upon the sending and receiving of sound waves between people. Hearing provides a significant amount of information needed for basic survival, and speech allows people to communicate information within a language group. The interaction between nature, in the form of speech and hearing organs, and human beings, in the form of developing specific languages, allowed us to send and receive sound signals through the air even when we cannot see one another. Human beings have extended symbolic sound beyond the here and now with musical instruments to send messages over greater distances covered by the unaided voice. Megaphones and spaces chosen or designed for their acoustical resonance also extended the human voice. Syllabic and alphabetic writing systems extended the human voice in visual form. It was the electromagnetic revolution that captured sound for distant communication with the clicks of the telegraph in its wired and wire-

less forms, but it was the actual transmission and recording of actual sound, including human speech, by the telephone and phonograph that truly extended communicative sound through time and over space by means of electromagnetic cycles harnessed for human use.

Consider how your sense of sound, in both hearing and speaking, plays a significant part in your daily communication. How has your sense of sound been extended? What techniques and technologies of communication that are central to you depend upon sound? If you could not hear or speak what would be lost? Consider the communication world of the hearing-impaired who rely upon sight (in the form of lip reading, signing, and gestures) and touch (using specific touches for the letters of the alphabet). Until the 19th century in Europe and North America and the 20th century in the rest of the developed world, the hearing-impaired (usually called "deaf and dumb") were regarded as less than fully human, frequently unprotected by law and social norms.

The visual world of sight and the acoustic world of sound provide us with sensory information critical for our physical survival, but these senses also provide us with the natural materials and abilities that we have developed into very sophisticated systems of symbolic sharing among people within a culture. In the world of orality, speaking and listening provide us with our primary message system of language that, in turn, makes all human culture possible by encoding–decoding and sharing of messages essential for the cultural and physical survival of individuals, groups, tribes, clans, and nations. Our very identities are shaped by and are dependent upon our language. More than the other senses, sight and sound have provided the central media that we have used for communication to enhance our survival and to promote cultural evolution and revolution.

While early technologies, including image-making, writing, and printing, enhanced the sense of sight at the expense of sound, later inventions tended to restore the balance between the two senses. While photography and early cinematography continued the extensions of sight, the telephone and phonograph enhanced sound. Samuel Morse's telegraph began by extending sight but quickly became a system that also enhanced sound as telegraphers became adept at decoding the clicks, representing dots and dashes, by sound alone. The integration of sight and sound with talking motion pictures reunited these key senses. While radio extended sound, television provided a rebalancing of the senses; the latest developments in digital electronic communication systems all involve systems that provide both sight and sound in integrated communication.

The senses of *smell* and *taste* play significant roles in intimate and social communication, but they have been almost totally unrepresented in the realities of public communication. Both senses provided valuable information for individual survival, but, except for enhancing the smells and tastes of consumer products and appealing to those senses in commercial advertising, they continue to play only minor roles in communicating information in the public sphere.

The final sense of *touch* plays a significant, some would say primary, role in intimate communication between people in terms of both love (handshakes, kissing, hugging, holding hands, and other forms of tactile intimacy) and hate (slapping, hitting, and other forms of tactile violence). Touch also plays a role in social communication within groups in terms of ritualized movements (waving, dancing, and other forms of symbolic kinesis) and in terms of how people use space to signal culturally expected and preferred distances to be maintained in different contexts (what Edward T. Hall called *proxemics*). Some recent developments in computer-generated systems have extended the sense of touch over time and space from the now and here to other times and places through robotic technologies and virtual realities in which people can reach out and touch someone and something in shared environments that exist only in cybertime and cyberspace.

Human evolution equipped us with these five senses, but human beings have succeeded in extending these senses by overcoming their natural limitations through the use of techniques and technologies that have enhanced and enriched each of these senses. In the area of communication, sight and sound have been the senses that have been most enhanced and extended by the various media we have created to improve human communication. For those of us who live in the Global Technological Cybersociety, the limits of our world have been expanded and extended far beyond the gifts provided by nature. Through culture and technology, we have changed ourselves and our communication environments profoundly. Today, we are not simply talking apes but cyborgs who embody both natural abilities and technological enhancements to be communicating humans.

Consider how you use the technologies available to extend yourself in time and space. How do you bring the outside world to you? How do you communicate with the outside world through cybernetic technologies? Are you a generator of information? In what areas? In what forms? For what purposes? How do you store information? In what areas? In what forms? For what purposes? What is the size of your storage capacities? Do you share information with other people? With whom? In what areas? In what forms? For what purpose? With

what results? Do you think that you can successfully generate, store, and share information? How do you make this judgment?

A general assumption underlying most work in human communication is that what people need is more and better communication to improve their understanding of other people and, thus, their own lives, thereby improving their chances for survival. Our current communication environment may be hampering our chances for survival by providing us with too much information from too many sources in too many areas through too many media. If information overload is as threatening as information insufficiency, what may be needed are new ways of managing our enriched information and media environments. All of us currently do this in our individual lives with various systems for information management.

Consider, to take one example, the role played by Wikipedia, the Open Source, open-receiver model of information sharing that is changing our conception of what is worth knowing, of what sources of information have validity and reliability, and of who has control over messages and message systems. And Wikipedia is only one example of what users call Open Source production that uses the Internet to link together critical masses of individuals into cybernetworks of information.

But, in addition to these technical solutions to the problem, we need some conceptual strategies for managing not only the problems of the present but the sure and certain problems of the future because, barring some catastrophic regression to a new Dark Ages of Communication (as occurred in Europe with the fall of Rome in the 5th century), information and information techniques and technologies will continue to expand with geometric progression. The expansion of information and the systems that carry information to more peoples and cultures across the globe may not solve the key problem that has always limited human communication. Some Holy Grail of Total Communication will not be reached through expanded communication any more than it has been reached through some secret knowledge. Simply put, total human communication is not possible because humans are fallible creatures. We have no perfect word or language, no perfect medium or armada of media that will provide us with total understanding and, therefore, control of ourselves and our world. We are imperfect beings in an imperfect world. Our tasks are to understand our own imperfections and the imperfections of the systems we create. If we focus on recognizing and overcoming our imperfections and limitations, some progress may be possible. It is the thesis of this book that this approach can explain how human communication was able to move from speech and visual representa-

tions to the present reality of cybernetic media.

The early 21st century has been heralded variously as the Information Age, the Digital Age, the Cybernetic Age, and the Age of Total Communication. Whatever the label, the focus is the same: We can best understand ourselves and our age by examining the communication techniques and technologies that are central to our time. Whether as prophets of progress through technological change or Cassandras warning us to beware the threats of these very changes, all analyzers of our contemporary world focus on communication and change as the key components for understanding our cosmos and our place in that cosmos. It is a central tenet of this book that in order to understand where we are now in terms of human communication, we need to understand how we got here. To have some sense of where we may be going in the future, we need to identify some principles of change that have been central to the evolutions and revolutions of human communication in the past and present. But no single approach or theory can hope to explain all of the history of human communication, much less predict its future direction. The limits of any approach need to be acknowledged at the outset and serve as a caution against overgeneralization and reductionism to a single cause-effect model. The model used in this book is a *media ecological* one that attempts to explain the evolutions and resolutions in communication media in terms of the context, the motivations, and the techniques and technologies of the people central to some key moments of development of these media. The key to understanding changes in communication techniques and technologies is *survival*—physical survival, economic survival, social survival, and cultural survival.

Many years ago, at the United States Marine Corps Recruit Training Base on Parris Island, South Carolina, our Senior Drill Instructor, Staff Sergeant P. E. Voelker, gave a platoon of new recruits some valuable advice: "Rules and regulations are for the guidance of the wise and the obedience of fools." What was true then and is still true now for the Marine Corps is equally true for those of us engaged in the study of media, culture, and communication: No model can explain all of communication history, much less predict its future development. But we can be guided by some reliable generalizations about how changes occur in media, culture, and communication that lay no claims to omniscience or ideological rigidity. My hope is that all users of this book will read it critically, evaluating and challenging every assertion, every claim, every conclusion, and every judgment. We are all human; therefore, we are all limited in what we know and think. But because we are human, we can learn from the past how to understand, to a limited but perhaps increasing degree, something of the

course of the evolutions and revolutions that have marked our human journey from environments structured by natural evolution to environments structured by cultural evolutions and revolutions in media, culture, and communication.

A General Theory of Human Communication

What this book proposes is a general theory of how human communication evolved from oral and visual signs and symbols to today's Cybernetic Age by examining the evolutions and revolutions involved in six key changes in how information is generated, stored, and shared:

1. Becoming Human—The Evolution and Revolution in Language that spawned Speech and Visual Communication
2. Becoming Literate—The Evolution and Revolution in Writing and Reading that facilitated Civilization, History, Literature, and the Beginnings of Science
3. Becoming Typographic—The Evolution and Revolution in Print Techniques and Technologies that nurtured the Modern World
4. Becoming Hypergraphic—The Evolution and Revolution in Photography and Cinematography that changed Image-Making
5. Becoming Electric—The Evolution and Revolution in Electric Techniques and Technologies that gave birth to the Age of Modern Mass Media
6. Becoming Cybernetic—The Evolution and Revolution in Digital Techniques and Technologies that wrought the Age of Cybernetic Communication.

A concluding chapter will attempt to provide guidelines for thinking critically about how evolutions and revolutions in communication can be understood. The approach taken in this exploration is predicated upon a nexus of ideas that can be summarized as a media–ecological approach to identifying some key variables that underlie each of the six great evolutions–revolutions that have changed and continue to change human communication from the Dawn of Humanity to the Age of Cybernetic Communication. These key variables involve how information is generated, stored, and shared in terms of time and space, energy and matter.

Some key terms need to be defined:

Change is alteration of the status quo in any system that significantly affects how that system operates. We will focus on two types of changes—evolution and revolution.

Evolution is gradual change over time that can result in significant change if the evolutionary change reaches a critical mass capable of changing a given system.

Revolution is either rapid significant change or the moment when evolutionary change reaches a critical mass that results in significant change in a system.

Communication consists of the sharing of information between and among humans and the systems they construct by means of agreed-upon conventional signs, symbols, and structures. In this text, we will use communication in two distinct but interrelated ways, what the linguistic anthropologist Bronislaw Malinowski called *emphatic communication* and *phatic communication*. Simply put, *emphatic communication* is what we usually mean when we reduce uncertainty by sharing specific bits of information. *Phatic communication*, on the other hand, refers to those messages that are used to keep communication systems open and functioning but do not convey specific information. Both are required for communication to take place.

Culture is the totality of ways and means that people in groups develop and sustain themselves over time in order to survive in given environments. It includes customs, mores, norms, and taboos, providing both the ways people are expected to believe and behave and the reasons for these beliefs and behaviors. In essence, culture consists of the shared communication of a group of people.

History is comprised of the narratives that people in a culture tell about the past, thereby remembering what they think is worthwhile. *History* is usually separated from *prehistory* by the introduction of literacy in Egypt and Sumer some 5,000 years ago. Therefore, *history* consists of what people have written down in various cultures in the past five millennia. Given that time did not begin with literacy, we are fortunate that we are able to use techniques made possible by science and technology to make educated inferences about what is likely to have happened in prehistory in terms of human evolution and cultural change. This text is focused on the history of human beings and human cultures

from *Homo sapiens* to *Homo cyberiens*.

Information is the nonrandom element capable of combating *entropy* (the tendency of all systems to degenerate from order to chaos). In the technical sense, one bit of information is the amount of data necessary to reduce uncertainty by half.

Techniques are the ways that people and cultures employ to communicate information in specific media systems.

Technologies are the specific tools and technical systems that people and cultures use to encode, store, transmit, receive, and decode information.

What ties all of these words and their definitions together is what Claude E. Shannon called "A Mathematical Theory of Information"[1] and what Shannon and Warren Weaver called "The Mathematical Theory of Communication" in 1948.[2] It is also what Norbert Wiener called "cybernetics," which he defined as "communication and control."[3] By whatever name it may be called, it is an attempt to create a rational structure-based theory to explain how information is communicated (shared) within any system, whether biological, chemical, or technological. This approach takes as givens the key constructs of Einsteinian physics: that time and space are relative to each other and that matter and energy are also relative to each other and, therefore, interchangeable. Albert Einstein's famous formula "$E = mc^2$" expresses exactly these relationships: that *energy* is equal to *mass* (matter) times the speed of light squared (the time it takes for light to travel through space).

In *A Brief History of Time*, Stephen W. Hawking, the Lucasian Professor of Mathematics at Cambridge University (once Isaac Newton's position), reminds us that all time–space, energy–matter, and information began with what Edwin Hubble called The Big Bang.[4] As Hawking notes, "We must accept that time is not completely separate from and independent of space, but is combined with it to form an object called space–time."[5] Similarly, energy and matter are not separate entities but form a common unit we can call "energy–matter." These two constructs—time–space and energy–matter—will be central to the analyses conducted in the book. According to recent estimates by astronomers, all time–space and all energy–matter began at the Big Bang some 13.7 billion years ago.[6] From a universe of "zero size" that was "infinitely hot," the Big Bang began an expansion that continues today.[7] Some 380,000 years after the Big Bang, the expanding universe began to cool sufficiently for protons and elections to form hydrogen atoms, thereby releasing the first energy waves which are detectable today as microwaves. When the first stars formed some 12 billion years ago, the

first true light waves began traveling through the cosmos, providing us with ways of measuring time–space in light years (the distance traveled by light in one earth solar year) and in light seconds (roughly 186,000 miles or 300,000 kilometers per second).

The Earth is some 4.7 billion years old, with early life forming some 4 billion years ago. In one sense, we are children of the Big Bang, with all our energy and matter having been created in that primal explosion. We belong to a subkingdom called Metazoa, of the animal kingdom, in a phylum called Chordata, a subphylum called vertebrates, in the class of mammals of the order of primates which has existed for some 50 million years. Some seven million years ago, the hominids branched off from our primate relatives and evolved into a line of non-ape primates of which we are the sole surviving species.

In terms of time, our species came very late to the evolution of the cosmos and of life on earth, arriving some 200,000 to 50,000 years ago with only a few genus cousins to keep us company. What distinguishes us from all of our ancestors and all of our other relatives in the animal kingdom are our highly developed symbolic structures that allow us to use and create tools, use language and symbol systems, and conceive of ways to adapt to our environments and to adapt our environments to us through what we call human culture.

Obviously, no human being was around to observe and record these cosmic developments. What we think we know about these occurrences comes from inferences formed by our observations of natural phenomena, limited by our senses and technological extensions of those senses to note regularities that can be used to identify predictable cycles that allow us to find order in the cosmos.[8] These theories and laws of how the natural world operates are never absolute and always provisional in that they can never be proven to be true.[9]

What these observations and theories tell us is that the cosmos is vast and filled with more information than mere mortals can ever observe or hope to understand fully. As Stephen Hawking notes, "We now know that our galaxy is only one of some hundred thousand million that can be seen using modern telescopes, each galaxy containing some hundred thousand million stars."[10] In addition, the total universe is expanding "by between 5 percent and 10 percent every thousand million years."[11] If nothing else, the magnitude of these numbers should make us humble in proposing any explanations for how the universe operates. But still we must try, for it is the very essence of being human to seek to understand and explain what seem to be the vast mysteries of existence.

Fortunately, human communication—while a product of the Big Bang and Expanding Universe—is infinitely smaller than the cosmos. There are still

uncertainties in our quest to understand how and why human beings communicate, but we can ground our searches in principles of the physical world, in the evidence available to our senses, and in the conceptualization made possible by our minds. Central to any ecological approach to understanding human communication is the recognition of the distinctions that the British philosopher Michael Oakeshott draws between the *processes of nature* that are subject to scientific study, therefore containing a high degree of probable predictability, and the *practices of human beings* that are subject to human behavior, therefore containing less predictability. Human communication contains both of these constructs and we need to take care in keeping these two variables separate by not confusing one with the other. It is as intellectually questionable to think that the *processes of nature* are mere social constrictions of reality, and thus open to human control, as it is to reify the *practices of human beings* into immutable laws of nature. In this book, I shall try to follow one central precept for all critical thinking: All human beings are fallible; therefore, all models created by human beings are fallible, including the ones used in this study.

In terms of communication, human fallibility begins with language itself. For human beings, language is our core communication system from which all other systems develop. At this moment I am expressing language—the instinctive ability to conceptualize reality in symbolic structures and to use outward manifestations of those structures to communicate my thoughts to other people—in the form of standard written American English of the early 21st century. As the great 20th century philosopher Ludwig Wittgenstein once noted, "The limits of my language are the limits of my world." All of us attempt to extend our world by extending our language through adding structure to our syntax and words to our vocabulary. Each subject area of human interest is a special kind of language system, and the language of the history of human communication is no different. But, in my judgment, language itself is the core system because it seeks to understand the *how*, the *what*, and the *why* of human communication. Without language, human communication would be little different from the communication systems that evolved with our nearest relatives among the primates—the bonobos, the chimpanzees, the gorillas, and the orangutans. Actually, without language, it is debatable whether we would be here at all since our survival as a species appears to be highly dependent upon the communication skills the language gave us for survival—the ability to use our oral–aural delivery system for signals and symbols to communicate information among our fellow humans to facilitate our survival. Of all of the descendents of the first hominids that branched away from the primate family some

five to seven million years ago, we are the sole survivors. It would seem that without a fully developed symbolic language system, a human being is only an incompetent ape incapable of enduring, much less prevailing, in the struggle to survive in the natural world. We survived because we used language to understand ourselves and our world and to modify both our behavior and our environment to enhance our chances of survival in an environment shaped not only by nature but by cultures as well.

One of the main messages that Charles Darwin gave to humankind was that it is not the strongest of the species that survive, nor the most intelligent, but the ones most responsive to change. And that has been the special gift of humans—to survive by changing our behavior and our environment. All of our primate cousins among the great apes adapted to nature some five to seven million years ago and became successful survivors. Ironically, their continued survival seems to be contingent upon the descendents of their weak hominid relatives because humans now represent the greatest threat to the rest of the primate family. A central ecological principle is that significant change does not merely add or subtract one variable in a system but changes everything within that system. Thus, language does not merely make us apes with one added skill but a significantly different species. That is why *we* write books about the bonobos, chimpanzees, gorillas, and orangutans; why *we* study them, cage them, experiment upon them, and even attempt to teach them to engage in human symbolic communication in an attempt to break down the communication barrier between ape and human. We think that if we can find a language bridge between apes and humans, we can make what is unique to humans universal for all primates. It is exactly what we humans have been trying to accomplish among our own species from the dawn of *Homo sapiens*.

Among scholars of communication, a vast number of words are spoken and written to debate the dichotomies of the unique versus the universal, to contrast the information, interpretation, representation, hopes, fears, knowledge, truths, and wisdoms of a particular individual or culture with some human-wide universal principles of communication. In an ecological perspective, this is a false dichotomy. What we are facing is not a dichotomy at all but a dialectic that offers us not an either–or choice but a this-and-that relationship. In this book, the approach to understanding all human communication systems incorporates this dialectic principle and views opposing variables in change as dynamic partners in an evolving communication environment. And these communication environments construct the limits of how we perceive and conceive the world.

The limitations of my own language skills are painfully apparent to me as I attempt to translate into words the information and concepts that I have received from the spoken and written words of other people—some long dead but not forgotten—and from my own thinking on the subject. I am keenly aware that despite my most earnest efforts, some communication will be lost between my thinking and my writing, and between my writing and your reading. The very structure of the printed book carrying the typed words and punctuation of my writing limits our sharing of information, meaning, and understanding. There is nothing abnormal about this imperfect sharing because we are all unique human beings who bring to the communication exchange our own limitations based upon who we are and what we have experienced. The profound meanings that humans have woven from what Plato called "the loom of language" will be explored in the next chapter, but it is well that we note the dangers of being seduced into thinking that language is some neutral describer of ourselves and the reality we perceive. I will try, and I trust that you will help me, to avoid this trap of thinking that my words are unbiased representations of what they symbolize.

An old saying among semanticists is that words have no meaning, only people do. True enough, but communication between and among people is only possible if we share enough of a language's vocabulary, syntax, and delivery systems to make some common meanings understandable. The history of human communication is a struggle to overcome the limitations of our media to expand our shared understandings with the ever increasing numbers of our fellow human beings. We use our evolutionary-inherited gift of language to expand our communication systems through the cultures and technologies we develop to improve upon that inheritance.

In trying to make sense of our place in the universe, we tend to base our understanding on three conceptualizations of how we relate to reality. One approach can be labeled *realism*—the belief that reality exists outside and independent of human perception. All that we can do is to find ways to describe and understand that reality through the limited and fallible senses that are given to us by nature—the senses of sight and sound, of smell and taste, and of touch. The task of the *realist researcher* is to seek the truths of reality through examination and testing.

A second approach can be labeled *relativism*—the belief that reality is only a conceptual construction based upon our limited senses and dependent upon our social and cultural environments. Thus, our focus of study should be upon these sensual–social–cultural constructions of reality, especially the key

role that language plays in such constructions. The task of the *relativist researcher* is to uncover the epistemological, logical, political, social, and cultural biases that frame the ways we construct reality in order to deconstruct those constructions.

A third approach can be called *transactional* or *ecological*—the belief that reality exists but that our understandings of reality are always mediated by our senses and how our minds process the information gathered by our senses. The task of the *transactional researcher* is to examine how we perceive and understand reality and the reality that is revealed by our perceptions and understandings.

While all these approaches have much to recommend them and each provides special insights into how humans interact with nature, this book tends to uphold the third approach as the most ecologically sound perspective from which to explore the history of human communication from language to digital data processing and beyond.

The Great Mythic Questions

All humans, in all societies, at all times have faced the same cosmic questions of existence. All have tried to find ways to understand and to provide answers to what can be called the Four Great Mythic Questions of Life. Here, myth is defined as self-evident truths accepted by and acted upon by groups of people gathered together into cultures. Culture, itself, is a word and a concept that is, at once, both commonplace and somewhat difficult to define easily. In communication studies, it can refer to popular culture, resulting from mass media, to high culture, resulting from aspirations to achieve the finest possible expressions of human thoughts and feelings. Here, I am using *culture* as Edward Burnett Tylor defined it in 1889: "That complex whole which includes knowledge, belief, art, morals, customs, and any other capabilities and habits acquired by man as a member of society."[12] I would, however, focus Tylor's definition on the role played by language and other communication media in shaping thought and behavior.

Whatever the culture at whatever time, all peoples have tried to provide answers to Four Mythic Questions of Life: Identity, Creation, Destiny, and Quest. Within the realm of human communication, these questions can be focused as follows:

Identity: Who are we as communicating animals? How are we different

from all other animals in terms of communication? How have these differences shaped human culture? How do our communication systems shape us as human beings? Do different communication systems shape peoples and cultures differently?

Creation: When, where, how, and why did our communication systems evolve? What roles did nature and culture play in these creations? To what extent were these creations evolutions? To what extent were they revolutions?

Destiny: What are the purposes of our communication systems? What problems of human communication were addressed by the different communication systems inherited or developed by humans? Where do we want our communication systems to take us? What do we want them to help us to achieve? Is there an ultimate goal to human communication systems? Instantaneous Total Universal Communications? Overcoming time–space limitations? Integrating energy and matter?

***Quest*:** What have we done in the past to achieve our goals? What changes were introduced to improve human communication? What are we doing today to achieve our goals? What future changes can we propose to help us to improve human communication?

One useful triad for organizing how different people and cultures have attempted to answer the Four Great Questions of Life was provided by the linguistic anthropologist Bronislaw Malinowski in *Magic, Science, and Religion*.[13] *Magic* is the belief that forces exist that can control nature, that these forces can be located in air, water, fire, earth, trees, rocks, the sun, moon, planets, and stars. Thus, if people can learn the secrets of the magic powers, they can gain control over these powers, or, at least, placate them in ways that ensure the survival of the group. Myths are the narratives that tell us how these powers work and rituals are the acting out of the myths that can be used to influence these powers. *Religion* also encourages belief in supernatural forces that exert their will on the natural world, but rather than seeking to control these forces as in magic, religion recognizes that these spiritual forces can only be partially understood, and must be obeyed and prayed to for help and salvation. Religion uses both myth and ritual in its attempts at communicating with the universe but acknowledges the essential weakness of human beings and our inability to ever know fully all of the mysteries of the Universe, which are knowable only to the Supreme Being some call God. Thus, all we can do is to seek wisdom from the words of God as received through Divine Revelation and thereby seek eter-

nal salvation by following God's will. *Science* is the belief that while humans cannot ever know the total secrets of the Universe, all of the forces operating in the Universe are not spiritual but understandable in terms of time–space, energy–matter, and information. In brief, the Universe is organized and human beings are especially endowed by nature to be able to perceive, conceive, and understand the essential nature of the Universe. In some respects, magic, and science share a belief that humans can uncover the secrets of nature and gain some control over the forces that drive the world. The essential difference between a magical incantation and a scientific formula is that the latter is always subject to refutation while the former can never be proven or disproven. Science recognizes human limitations but also knows that human understanding and control of nature can improve and expand through the scientific method of testing all hypotheses. That is why, for example, astrology is basically magic while astronomy, which evolved from astrology, is science. In essence, science changes because of findings while magic relies upon fundamental truths that are unchanging despite whatever modern calculations of the heavenly bodies are incorporated into incantations. As with all systems that involve communication, change is the ever-present factor.

A second triad that is useful in considering how cultures have attempted to answer the Four Great Mythic Questions can be found in the work of the American anthropologists Edward T. Hall and George L. Trager. In *The Silent Language*, Hall explicates a tripartite theory of culture as being composed of *formal*, *informal*, and *technical* variables. *Formal learning* is essentially a patterned binary system of yes–no, good–bad, right–wrong, do–don't do, prescriptions imposed on the young by their elders. In essence, the carriers of a culture instruct the young in the proper ways of thought and behavior by invoking the ultimate cultural commandments: "This is what *we* believe" and "This is the way that *we* do it."[14] *Informal learning* is based upon providing models to be used for imitating the language and behavior expected in a culture in terms of customs, mores, and norms. *Informal learning* is, at once, a powerful socializing agent and a largely overlooked component of how people are encultured.[15] *Technical learning* consists of explicit rules based upon logical analysis and clarity of instruction. In its developed format, technical learning is devoid of emotions and personal or cultural desires. Science provides an excellent example of a technical system in operation.[16]

This triad of formal, informal, and technical can be used to examine a cultural environment in terms of learning, of attitudes toward change, how time is conceptualized, rules of behavior, and how we communicate. Each evolu-

tion–revolution in human communication involves formal, informal, and technical variables that need to be examined and understood in order to have some clarity in our perceptions and conceptions of how different communication systems operate. In human communication, from language to the latest cybernetic technology, all three variables play significant roles that need to be made manifest.

Media and Messages

It is a basic assumption of this book that we can conceive of all human communication systems as *media*. Simply put, a *medium* is anything in the middle, as in Marshall McLuhan's pun that "Television is a medium because it is rarely well done." Some, including McLuhan himself, tend to equate media with technology. I prefer to follow Neil Postman's idea that a medium is what we do with technology: The total system of communication that is created and structured by the particular techniques and technologies that support that medium. Thus, language is a medium that is created by the brain, the central nervous system, the speech and hearing organs that allow us to articulate and receive symbolic sounds, and the air that carries the sound waves from mouth to ear. Similarly, computing is what all of the technologies involved in modern electronic computing and data transfer allow us to achieve. Therefore, a medium is what technology does. In this book, we will examine language as a medium by examining how speech and hearing are used to share meaning. Then, we will examine how writing as a medium began as a notation system and evolved into highly developed logographic systems and, eventually, into alphabets. Next, we will explore printing as a medium that extended written language through a number of technological developments. Visual communication began as an extension of language and became image-making throughout history through a series of evolutions and revolutions in media that continue today. The electric revolution in communication brought a number of new media to carry sight and sound faster than human, animal, or mechanical transportation could. Finally, the Cybernetic Age will present us with a plethora of media that emerge, nurture, and die in seemingly rapid change.

What all of these evolutions–revolutions have in common are the media that are central to each. In thinking about media not as technologies but as communication environments created by technologies, we can begin to describe four central characteristics of all media.

First, media differ in their *forms*, both symbolic and physical. Each medium contains a symbolic form that encodes and decodes the information shared by the sender and the receiver of the message. In speech, for example, the sounds that form the smallest significant sounds of a language (the *phonemes*) are combined into meaningful clusters called *morphemes*, which can be bound (like American English prefixes and suffixes that have meaning but are also never used alone) or free (like American English words that can convey meaning in themselves). These *morphemes* then need to be placed in a context, into a *syntax*, that makes even more sense—what we conventionally call a sentence. Of course, individual sentences usually need to be combined into larger contexts that allow the sender and receiver some confidence that the message being shared is understood to have highly similar meanings for each party to the communication. Obviously, "$E = mc^2$" should carry more shared meaning than, say, "I love you." Confusing the meaning of the second message may lead to unhappy relationships but confusing the meaning of the first could lead to nuclear annihilation. The different symbolic forms, with their different systems of encoding and decoding information, tend to have different *cognitive* and *emotive biases*, favoring some kind of information generation, storage/transfer, and sharing while ignoring or downplaying other kinds of information to be generated, stored or retrieved, and shared. Thus, "$E = mc^2$" favors precise cognitive information with little or no emotional involvement required for understanding the equation. Of course, the pragmatic implications of actually employing the equation to set off an atomic chain reaction in the form of an atomic bomb do carry their own emotional connotations. On the other hand, less precise messages, like "I love you," carry more emotional meanings than cognitive information. Media also possess *physical forms* in terms of the technologies that allow the symbolic codes to be shared from one human being to another. In speech, whether you say "$E = mc^2$" or "I love you," the physical forms that carry the messages are identical, involving all parts of the human anatomy that produce and receive oral–aural language transmission through the airwaves from one person to another. These different *physical forms* of media also contain built-in biases of their own, in the ways that they extend or limit our biological senses of sight, sound, taste, smell, and touch. These physical forms also affect how we deal with information storage and sharing over *time* and *space*. Simply

put, some media are better at preserving information over time while other media are better at moving information through space. Human speech, of course, is both time and space bound in the now and the here. Speech acts occur in the present as it becomes the past and in the physical space bound by the limits of the human voice. With pure speech, human memory is the key storage center for overcoming the limits of the now and here. We extend time by remembering information as individuals or as members of a collective group. Memory also allows us to carry information in space away from the *here* to other places. In both cases, however, there is always the problem of having to store increasing amounts of information without loss of significant details. In a very basic sense, all of human communication history can be summed up as a search for ways to overcome the limitations of the *now* and the *here* by extending our senses through time and space via media technologies.

Second, the symbolic and physical forms of media contain biases in how they provide *accessibility* to the information they carry. *Accessibility* involves both the question of who will know the information and the question of what will be the conditions under which the information will be accessible. In oral–aural communication individual languages define who will understand what is being said, thus assuring group identity and cohesion. But even among speakers of the same language, it is not only possible but common for individuals or small groups to be in possession of secret languages that contain the codes for understanding the cosmos through magic, religion, or science. In a sense, every branch of knowledge is based on a specialized language system that defines that branch and limits who will have access to and be able to understand that knowledge. This holds true whether we are considering tribal astrologers, shamans, soothsayers, and magicians involved in magic: prophets, priests, and theologians involved in religion; astronomers, biologists, chemists, geologists, and physicists involved in science; or anyone involved in the social sciences, the arts, and the humanities. Each subject is formed around a universe of discourse that, however open, will always include some and exclude others, whether that inclusion–exclusion is based upon race, sex, age, family, wealth, education, individual gifts, or whatever. Even in the Age of the Internet and the World Wide Web, universal information available universally to all people is still a dream for the future. Information is

never freely accessible to all and is never used equally by all. Our task is to examine information accessibility with different media in different contexts and to identify the conditions that govern accessibility to different groups of people. The *conditions of attendance* required by the symbolic and physical forms of media result in different biases among media and thereby limit the accessibility of information carried by different media.

Third, different media contain biases in terms of their information flow. Media differ in terms of the speed at which information can be shared across time and space. Media differ in terms of the quantity of information that is available and can be conveyed in a given length of time over a given expanse of space. And media differ in the directions in which information tends to flow: from one source to many, unidirectional flow, bidirectional flow, or multidirectional flow. Involved in these time–space biases of media are the correlating biases of energy–matter. Simply put, all technologies of media communication, whether natural or human created, require the transformation of matter into energy over time through space in order to carry the messages that humans use to try to make some sense of our existence and to try to improve our chances of survival in an uncertain cosmos.

Fourth, different media are controlled differently by different factors in whatever contexts they operate. The question of *control* is central to understanding how all media operate in society. Are the structures of some media more conducive to different kinds of control? Is control of media dependent upon form? Upon culture? Upon political structures? Upon economic factors? Upon social values? Upon chance? Upon the technologies themselves?

The task before us is to examine critically the content (cognitive and emotive), time–space, energy–matter, cultural, sensory, and control biases that are fundamental to each of the dominant media in the six evolutions–revolutions in human communication covered by this text. In this endeavor, we need to be careful about leaning toward a reductive cause–effect explanation that would assign to technologies of media power to shape how human beings and cultures react to and use different media to communicate the messages they deem significant for their survival. Rather, the approach here is *ecological* in that it tries to examine the totality of the context, or contexts, in which each evolution–revolution occurred. We will keep foremost in our thinking the

distinction between processes of nature and practices of human beings. While we humans are constrained by our biological and physical structures, I do think that we have some measure of volitional thinking and acting, some exercise of free will within the constraints of nature and our own natures. I believe neither in some sort of technological predestination (whether optimistic or pessimistic) nor in some utopian concept of total freewill by which human beings become the Masters of the Universe. What is required is some reasonable middle position in which the dialectic of nature and nurture, of processes and practices, can be examined as human beings move from the world of nature into new worlds shaped by human culture and technology.

Change in Human Communication

Such a dialectic model for understanding change in human communication systems from the Dawn of Humanity to the Cybernetic Age begins with four fundamental concepts:

First, all changes in communication techniques and technologies are ecological in that the effects will be felt not only in one area of an environment but in all areas of that environment. However, not all areas will be affected equally and not all changes will have the same influences in all environments because the ecological wholes could be quite different. Our task is to note these differences in impact while trying to identify some general tendencies encouraged and discouraged by the introduction of some key changes in techniques and technologies into specific environments.

Second, all changes in communication techniques and technologies must be examined within specific ecological contexts. Therefore, we need to examine the key variables connected to time–space, energy–matter, information, and the peoples and cultures in the environments within which significant changes occurred. What variables within a particular environment welcomed the changes, resisted the changes, or were indifferent to the changes? What aspects of the environment were affected the most and the least? What aspects of the environment were damaged or challenged by the changes? What variables within an environment aided the successful adaptation to changes in techniques and technologies of communication media?

Third, all changes in the techniques and technologies of media used to

communicate meanings are in response to some perceived problem, ideal, or desire related to the generation, storage–transmission, and sharing of information. When and where did these problems arise? Why? What were the problems, needs, and desires of communication addressed by the changes? How well were they addressed? What continuing problems, needs, and desires were generated by the new media? How were these continuing and emerging problems, needs, and desires addressed?

Fourth, all changes in communication are *Faustian Bargains* that will have positive, negative, and unforeseen effects for different human senses, ideas, values, beliefs, lifestyles, groups, individuals, societies, and cultures, with winners, losers, and unaffecteds in each category.

From Aristotle to Cybernetics

Some 2,300 years ago, the Greek philosopher Aristotle (384–322 B.C.E.) provided Western thought with its first theory and model of how persuasion in public discourse operated. In his *Rhetoric*, Aristotle provided us with a four part construct within which to examine how one person convinces other people to accept his message. Simply put, Aristotle instructed us to examine the *setting* within which the persuasion occurred—the time, place, people, events, and circumstances. Within that setting, the *ethos of the speaker* is dependent upon the speaker's reputation for knowledge of the subject and truthfulness, what we today call credibility. The third element is the *logos of the speech*—the logical arguments that can be tested for internal consistency and external verification. Finally, there is the all-important *pathos of the audience*—the feelings of the audience toward the setting, the speaker, and the speech. In 20th century America, Aristotle's *Rhetoric* was updated with some label changes and a few additions. The *setting* became the *context*. The *speaker* became the *source* and we became concerned with the source's *credibility* rather than the speaker's *ethos*. The *speech* became the *message* and our focus was not on *logos* but on cognitive and emotional appeals. The *pathos* of the audience was relabeled *biases*. Two significant elements were added to Aristotle's model—the *media* of communication used to carry the message and the *effects* of the persuasion on the audience.

At the close of the first half of the 20th century, three remarkable men provided a more comprehensive explanation (theory and model) of how communication must take place in any system. In 1948, Claude E. Shannon published

"A Mathematical Theory of Information" in the *Bell System Technical Journal* on the protocols and problems involved in the transmission of messages from sender to receiver.[17] That same year, Shannon was joined by Warren Weaver to produce *The Mathematical Theory of Communication*, which expanded Shannon's theories from information to communication.[18] Working on similar problems, but not directly with Shannon, was Norbert Wiener, a professor at the Massachusetts Institute of Technology, who in 1948 coined the term *cybernetics*, which he borrowed from the Greek *kubernetes* (steersman) and which Wiener defined as "communication and control."[19] To Wiener, "…society can only be understood through a study of the messages and the communication facilities which belong to it…."[20] To these men, human communication was not simply one attribute of being human but the defining attribute. In a universe where *entropy* (the lack of order or chaos) is the norm, communication functions as a negentropic counterforce to this norm, providing "islands of locally decreasing entropy."[21] Here, information is defined not simply as any data on a subject but specific data relevant to decreasing entropy. As Wiener puts it, "To live effectively is to live with adequate information."[22] In other words, too little information and too much information are both forms of entropy, as are irrelevant data which contain no information at all.

Wiener also introduced the concept of "feedback" into communication models. Not mere effects, "…feedback is a method of controlling a system by reinserting into it the results of its past performance."[23] Today, these then-revolutionary concepts of how communication functions have become commonplace in both scholarly and popular thinking. The general model provided by Shannon, Weaver, and Wiener provides a sound framework upon which to construct a dynamic model of human communication. Below is my interpretation of that model, which could be called the Aristotle–Shannon–Weaver–Wiener Cybernetic Model of Communicating Information among Human Beings.

As I see it, there are twelve variables that need to be considered in using this model to describe human communication:

1. The *context* in which the messages are shared.
2. The *source* of the messages to be shared.
3. The *content* of the messages to be shared.
4. The *encoding* of the messages into signals that carry the messages.
5. The *transmitter* that sends the signals that carry the messages.
6. The actual *signals* sent by the *transmitter*.

7. The *channel* that carries the signals.
8. The actual *signals* received by the *receiver*.
9. The *receiver* that receives the signals carried by the *channel*.
10. The *decoding* of the signals into messages.
11. The *destination* for the messages (both intended and unintended).
12. The *feedback system* that informs the source that the messages were received and how their meanings were understood.

We begin with an analysis of the *context* within which any communication of messages occurs. When and where did the communication take place? Why *then* and *there* and not at some other time and place? Who were the people involved and what kind of culture did they have? What were the key circumstances and events that shaped the culture? How did the context influence the messages and message systems central to the communication? How did the messages and message systems influence the context?

The second variable is the *source* of the messages. Who were the key sources involved in this evolution–revolution of communication? What types of messages were generated by the sources? How was information generated and used by these sources? What were their restrictions for sending the messages? What benefits did they expect to attain? What benefits did they actually receive? How did the sources exercise command and control over the messages and message systems? How did people become sources in the particular context? How open and closed were the opportunities for becoming sources?

The third variable involves the *content* of the messages. What constituted the first messages of the evolution–revolution in human communication? What categories of information were present in the system? What kinds of messages were carried by the media central to this evolution–revolution? What new kinds and categories of information were encouraged by this evolution–revolution? What older kinds and types of information were downgraded or made obsolete by this evolution–revolution? Who had command and control over the content of and access to the information? How was the content shaped by the context, the sources, and the structures of the media central to this evolution–revolution?

The fourth variable is the *encoding* of the message. What were the symbolic forms and technical mechanisms involved in encoding the message? What protocols governed the encoding? Who had command and control over the encoding? What roles did the encoding play in determining who could encode messages and what information could be contained in the messages? What were

the key strengths and limitations of the encoding system?

The fifth variable is the *transmitter* that actually sends the signal through a channel to the receiver. What were the physical forms of the transmitter that actually sends the signal through a channel to the receiver? What determined the forms of the signals sent? Who had command and control over the transmitter? What were the time–space biases of the transmitter? How was energy–matter involved in the transmitter? What were the key strengths and limitations of the transmitter?

The sixth variable is the *signal sent* by the transmitter through the channel in the direction of the receiver. How was the signal sent? What was the physical form of the signal? Who had command and control over the sending of the signal? How was time–space involved in the signal? How was energy–matter involved in the signal? What were the key strengths and limitations of the signal sent?

The seventh variable concerns the *channel* through which the signal is carried from transmitter to receiver. What were the physical forms that constituted the channel? Who had command and control over the channel? How was energy–matter involved in the operation of the channel? What were the key strengths and weaknesses of the channel?

The eighth variable is the *signal received* by the receiver through the channel. How was the signal received? Who had command and control over the receiving of the signal? What was the physical form of the signal? How was time–space involved in the received signal? What were the key strengths and limitations of the received signals?

The ninth variable is the *receiver* that actually receives the signal sent by the transmitter through the channel. What were the physical forms of the receiver? What determined the forms of the signals received? Who had command and control over the receiver? What were the time–space biases of the receiver? How was energy–matter involved in the receiver? What were the key strengths and limitations of the receiver?

The tenth variable is the *decoding* of the signal into a message. What were the symbolic forms and technical mechanisms involved in the decoding of the signal? What protocols governed the decoding? Who had command and control over the decoding? What roles did the decoding play in determining who could receive signals and what information could be contained in these signals? What were the key strengths and weaknesses of the decoding systems?

The eleventh variable is the *destination* for the messages. What were the key destinations involved in this evolution–revolution of communication? What

types of messages were received by these destinations? Who had command and control over the destinations? How was information received and used by these destinations? What were the motivations for receiving information? What benefits did they expect to attain? What benefits did they actually receive? How did the destinations exercise command and control over the messages received? How did people become destinations in this particular context? How open or closed are the opportunities for becoming destinations?

The twelfth variable involves the *feedback system*. How did feedback operate in this evolution–revolution? Who had command and control over the feedback system? What were the sources, contents, encodings, transmitters, signals, channels, decodings, receivers, and destinations of the feedback? What were the time–space biases of the feedback system? What was the energy–matter form of the feedback? What were the key strengths and limitations of the feedback system?

In each and every variable of this model, the problem of *entropy* is involved. In all communication systems, there is a general tendency toward disorder that threatens the efficient and accurate sharing of information among people. For communication to take place, the destination must share with the sender a sense of what the messages mean to both. Some theorists of communication have proposed that all human communication can be classified as either *dialogue* with the goal of achieving total sharing of messages and meanings among people or *dissemination* in which the source encodes and transmits messages to an audience with little or no feedback or interaction between the source and the destination.[24] With or without feedback, entropy plays a role in all communication. The *context* itself could involve ambiguity and uncertainty for everyone involved. The *source* may not know or fully understand the information to be shared. The *information* could be inaccurate incomplete, or even false. If the information is mistakenly false, we label it *misinformation*; if it is deliberately false, we label it *disinformation*. In either case, increased entropy enters the system. The *encoding* process may carry its own entropy by the use of inaccurate or imprecise symbols that signify different meanings for the source and the destination (called *bypassing* by semanticists). The *transmitter* used to send the signals may be defective or impaired. The *signals* may be weak or unclear. The *channel* may be filled with competing signals and other forms of noise. The *receiver* may contain defects or limitations that impede the clear reception of the signals. The *decoding* of the signal into a message may be inaccurate. The *destination* may not understand the received message or may misunderstand it because of the limitations of the human being involved. Finally, the *feedback*

system may be limited in terms of time and space, access, and all of the sources of entropy present in the sending–receiving process.

For communication to take place, the destination must share with the source some understanding of the context, encoding, transmitter, channel, receiver, and decoding systems that constitute the total communication system. Feedback allows the destination to become a sender of messages back to the source (who now becomes a destination). One key difference between different systems of human communication is the feedback system itself. If the feedback system is limited to providing the source with information about how the source's messages are received and command and control of the message system remain with the source, the result is likely to be manipulation. If, however, the source and the destination use feedback to share command and control of the messages and the message system, genuine communication in the form of mutual sharing of messages may occur. The difference between the two systems is that the former enables and encourages persuasion and propaganda while the latter holds out hope for true human communication.

What the Cybernetic Model of Communication proposes is a way for exploring how all human communication systems can be examined and understood by identifying key fundamental elements and principles present in all of our communication systems, from language to cybernetic systems and beyond. In *Grammatical Man*, Jeremy Campbell attempts to present Information Theory as *the* theory to explain all of existence, insisting that "sense and order…can prevail against nonsense and disorder" and that "grammatical man inhabits a grammatical universe."[25] My goal is simpler because all human communication is founded upon language, that uniquely human instinct that allows our species to conceive of and represent our perceptions and conceptions of ourselves and our universe in signs and symbols encoded into syntactic forms and conveyed in sight and sound to be shared with our fellow humans.

The key to understanding how it is possible to communicate at all is the principle of redundancy. Simply put, any system can only communicate if some rules are inherent in the system itself. Thus, when two people speak to each other in the same language, they share a set of rules governing pronunciation, vocabulary, and syntax that allows them to share information. In any given message, simple redundancy in the form of repetition of words and phrases, paraphrasing, using synonyms, etc. also contributes to shared understanding. But consider this sentence in contemporary American English: "Him and me loves Mary." Despite three clues that indicate that *Mary* is the subject and *him* and *me* are the objects of the verb *loves* (which indicates a singular subject),

the meaning is perfectly clear to native speakers of American English because the word order overrides all other rules of case that would apply in Latin, for example.

For Claude E. Shannon, the redundancy provided by the structure of a language strongly influences what we can say or else nonsense would result. Creativity in expression, therefore, is limited, but we benefit with increased sharing of information. If information were totally free of all rules, there would be no communication possible because each bit of information would exist independently of all other bits and of all content. Similarly, if information were totally controlled by rigid rules, there would be no communication possible because there would be endless repetition of already known data. What is needed is a balance between total freedom and total control; and redundancy provides that balance in any message system.[26] As a media ecologist would put it: We cannot live with too little information or with too much information.

We bring order to anything by noting differences among things. Uniformity is a form of entropy, but differentiation is the key to order because it allows us to arrange different things in relation to each other and to the whole of the system. Consider the first time a baby hears a person speaking or we encounter someone speaking a language unknown to us. The baby and we have no understanding because the sounds we hear are all one continuous jumble. Only when the baby and we are able to recognize the separate syllables and the phonemes carried by those syllables can we hear the distinct morphemes of the language. Of course, we have to also learn the vocabulary and syntax of that language in order to make any sense of what we are hearing. Any order we are able to bring to understanding a system depends upon information sharing among people. Our understanding of ourselves and other human beings and the cosmos is dependent upon our human sensory systems and the brain and central nervous system that allow us to obtain and to process information. We use language and the techniques and technologies that language allows us to develop and extend our human senses to understand and to seek to control ourselves and our environments.

Change and Progress

The environments of concern for this text are those shaped by the significant communication systems available to and developed by human beings over the course of our existence on earth. This course extends back into prehistory to our becoming fully human with language and moves forward into history itself

with the invention of writing systems beginning some 5,000 years ago and continuing through the communication evolutions–revolutions that brought us modern science and technology and the digital age. Our long journey is far from over but we can pause at this stage to look back in time in order to seek some understanding of where we come from, how we got to the now and here, and where and how we are likely to move forward in the future.

There is a temptation in looking at any history to see change as progress. Certainly, in studying the history of science and technology that temptation is very great for the simple reason that both science and technology can be shown to have progressed over time with new techniques and technologies surpassing older systems in terms of efficiency in overcoming time–space limitations and in using energy–matter to a greater effect. With human communication, it is easy to demonstrate the greater efficiency of each new media system over a previous one, but as Norbert Wiener warned us, "Our worship of progress can be discussed from two points of view: a factual one and an ethical one…."[27] We have certainly overcome problems of time and space that limited earlier systems but the question remains as to whether we have improved our chances for survival through improved communication systems. Indeed, the implementation of Einstein's "$E = mc^2$" may well result in the end of human beings on earth.

Still, the history of human communication can be read as a series of evolutions–revolutions that improved the systems used by people to generate, store, and share information. And these improved systems provided power to some peoples, groups, and nations to exercise greater control over themselves, over other peoples, and over their environments. Information has the potential to bestow power on those who control the messages and message systems in any culture, and any culture with communication systems more developed than other cultures will tend to exercise control over those cultures with less-developed systems. I am not proposing some iron law of communication history here, but it is, I think, a valid generalization that can serve to guide our explorations into six key communication changes that have had significant impacts upon all human history.

A Model for Examining Changes in Communication

For each of the six evolutions–revolutions in human communication surveyed in this text, our explorations are organized under six general categories: the *con-*

text within which the change began and spread; the central *people* involved; the *messages* shared; the *media* used to share the messages; the *impacts* of the change on people and cultures; and the *limitations* of the messages and message systems of this evolution–revolution that would provide the motivation for additional change.

1. ***Context***: When, where, how, and why did this evolution–revolution begin? What problems of acquiring–generating, coding–decoding, storing–transmitting, and sharing of information were the motivations for this change? When, where, how, and why did this evolution–revolution spread to other places and times, peoples and cultures? What environmental variables facilitated and/or hindered this evolution–revolution?
2. ***People***: Who were the central people involved in the birth and spread of this evolution–revolution? What were their motivations? What were their rewards? Who had command and control of the central media? Why?
3. ***Messages***: What were the messages central to this evolution–revolution? What areas of cultures were involved in these messages? How were the messages shaped by these areas? How were the areas changed by the messages? How were the messages shaped by the cultures and/or by the media?
4. ***Media***: What were the central media involved in this evolution–revolution? What techniques and technologies were needed to shape and maintain these media? What problems of communication did these media address? What were the symbolic and physical forms of these media? How did they encode–decode and store–transmit messages? Which sense or senses did these media enhance and extend? Which sense or senses did these media ignore or suppress? How were command and control exercised with these media? What did these media allow or encourage in terms of command and control, messages, and uses of communication?
5. ***Impacts***: What impacts did this evolution–revolution in communication have on the peoples and cultures involved in its birth and spread? Were these impacts similar for different peoples and cultures at different times in different places? What were the major benefits bestowed by this evolution–revolution? Were the benefits distributed equally and equitably? What were the major disadvantages wrought by this evolu-

tion–revolution? Were the disadvantages distributed equally and equitably? What unexpected impacts came with this change in communication?

6. ***Limitations***: What were the major limitations of the evolution–revolution in communication in terms of: time–space and energy–matter; extension of senses; source and destination; encoding–decoding; sending–receiving; storing–sharing; and using of information? What old problems of communication were not addressed by this evolution–revolution? What new problems of communication were generated or revealed by this evolution–revolution? How did these limitations influence future evolutions–revolutions in communication?

Armed with the strategic and tactical weapons of critical thinking provided by this ecological approach to understanding how the continuing evolutions and revolutions in human communication are connected, we are able to begin our explorations into the history of how humans have used the techniques and technologies of communication systems to shape ourselves, our cultures, and our environments during the past 200,000 years of our existence as a separate species within the primate family.

The media ecological model advocated by this book invites each of us to undertake an intellectual journey through time and space, back to our beginnings as talking primates who used symbolic language to communicate through speech and visual imagery. We will journey through the evolutions–revolutions that gave us writing; printing; photography and cinematography; the electric capturing and sending of sound and image; and the digital marvels of the Cybernetic Age. If the history of human communication reveals anything, it is this: Our journey is far from over. Whatever the limitations of today's media, humans will try to find ways to overcome these limitations to create new techniques and technologies that will further extend our senses through time and space. If the advocates of the Cybernetic Theory of Communication are right, we humans are uniquely endowed with abilities to understand the universe and through that understanding to engage in a symbolic relationship with Nature that allows us to change both ourselves and our environments.

Journeys in human communication may not return us to some mythical beginning where we were one with nature. Such journeys may not even allow us to achieve perfect and total communication among all human beings. But it is my hope that our journeys into the history of human communication will give us some understanding of how we got to this time and space and where we

might be voyaging in future times and places. In the most fundamental and profound sense, we are all voyagers in time and space, time travelers and space travelers not only in our own individual lives but as members of the human species who can trace our ancestry to the very beginnings of time and space, energy and matter, and information some 13.7 billion years ago. The future may be uncertain and uncharted, but we have our knowledge of the past and some understanding of how evolutions and revolutions in communication have taken us to where we are today and will carry us into the future. Let our voyages begin.[28]