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The Origin of Language and the Co-Evolution of Literacy and Conceptualization

by Robert K. Logan

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PART TWO: LANGUAGE AND ORALITY

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by Prof. Robert K. Logan

Living Literacies

The Living Literacies conference was appropriately named from this author's perspective because one of the theses of this essay is that verbal language is a living organism. This living organism, human language, has continued to evolve since its first emergence as speech, so that speech, writing, mathematics, science, computing and the Internet form an evolutionary chain of six distinct languages (Logan 1995; 2000a). The third theme we will explore is that a complete education entails mastery of all six languages (ibid.) hence the appropriateness of the plural form in the title Living Literacies. Literacy for me includes not only the literacy associated with reading and writing, but also orality, numeracy, science literacy, computer literacy, and Internet literacy. For the purposes of our discussion, science literacy entails an understanding of the scientific method and a passing acquaintance with the popular science literature and some of the basic principles of science. Computer literacy and Internet literacy entail the ability to use computers and the Internet respectively to access, create, process, and share information.

The subtitle of our conference, "What does it mean to read and write now?", appropriately generalized to include all six forms of literacy, provided me with the inspiration for my presentation and this essay.

One obvious response to this question is that to read and write now is to be able to access, transmit, and create information. Given my notion that there are six forms of verbal language, this ability to access, transmit and create information includes all forms of information: oral, literary, mathematical, scientific, and computer or Internet based. But to read and write now also mean one has an increased power of conceptualization, and that is the novel point I hope to make with this essay, namely, that there is an intimate connection between literacy and the ability to conceptualize or think abstractly.

In order to support this thesis I would like to draw upon my research over the past thirty years into the nature of communication, informatics, and language and their interrelationship. It all began in 1970 with my decision, as a physics professor who studied elementary particles and quarks, to share the ideas from my field with high school students and undergraduate humanities students at the University of Toronto. My course, The Poetry of Physics and the Physics of Poetry, was designed to provide liberal arts students who were challenged by mathematics with some much-needed science literacy. It also had the unintended result of starting me off in a whole new research direction which I have pursued ever since. I must confess that I am a physics prof who went astray into the humanities.

The Alphabet Effect

The first mystery I encountered in preparing material for my Poetry of Physics course was a puzzle presented by Joseph Needham, the great scholar of Chinese science and author of the book *The Grand Titration* (1969). He pointed out that abstract science had begun in Europe despite the fact that many technologies and inventions had emerged in China, ranging from paper, ink, printing, silk, and porcelain, to clockworks, water wheels, windmills, and the stirrup, just to mention a few. My first crack at this problem was to suggest that this was due to the fact that in the West there was a tradition of monotheism

and codified law that gave rise to a notion of universal law, an essential building block of abstract Western science.

Lest the reader should think that I have a Eurocentric bias, I want to briefly make a few pertinent points. First, Chinese culture and philosophy was highly spiritual, but they did not have a monotheistic tradition. As well, they had a sophisticated system of law, but not one that could be thought of as codified. Second, science is a universal activity and major contributions were not made only by Chinese and European cultures. Hindu and Buddhist mathematicians made a critical contribution with the invention of the concept of zero, completely missed by the ancient Greeks. The idea of zero led to the notion of place numbers, negative numbers, algebra, infinity, and the infinitesimal, without which modern science and mathematics would not have been possible. Third, I wish to draw the reader's attention to the contribution of Islamic culture, which rescued the early scientific works of the ancient Greeks and transmitted this body of work to European scholars at the end of the Middle Ages. But their contribution was more than just the transmission of this body of work because they vastly improved and enriched it, especially in the areas of chemistry and medicine. They also transmitted the notion of zero and place numbers and enriched mathematics. The words chemistry, algebra, and algorithm (which are derived from Arabic), and the term Arabic numerals are monuments to the contribution of Islamic culture to modern science and mathematics.

In 1974 I met Marshall McLuhan for the first time and shared with him my hypothesis that modern science developed in Europe partially due to the notion of universal law, which derives from their tradition of monotheism and codified law. Upon hearing my theory he immediately pointed out that the use of the phonetic alphabet was also unique to the West and that it influenced the development of abstract science and deductive logic. We (McLuhan and Logan 1977) combined our ideas and developed the hypothesis that the phonetic alphabet, codified law, monotheism, abstract science, and deductive logic formed a group of five self-supporting ideas that emerged in the West for the very first time between 2000 and 500 BC in the narrow geographic zone between the Tigris-Euphrates river system and the Aegean Sea.

The alphabet operates as a writing system by breaking down words into their basic phonemic elements and then representing those phonemic elements with meaningless visual signs. The use of the phonetic alphabet therefore requires analysis, coding, and decoding. It is the most abstract writing system ever developed and can represent any language with twenty to thirty signs. It also permits a perfect ordering or classification of all the words of a language. The phonetic alphabet was an invention of the Seirites, a Semitic people who mined copper, traded with the ancient Egyptians, and occupied the southern part of the Sinai desert almost four thousand years ago. All other phonetic alphabets are derived from this first alphabet and they all stimulate abstraction, analysis, classification, coding, and decoding all of which are essential for codified law, monotheism, abstract science and deductive logic. Please consult *The Alphabet Effect* (Logan 1986) for more details.

The alphabet effect taught me that a writing system can influence conceptual thinking in a fundamental way. My study of language and science revealed that there is no tradition of science without a tradition of both writing and mathematics, and that there has been no tradition of abstract science without the use of a phonetic alphabetic. It is obvious that the literacy of letters and numbers and conceptualization are linked in a very profound manner.

Six Languages: Speech, Writing, Math, Science, Computing, and the Internet

The next step in my study of languages beginning in the early 80s was to look at the impact of computers on education. My colleagues in this field were fond to point out that computers are informatic tools and I, loyal to my mentor Marshall McLuhan, insisted they were also a medium of communication. To me there was no conflict and I quickly concluded that computers are both a medium of communication and an informatic tool. After reaching this somewhat trivial conclusion I suddenly realized that this was also true of alphabetic writing as McLuhan and I had discovered in our study of the alphabet effect. I then generalized this idea and came to the conclusion that this was true of all forms of verbal language – they all allow us to communicate but they also help us to conceptualize (Logan 1995; 2000a). To my mind:

Language = Communications + Informatics

I also saw a pattern that connected the six forms of language into what I conceived of as an evolutionary chain of languages. Beginning with speech, each new form of language emerged to deal with the chaos of an information overload that arose with the use of the previous language(s). I made use of complexity theory and Prigogine's notion that a new level of order emerges out of chaos, which in the case of languages manifests itself as an information overload. The new level of order that emerges to handle the information overload is a new form of language.

Writing and mathematical notation emerged in Sumer shortly before 3000 BC to make a record of the tributes paid by farmers to the priesthood. The clay tokens used to record the agricultural commodities paid by the farmers were placed in clay envelopes whose purpose was to keep all the tokens securely in one single container. In order not to have to break open the clay envelope each time to see what was inside it, the practice of pressing the tokens onto the outer surface of the clay envelope while it was still wet and before closing it began. It was quickly realized that once the impression were made on the outer surface of the envelope one did not need to place the tokens inside the envelope and seal it. Thus was born the impressed clay tablet with a written notation to represent the agricultural commodities and a notation for numbers to represent the quantity of those commodities. Writing and mathematics notation were thus an invention of accountants and civil servants and not writers or mathematicians (ibid.). Another interesting point is that writing and mathematics notation arose at exactly the same point in times as revealed by my analysis of the data of Schmandt-Besserat (1992), the archaeologist who first deciphered the meaning and function of the clay tokens. This means that the skills entailed in literacy and numeracy are parallel and similar. In other words, if one can read and write one should be able to do math, and vice versa, if one can do math one should be able to read and write.

To teach young people how to read and write and use mathematical signs, the world's first formal schools were organized in Sumer shortly after the invention of writing and a math notation. Schools naturally led to teachers who prepared lessons in the forms of lists and thus were born the world's first scholars. Scholars led to scholarship and an explosion of knowledge and to still another kind of information overload. Science, which is basically organized knowledge, emerged approximately around 2000 BC to deal with the information overload created by teachers and scholars. Science in turn gave rise to its own unique information overload, which led to computing at first in the form of punched cards manipulated by mechanical machines, used for the first time for the 1870 US census by a company that later became known as International Business Machines. The mechanical computers eventually evolved into electronic computers beginning in 1945 with the Illiac and the Eniac. The overload from computer use in turn quickly led to the Internet, which represents a marriage of computing with telephony. This process of one form of language

giving rise to a new form of language as information overloads developed led to the evolutionary chain of six languages (Logan 2000a), namely :

1. Speech,
2. Writing,
3. Mathematics,
4. Science,
5. Computing, and
6. the Internet.

The justification for regarding each of these six forms of verbal language as distinct languages is that each has its own unique semantics or lexicon and each has its own unique syntax or grammar, which linguists such as Paivio and Begg regard as the criteria for identifying a system of communication as a distinct language. "Semantics and syntax (meaning and grammatical patterning) are the indispensable core attributes of any language" (25)

The Six Literacies

The vocabulary and grammar of spoken and written language are similar, but there are subtle differences. The vocabulary of math and science are completely different from each other and from spoken and written language. The vocabulary and grammar of computing and the Internet are also quite distinct from the other forms of language with elements in the case of computing such as word processing, databases, and spread sheets, and in the case of the Internet, such as Web pages, hypertext, and search engines. Another reason the six forms of language may be considered as distinct languages is that each helps us to think or conceptualize differently. It is for this reason that it is important to acquire all six forms of literacy, namely: 1. orality or rhetoric; 2. literacy; 3. numeracy; 4. science literacy; 5. computer literacy; and 6. Internet literacy.

The Origin of Speech

What about the origin of speech? Given that all of the other forms of language are derived either directly or indirectly from speech, the question arises: Where did speech come from and why did it emerge? What information overload was it dealing with? I claim that speech arose not out of the need to improve communication but rather as a cognitive tool that allowed conceptualization, a skill that became necessary as hominid life became more complex. The complexity of hominid life increased slowly over hundreds of thousands of years with the following advancements, each of which entailed new cognitive skills:

manual praxic articulation including toolmaking and the control of fire;

social organization or the language of social interaction required to maintain and control fire and organize food sharing and large scale coordinated hunting;

pre-verbal mimetic communication that entails the use of gesture, hand signals, body language, and prosodic vocalization, which facilitated various aspects of social organization (Donald 1991).

The three pre-verbal cognitive developments listed above were, according to Donald, the cognitive laboratory in which the skills of generativity, representation, and communication developed and, hence, were the source of the cognitive framework for speech. Each entails some form of sequential learning and processing and, hence, following the ideas of Christiansen, would have served as pre-adaptations for speech.

According to Donald, these three cognitive skills allowed a rather sophisticated level of performance and intentional communication for pre-verbal hominids.

Individuals can perform a variety of difficult functions without language, without even the possibility of internal speech. The range of their cognitive competence is impressive: it includes intentional communication, mimetic and gestural representation, categorical perception, various generative patterns of action, and above all the comprehension of social relationships, which implies a capacity for social attribution and considerable communicative ability (166).

If mimetics that pre-dated speech provided an adequate system of communication, then one is left with the conclusion that the principal function of language and the reason for its emergence was conceptualization (Logan 2000b). Donald was the first to suggest this:

Although language was first and foremost a social device, its initial utility was not so much in enabling a new level of collective technology or social organization, which it eventually did, or in transmitting skills, or in achieving larger political organizations, which it eventually did. Initially, it was used to construct conceptual models of the human universe (215).

I regard the transition from mimetic culture to semiotic (verbal) culture as the transition from percept-based mental processes to concept-based ones. As was the case with the notated forms of language – writing, math, science, computing and the Internet (Logan 1995, 2000a) – speech emerged as a form of conceptualization in order to deal with the complexity of hominid existence due to toolmaking, social organization, and mimetic communication. Verbal language did not emerge primarily for the purpose of communication because, as is claimed by Merlin Donald (1991) mimetic communication was quite a robust system of communication, though not a tool that allowed for conceptualization.

I believe that our first concepts were our first words. Each word acted as a strange attractor that united all the percepts associated with that word. For example, the word water brings to mind all of our percepts associated with water: the water we drink; the water we cook with; the water we bathe in and clean with; the water of rivers, ponds, lakes, and oceans; and the water that falls as rain, sleet, and snow.

Speech represents four distinct bifurcations:

1. the bifurcation from mimetic communication to verbal language,
2. the bifurcation from perceptual thought to conceptual thought,
3. the bifurcation from hominids to *Homo sapiens sapiens*, and
4. the bifurcation from the brain to the human mind.

Reflecting on these four bifurcations provides some interesting insights into the nature of language, literacy, and conceptualization. The bifurcation from mimetic communication to verbal language teaches us that there is an intimate connection between speech and the elements of mimetic communication. In fact speech or orality almost always entails the marriage of the spoken words with facial gestures, tone or prosody, hand signals, and body language. Without these devices borrowed from mimetic communication, the spoken word would be dead and wooden. It has often been pointed out that the words themselves in spoken language represent only a small part of what is communicated. This is perhaps an exaggeration but one that could only be made because mimetic communication is such an integral part of speech.

The second bifurcation from percept-based thinking to concept-based thinking bears on the many discussions we had at our conference of imagery versus literacy and the notion of

image literacy which was the focus of Geoff Pevere's presentation. Images are perceived and hence are processed by the more primitive mechanisms of our brain, whereas literacy entails concepts and concept-based thinking, which are cognitive processes of the brain that developed after or with the emergence of speech.

Some speakers spoke of the dread possibility that verbal language would be replaced totally by images or imagery. I think my analysis puts that fear to rest. Verbal language is here to stay because it serves a purpose that images, as powerful and persuasive as they are, cannot possibly serve, namely, conceptualization, which is so essential for abstract thinking, analysis, and planning. Images might be powerful persuaders of what to buy or what to wear but they cannot be used by us to determine whether the purchase is good for us and whether it supports our values.

It is conceptualization and verbal language that make us human, allow us to plan for our well-being, and allow us to determine our values and behave in a moral fashion. This is why I consider the emergence of verbal language as the bifurcation from hominids to humans, or *Homo sapiens sapiens*. It is verbal language that clearly distinguishes us from the other animals of this world and allows us to make plans, to develop morality, to tell stories, to pursue mathematics and science, and to create the fine arts – even those whose media are nonverbal, such as music, painting, dance, and sculpture.

It is for this reason that the literacies of which I spoke in this essay are so precious. It is because they are the entree or doorway to all these wonderful activities and creations of humankind. Not to enjoy them is a terrible loss for those who are not literate, which is why those who pursue the cause of universal literacies are so passionate about their work.

Concepts are "artificial percepts" – instead of bringing the mountain or the percept of the mountain directly to the mind, the word brings the mind to the mountain through the concept of the mountain. The concept of the mountain triggers instantaneously all of the mind's direct experiences of mountains as well as instances where the word mountain was used in any discourses in which that mind participated either as speaker or listener. The word mountain acting as a concept and an attractor not only brings to mind all "mountain" transactions but it also provides a name or a handle for that attractor/concept, which makes it easier to access memories and share them with others. They speed up reaction time and, hence, confer a selection advantage for their users. And at the same time, those languages and those words within a language which most easily capture memories enjoy a selection advantage over alternative languages and words respectively.

In suggesting that the first words were the strange attractors of percepts I did not mean to imply that all words arose in this fashion. I certainly believe that the first words to appear were the strange attractors of percepts, but once a simple lexicon of words and a primitive grammar came into being a new mental dynamic was established. The human mind was now capable of abstract thought and abstract concepts that would need to be represented by new words. These new words would not have emerged as attractors of percepts but rather as representations of abstract concepts.

The first words of this nature would have been, in all likelihood, associated with grammar and categorization. Examples of the former would be function words such as: this, that, and, or, but, if, and so forth; and examples of the words for categorization would be words such as: animals, people, birds, fish, insects, plants, and fruits.

The Origin and Evolution of the Extended Mind

The bifurcation from percept-based thinking to concept-based thinking also represents a fourth bifurcation from the brain to the human mind. Before verbal language, the brain was basically a percept processor. With language and the emergence of the concepts, the human mind also emerges – I define the mind as the brain plus language. Language extends the brain into a human mind.

I have attempted to develop insights into the role that language has played in the development of human thought and activity by combining ideas on the nature and function of language, the concept of bifurcation from chaos theory, and Merlin Donald's notions of evolutionary psychology. Building on these ideas I would like to tackle the age-old question of the relationship of the human mind and the brain. For some psychologists this is a non-problem as they believe that the brain and the mind are synonymous, just two different words to describe the same phenomena, one derived from biology, the other from philosophy. For others there is a difference. Some define the mind as the seat of consciousness, thought, feeling, and will. Those processes of which we are not conscious, such as the regulation of our vital organs, the reception of sense data, reflex actions, and motor control, on the other hand, are not activities of our mind but functions of our brain.

I believe that there is no objective way to resolve these two different points of view but that a useful distinction can be made between the mind and the brain based on our dynamic-systems model of language as the bifurcation from concrete percept-based thought to abstract concept-based thought. Therefore, I assume that the mind came into being with the advent of verbal language and, hence, conceptual thought. Verbal language extended the effectiveness of the human brain and created the mind. Language is a tool, and all tools, according to McLuhan, are extensions of the body that allow us to use our bodies more efficiently. I believe that language is a tool that extended the brain and made it more effective thus creating the human mind, which I have termed the extended mind. I have expressed this idea in terms of the equation: **mind = brain + language**.

The human mind is the verbal extension of the brain, a bifurcation of the brain which vestigially retains the perceptual features of the hominid brain while becoming capable of abstract conceptual thought. It also represents, for me, the final bifurcation of hominids from the archaic form of Homo Sapien into the full-fledged human species Homo sapiens sapiens. Humans are, therefore, the only species to have developed verbal language and also to have experienced mind. This is not to deny that our ancestors, the earlier forms of hominids, experienced thought and consciousness. Their thought patterns, however, were purely percept-based and their brains functioned as percept-processing engines operating without the benefit of the abstract concepts that only words can create and language can process. It follows that animals have brains but no minds and that the gap between humans and animals is that only humans possess verbal language and mind.

Conclusions

This essay may be considered by some to be somewhat academic from the point of view of promoting literacy but I remind the readers of the insight of one of my fellow presenters at the conference, Ruben Hurricane Carter, who reminded us that "understanding and action are simultaneous." To those engaged in the noble pursuit of promoting literacy, I believe, the following conclusions that can be drawn from this essay might prove useful for their work:

Speech or language emerged so as to facilitate conceptualization and hence abstract thinking;

Language = communications + informatics;

The emergence of language represents the transition from percept-based thinking to concept-based thinking;

Language evolved more sophisticated and abstract forms, namely, the notated forms of language, each of which requires its own unique literacy to access and use;

Speech, writing, math, science, computing, and the Internet represent an evolutionary chain of languages;

With the exception of speech, which is learned automatically whenever an infant is exposed to spoken language, all the other forms of language require instruction or formal schooling;

To read and write, to be numerate, to be literate in the other forms of language is to access languages that are more sophisticated than speech and whose use allows a greater power of conceptualization;

Computers and the Internet are great tools for teaching the three R's, reading, 'riting and 'rithmetic, because the more basic forms of language are easily accessed and manipulated in the electronic media;

Education should focus on conceptualization as a way of promoting the six literacies;

Numerical notation emerged at the same time as reading and writing, thus the skills of literacy with letters and numeracy are parallel and similar. If one can read and write one should be able to do math – and vice versa; if one can do math, one should be able to read and write.

Robert K. Logan

Robert Logan is an Associate Professor of Physics at the University of Toronto and cross-appointed to OISE's Curriculum Department. His research interests include the origin of speech, the evolution of language, the use of computers in education and work, and the history of information processing and education. He was a collaborator with Marshall McLuhan on many projects and has been a member of the board of directors of the McLuhan Program at the University of Toronto. Prof. Logan was also a Senior Fellow in the Department of Environmental Studies at York University. He is the author of *The Sixth Language* (winner of the Suzanne K. Langer Prize of the Media Ecology Association in 2000) and *The Alphabet Effect* (first published in 1986 and to appear in a second edition by Hampton Press in 2003).