

# The Emergence of Artistic Expression and Secondary Perception – April 19, 2007: A Reprint of My 2007 Unpublished Preprint

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## The Emergence of Artistic Expression and Secondary Perception – April 19, 2007: A Reprint of My 2007 Unpublished Preprint:

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### Pre-Amble

Andrey Mir (2024) referenced my unpublished preprint: “The Emergence of Artistic Expression and Secondary Perception” on page 13 of his 2004 book entitled *Digital Future in the Rearview Mirror: Jaspers’ Axial Age and Logan’s Alphabet Effect* where he wrote:

Robert Logan was the first to use the term “digital orality” in 2007. He introduced it to support and clarify the main term for this phenomenon, “tertiary orality”, which was inspired by Ong. Logan wrote:

Walter Ong (1991, 11) in his study of orality made a distinction between primary and secondary orality: “I style the orality of a culture totally untouched by any knowledge of writing or print, ‘primary orality.’ It is ‘primary’ by contrast with ‘secondary orality’ of present-day high-technology culture.” Based on the conversational nature of the Internet and text based communication I would like to suggest that there exists a third kind of orality, namely, tertiary or digital orality. Tertiary or digital orality is the orality of emails, blog posts, listservs, instant messages (IM) and SMS, which are mediated paradoxically by written text transmitted by the Internet. <sup>[1]</sup>

<sup>1</sup> Logan then developed it in: Logan, Robert (2010). *Understanding New Media: Extending Marshall McLuhan*. New York: Peter Lang.

Logan used the term before social media emerged, so he could not observe in detail the hybridization of oral and written speech into digital speech. His derivation of “tertiary or digital orality” from Ong’s succession of oralities was a pure and genuine insight, the farsighted introduction of a definition, the meaning of which still continues to be filled in by the subsequent development of media.

Given the kind words Andrey Mir wrote about my unpublished article which he found on my Department of Physics, University of Toronto website by googling, I thought it might be of interest to the readers of New Explorations so here is my 2007 unpublished preprint where I first used the term “tertiary or digital orality”.

Being the founding editor of NExJ I have taken advantage of my position to publish my article given that our journal is digital and therefore there is no competition for space. I thought it might of some interest to our readers especially the younger ones who are digital natives to read the view of digital media from the perspective of a media ecologist 17 years ago. The article also contains, in my opinion, an interesting description of the historic development or evolution of language and media that links speech, writing, mathematics, science, computing and the Internet for those unacquainted with my books: *The Alphabet Effect* (Logan 2004a); *The Sixth Language* (Logan 2004b); and *The Extended Mind* (Logan 2007).

**My 2007 Unpublished Preprint,  
“The Emergence of Artistic Expression and Secondary Perception”  
begins here:**

## **Introduction**

One can roughly classify human communication as being either verbal or non-verbal. The verbal modes of communication include speech, writing, mathematics, science, computing and the Internet. The non-verbal modes of communication include the visual arts, music and dance, which we will refer to as artistic expression. Some modes like film, theatre and opera contain elements of both. The interesting question we will consider in this article is: What is the connection between verbal language and artistic expression? One hint of a connection is the fact that humans are the only animals that possess verbal language and express themselves artistically through visual images and music. We think this is no coincidence.

We will attempt to show in this paper that the origin of artistic expression is linked to the origin of verbal expression through what we term secondary perception which we define as the perception influenced by verbal language and conceptual symbolic thought. Primary perception, on the other hand, is the perception experienced by humans or their hominids ancestors before the advent of verbal language.

## **An Evolutionary Chain of Languages**

In a study of the verbal modes of communication in *The Sixth Language* (Logan 2004) the six modes of communication of speech, writing, mathematics, science, computing and the Internet were shown to form an evolutionary chain of languages. Each new form of language arose as an emergent phenomenon to deal with an information overload that the previous languages created and could not cope with. Each new form of language had its own unique semantics and syntax that differed from those of the prior languages.

Writing and mathematical notation arose for the first time in Sumer to deal with the information overload that developed in keeping track of tributes. Farmers made tributes to priests in the form of agricultural commodities that were redistributed to the irrigation workers that made farming in Sumer possible. This development quickly gave rise to formal schools and teachers to teach reading, writing and arithmetic. The teachers became scholars creating new forms of knowledge and a new information overload that led to science or organized knowledge. The information overload generated by science and science-based technology led to computing and the information overload of computing in turn led to the Internet.

## **From Percepts to Concepts: The Extended Mind Model of the Origin of Verbal Language**

The linking of the five forms of notated language back to spoken language led naturally to the question of the origin of spoken language. In an attempt to tackle this question the Extended Mind (Logan 2000, 2006 & 2007) model was developed in which it was proposed that speech emerged to deal with the complexity of hominid life due to tool making, the control of fire, the increased complexity of co-operative social structures that arose to take advantage of the hearth, large scale coordinated hunting and gathering and the emergence of non-verbal mimetic communication of hand signals, gesture, body language and non-verbal vocalizations. The percept-based thoughts of hominids could no longer cope with this complexity and as a result spoken language emerged together with a bifurcation from percept-based thinking to concept-based thinking. It is claimed that our first words were our first concepts acting as strange attractors for and uniting all of the percepts associated with that particular concept. The use of the word water calls to mind and unites all our perceptions of the water we drink, we wash with, we cook with, we swim in, and the water we associate with rivers, lakes, the sea, rain and melted snow. Words acting as concepts allowed for the uniquely human capability to plan and think about things that are not immediately at hand and hence could not be immediately perceived.

The abstract achievements of modern homo sapiens such as technology, science, scholarship and literature beginning 50,000 years ago can be largely attributed to the conceptual thought that verbal language made possible. The one exception to this claim are the achievements of humankind in the visual arts and music which are activities grounded in visual and auditory perception respectively. Ever since I proposed the evolutionary relationship between the different forms of verbal language, I have been asked what about the visual arts and music. Aren't they languages also? My answer has always been: yes, they are languages also but non-verbal ones. My speculations about the evolutionary relationship of the verbal languages did not encompass the fine arts.

### **Percepts, Concepts and the Link Between Verbal and Artistic Expression**

I now believe I can speak of a relationship (perhaps a tenuous one but one nevertheless) between the six verbal languages that I have suggested are related evolutionarily, on the one hand, and the visual and auditory arts, on the other hand. In the Extended Mind model the emergence of verbal language is linked to the bifurcation from percept-based thinking to concept-based thinking where the words of verbal language represent our first concepts. The insight that led to this current attempt to link the verbal languages with those of artistic expression was the realization that the visual arts and music are both percept-based because of the physicality of the artistic medium and, most importantly, conceptual as well because of the symbolic and representational nature of the arts. Artists make use of concepts as much as the scientist but artists are also grounded in their physical media whether that is paint, marble or musical sounds. The artist engages both our emotions through our perception of their medium and our intellect through the symbolic representations of their compositions.

The influence of language is not limited to the symbolic representations of the artwork but they also impact on the nature of the artist's perceptive powers, which differs from those of our pre-lingual hominid ancestors. The conceptual powers of the artists change the nature of their perceptive capabilities creating what I have termed as secondary perception.

If this hypothesis is correct then there should be a correlation between verbal language and artistic expression as well as evidence for their simultaneous emergence in the history of humankind. Now I must admit in all honesty that this is not a true scientific prediction as I am well aware of the putative correlation of speech and artistic expression claimed by a number of scholars and reviewed below. In addition to my knowledge of this claim I must also confess to another influence or source of inspiration for my hypothesis of the influence of secondary perception on artistic expression, namely Walter Ong's (1991) notion of secondary orality from which I derived the notion of secondary perception, i.e. perception influenced by verbal language and concept-based thought.

## **Secondary Perception**

In the Extended Mind model (Logan 2007) it was suggested that before language emerged hominid thought was purely percept-based and the brain was basically a percept processor. With the emergence of verbal language the brain bifurcated into the brain and the mind. The brain continued as the seat of percept-based thought and the mind became the seat of concept-based thought. The metaphoric formulation of this notion is captured with the equation: mind = brain + language.

The best way to understand the relationship between the brain and the mind is in terms of complexity or emergence theory. The notion of the biosphere consisting of all living organisms was introduced to distinguish it from the abiotic universe. Living organisms represent a level of complexity above and beyond that of the physical components of which they are composed. Living organisms represent emergent phenomena in the sense that the properties of a living organism cannot be predicted from, derived from or reduced to the properties of the physical biomolecules of which they are composed. Life represents a higher level of organization with respect to abiotic material. The biosphere, on the other hand, gives rise to a more complex and emergent domain, the symbolosphere, defined as the human mind and all the products of the human mind including symbolic abstract thought, language and culture including technology, science, governance, economies and the forms of artistic expression. The notion of the symbolosphere was first introduced by John Schumann (2003a & b) and later elaborated in Logan and Schumann (2005) and Logan (2006b). It represents another emergent phenomenon at a higher level of organization than the biosphere in the sense that its properties cannot be predicted from, derived from or reduced to the properties of the human brain from which it emerges. The universe constructs itself from energy, the biosphere constructs itself from biomolecules and the symbolosphere constructs itself from concepts acting as strange attractors for neural-based percepts in the human brain (Logan 2007).

The new insight regarding the emergence of art is that with language and concept-based thought secondary perception emerged in which perception is transformed by conceptual thought in much the same way that orality was transformed by literacy giving rise to secondary orality. Secondary orality is Walter Ong's (1991) simple idea that there is a difference between primary and secondary orality, where primary orality is the orality of a pre-literate culture and secondary orality is the orality of a literate culture. Ong observed that literacy changes the nature of orality creating what he coined to be "secondary orality". Once humans acquired verbal language and conceptual symbolic thought the nature of their perceptual sensorium changed into what we are now calling secondary perception. Secondary perception is to

primary or pre-verbal perception what secondary orality is to primary or pre-literate orality. Secondary perception allows the potential artists to combine their perceptual capabilities with their ability to create symbols and to think symbolically, which are the necessary ingredients for artistic expression.

This formulation yields a theory for the emergence of art as the product of secondary perception and concept-based thought. It also explains the apparent correlation of the emergence of speech and symbolic art. Unfortunately this hypothesis can be construed as a just-so story as the emergence of symbolic art and verbal language were each one-time events in the history of humankind. However, one independent prediction is possible based on the idea that artistic expression entails secondary perception and concept-based thought. I believe that a brain scan of an artist composing or performing a work of art would reveal activity in both the part of the brain associated with verbal language and the part of the brain associated with visual or auditory perception depending on the art form.

A Google search of the literature revealed that there is a definite impact of the left brain associated with verbal language skills and conceptual thought on artistic expression which is largely associated with right brain function.

The following excerpt from a study of an artist who suffered a minor stroke reveals the involvement of both hemispheres in artistic expression indicating that conceptualization plays a role in artistic expression (Annoni et al. 2005, p. 797).

Painting is a very complex behaviour and its neural correlates involve brain areas processing the perceptive, cognitive, and emotional valences of stimuli; brain damage, therefore, could modify artistic expression... Right parieto-occipital damage resulting in spatial neglect, constructional apraxia, or perceptual agnosia can alter the spatial configuration of the whole painting or individual parts, while extensive left hemisphere damage may be responsible for simplification of detail of represented objects.

Another neurologist, Anjan Chatterjee (2004, p. 1573), based on studies of artists with neurological deficits also links conceptualization with artistic expression: Thus, from the limited data available, the art of patients with visual agnosias seems to be largely determined by whether their deficit is closer to the perceptual or the conceptual end of object recognition processes. If the deficit is at the perceptual end, patients are likely to not produce the overall form and composition of images, but continue to render individual features of objects. By contrast, patients with deficits at the **conceptual** end are still able to draw very well if copying from a rich source, but fall apart when having to draw from memory or if guided by their knowledge of the world.

Ellen Dissanayake (1988, p. 112) argues that “the elements of art are human nature’s fundamental elements” of which she includes “Language and speech - Classification and concept formation - Symbolization.” She goes on to suggest the connection between these elements, “Inseparable from abstract or conceptual thought and language is the ability to symbolize, to recognize one thing as standing for or representing another (ibid., p 118).”

## **The Joint Emergence of Verbal Language and Artistic Expression**

A number of scholars have suggested that the emergence of language, symbolic or conceptual

thought and artistic expression were all connected and simultaneously began about 50,000 years ago in what Jared Diamond called the “great leap forward” and what Pfeiffer (1982) and Tattersall (1998) call the “creative explosion”. It was at this time there was an explosion of human inventiveness when for the first time there emerged a profusion of new tools, clothing made from animal hides, decoration of tools, jewelry, rituals such as ceremonial burials, artistic expression in the form of cave paintings and carved figurines and musical instruments.

To many archaeologists, art--or symbolic representation, as they prefer to call it-- burst on the scene 50,000 years ago, a time when modern humans are widely thought to have migrated out of Africa to the far corners of the globe. These scholars say the migrants brought with them an ability to manipulate symbols and make images that earlier humans had lacked... As Richard Klein of Stanford University puts it, "There was a kind of behavioral revolution [in Africa] 50,000 years ago. Nobody made art before 50,000 years ago; everybody did afterward." (Appenzeller 1998) Dunbar (1998, p. 105) reaches a similar conclusion.

Symbolic language (the language of metaphysics and religion, of science and instruction) would have emerged later as a form of software development (it embodies no new structural or cognitive features not already present in social language), probably at the time of the Upper Paleolithic Revolution some 50,000 years ago when we see the first unequivocal archaeological evidence for symbolism (including a dramatic improvement in the quality and form of tools, the possible use of ochre for decorative purposes, followed in short order by evidence of deliberate burials, art and non-functional jewelry).

Emanuel Anati (1989, p. 209), an expert on rock art, maintains that art, language and religion have a single root. He also dates the advent of visual art to 50,000 BCE. There is no evidence of a full-scale use of visual art until 50,000 years ago. The consistency throughout the world of the same basic repertory of symbols and images exhibited in the early phases of rock art testifies to the common origin of *Homo sapiens* and of his uniquely human intellect... Early prehistoric men already operated within a framework of mental mechanisms of association, symbolism, and abstraction, which still today are defining characteristics of our species. In comparison to the preceding hominids, using these cognitive skills was not only an evolution, but also a true revolution: a leap forward that once taken has made us forever a very different Primate (Anati 2004, p. 53)."

David Lewis-Williams (2004), an art historian in his book *The Mind in the Cave: Consciousness and the Origins of Art*, as the title of his book indicates, links the origin of art to consciousness. Like Anati he also links the origin of art to religion. In the Extended Mind model (Logan 2007) that we base this study upon both religion and consciousness depends on conceptual thinking and hence language. We therefore consider the work of Lewis-Williams and Anati as supporting the link between the origin of language and the origin of art.

### **Similarities and Differences of Verbal Language and Artistic Expression**

Both verbal language and artistic expression communicate the intentions of the speaker or writer and the artist and hence both entail a theory of mind, which we will explicate in a separate section. Both forms of communication can be used to express emotions. Both require thought and planning although speech and some forms of musical performance tends to be

more spontaneous and less planned. But even conversational speech entails a certain amount of planning even though it takes place as the speaker speaks and hence is not a very lengthy process. Both language and art are abstract in that they represent transformations of reality into words or utterances in the case of language and visual forms or sounds in the case of art. As a result both language and art are representational and symbolic. From a Piercian semiotic perspective, however, verbal language is always symbolic but art can be iconic, indexical or symbolic. Iconic representation is representation by similarity as a photograph represents a person. An indexical representation is a sign that is associated with the thing being represented as smoke indexically represents fire. Symbolic representation is when the sign stands for something else by convention. Like the word dog represents the four-legged animal that we think of as man's best friend.

Another similarity is the fact that every human culture that we know of possesses both verbal language and artistic expression. They are both universals of the human condition and unique to our species. Hominids had been evolving for 4 million years, but art only appeared with *Homo sapiens* and proved to be an exquisitely human expression. The «creation» of art was a revolution (Anati 2004, p. 67).

Our ancestor early *sapiens* was characterised by the neurological capacity of creating an ideology, whose basic matrix is still present at the core of modern man's conceptual cognition. This framework included a capacity for synthesis and abstraction which, among other things, led man to produce art and abstract thought, and to develop an articulate and complex language (ibid., p. 60). And finally to conclude this catalog of similarities it is important to remember that painting, sculpture and music are often referred to as languages and verbal language in the form of oratory, poetry and literature is often referred to as an art form. There are many crossovers between verbal and artistic expression but let us now examine some of the differences.

The arts appeal immediately to the sensual aspect of human thought and then to the intellectual side. Verbal language, on the other hand, appeals immediately to the intellect and then possibly through imagery to the sensual side of our mentality. Verbal language is linear whereas the arts are multidimensional. Even music, which has a temporal linear progression is multi-dimensional because it is composed of pitch, timbre, tempo, volume, melody and harmony. Verbal language can be analytic and has led to mathematics, science and computing whereas the arts are synthetic and aesthetic. Both verbal language and artistic expression can express both ideas and feelings but the arts tend to be more about feelings and verbal language more about expressing ideas.

## **A Theory of Mind – Art as Creating an Effect**

As was already noted both the arts and verbal language are about communicating intentions and expressing thoughts and feelings. Both forms of communication therefore are based on a theory of mind, i.e. the notion that the communicator believes those who are their audience have a mind similar to their own and hence will comprehend their communication whether that is verbal or artistic. Those who study the origin of language consider the human capability of a theory of mind was a cognitive capability unique to humans that made verbal language possible. Dunbar (1998, p. 102) defines a theory of mind as “the ability to understand another's individual mental state” without which he claims, there would be no language in the form we know it....Language requires more than the mere coding and deciphering of well-formed grammatical statements. Indeed, as has been often pointed out, many everyday conversations



are conspicuous by their lack of grammatical structure (Gumperz 1982). However, important formal grammar may be in the precision of information transfer, it is surely the intentionality of speech that is the most demanding feature for both speaker and listener (ibid., p. 101).

I believe that a theory of mind is just as critical for the origin of artistic expression as it was for the origin of language. Artistic expression is also a uniquely human attribute and also requires a theory of mind mind-set on the part of the artist to be executed. Artists through their artwork are trying to create an effect on their audience and this requires a theory of mind on the part of the artists to believe that they can create effects on their audience like the ones they experience. McLuhan described the artist's methodology as working backwards from the effect they want to create to the causal elements that will produce the effect they have in mind. In order to work in this manner the artists obviously must have a theory of mind.

## **Social Communication**

Both verbal language and artistic expression are forms of social communication. "Speech... serves two functions, that of social communication, and the representation of and a medium for abstract thought (Logan 2007)." The same may be said of artistic expression. Both verbal language and artistic expression are forms of abstract thought. While both are vehicles for the expression of emotions the visual and musical arts tend to favour emotional expression over analytic thought more so than verbal language. This generalization is only a general trend as one can find superb examples of emotional expression through verbal language and music and visual art that is extremely analytic and everything in between.

Verbal language has been a very important tool for creating social cohesion and cooperation. There is a very strong correlation between altruism and the origin of verbal language. Speech entails the sharing of information which in itself is an altruistic act. Without the desire to help conspecifics there would have been no motivation to want to communicate with fellow humans so there is no doubt that verbal language and altruism go hand in hand. But a similar argument can be made for artistic expression.

"Why did humans have the need to record their own thoughts and emotive stimulation? No doubt this is part of the nature of *Homo sapiens*, like socialisation, the sense of aesthetic, love, ambition, and solidarity (Anati 2004, p. 67)."

## **Art Arising from Mimetic Communication**

Merlin Donald has suggested that mimetic communication was the cognitive laboratory in which verbal language developed. The roots of the fine arts can also be traced to percept-based mimetic communication whose basic elements were prosody (the tones of vocalization), facial gesture, hand signals and mime (or body language). The very first art forms were all non-verbal and grew out of mimetic communication. They included music, painting, sculpture and dance all of which were a part of ritual. Music can be traced to the variation of tone and rhythm and hence to prosody. Dance is basically a form of body language set to music. The first forms of painting were body and face painting and the first forms of sculpture were masks and costumes, which can be seen as attempts to enhance and intensify facial gesture and mime. With the advent of spoken language new hybrid forms of the arts emerged which

combined mimetic communication with words to produce modern (post-verbal) art forms such as poetry, which include both words and prosody, songs which combine words and music and theater which combines words with mime and dance (Logan 2007).

## 9.2 Tertiary or Digital Orality and Perception

I obtained an insight into the nature of Internet-mediated written communication from an exchange on an academic listserv on which I am an active participant. We were having a free reeling exchange on our media ecology listserv that lurched from one topic to another when one of the participants complained that the thread was getting hard to follow because the responders were not responding directly to what had been said before. In other words new posts were not following logically from the previous posts. I understood the frustration of the person who complained, which, I believe, can be explained in media ecology terms. The listserv is used by academics whose language of discourse is literate even when they are speaking to each other. As a result because the content of the listserv is that of academics and their interest in their field of study there is an expectation on the part of some that the listserv discourse should follow suit with the usual literate discourse in which one response follows logically from another. However, the medium of the listserv is actually an oral medium as I have argued above and is highly conversational in which the input of one participant can give rise to some random thought on the part of another participant, who because the listserv is conversation-like, can go off on a tangent. For those users who operate in this fashion the listserv is a vehicle for exploration rather than a medium for carrying out a polished logical argument. As a result of this incident and the discussion that ensued, I was led to an insight into the nature of Internet-mediated text-based communication. I concluded that listservs and email exchanges in general although they are written have the structure of oral discourse and hence represent a form of orality.

Walter Ong (1991, p. 11) in his study of orality made a distinction between primary and secondary orality. "I style the orality of a culture totally untouched by any knowledge of writing or print, 'primary orality.' It is 'primary' by contrast with 'secondary orality' of present-day high-technology culture." Based on the conversational nature of Internet and text-based communication I would like to suggest that there exists a third kind of orality, namely, tertiary or digital orality. Tertiary or digital orality is the orality of emails, blog posts, listservs, instant messages (IM) and SMS, which are mediated paradoxically by written text transmitted by the Internet.

When I first shared this insight on the very same media ecology listserv I received an email from Frank Dance indicating that he too had independently and much earlier than I had formulated the notion of tertiary orality and associated it with digital media: "Digitality is the source of a tertiary orality (Dance 2004)." I also received an email from Roxanne O'Connell who said "I have been coming to 'call' this post-secondary orality 'digital orality'. Once again, an independent confirmation of the notion that text-based Internet communications are a form of orality – tertiary or digital orality – the unspoken form of orality.

An added insight into the range of oralities that I have cited above was provided by Catharine Macintosh at the Ontario College of Art and Design who suggested that there was a fourth kind of orality that preceded all of the above oralities, namely gestural orality. In fact what Catharine put her finger on was the mimetic form of communication that preceded speech, which we discussed in detail in Chapter 3. Gestural or mimetic orality, another form of unspoken orality, is the ground zero of orality. It is the beginning of an evolutionary chain of oralities where the

term orality has been exploded to encompass all forms of human communication in which the players converse spontaneously by taking turns.

Mimetic or gestural orality is non-verbal and unspoken. Primary orality is spoken in which the semantics and syntax are characteristic of oral culture. Secondary orality is also spoken but the semantics and syntax are characteristic of literate culture. And finally, tertiary or digital orality is written in which the semantics and syntax are characteristic of digital culture.

## References

Anati, Emmanuel. 1989. *Les origines de l'art et la formation de l'esprit humain*. (Transl.) Diane Ménard (transl.). Paris: Albin Michel.

\_\_\_\_\_. 2004. Introducing the World Archives of Rock Art (WARA): 50.000 years of visual arts. In (XXI Valcamonica Symposium) *New Discoveries, New interpretations, New Research Methods*. Capo di Ponte: Edizioni del Centro.

Annoni J. M. , G. Devuyst, A. Carota, L. Bruggimann and J. Bogousslavsky. 2005. Changes in artistic style after minor posterior stroke. *Journal of Neurology Neurosurgery and Psychiatry* 76:797-803

Appenzeller, Tim. 1998. Art: Evolution or revolution. *Science* 282, 1451-54. Chatterjee, Anjan. 2004. The neuropsychology of visual artistic production. *Neuropsychologia* 42 (2004) 1568–1583.

Chatterjee, Anjan. 2004. The neuropsychology of visual artistic production. *Neuropsychologia* 42 (2004) 1568–1583.

Dissanayake, Ellen. 1988. *What is Art For*. Seattle: University of Washington Press.

Dunbar, Robin. 1998. Theory of mind and the evolution of language. In James Hurford, Michael Studdert-Kennedy, Chris Knight (eds), *Approaches to the Evolution of Language*. Cambridge: Cambridge University Press, pp. 92-110.

Gumperz, J. J., 1982. *Discourse Strategies*. Cambridge: Cambridge University Press.  
Lewis-Williams, David. 2004. *The Mind in the Cave: Consciousness and the Origins of Art*. London: Thames and Hudson.

Lewis-Williams, David. 2004. *The Mind in the Cave: Consciousness and the Origins of Art*. London: Thames and Hudson

Logan, Robert. 2000. "The Extended Mind" In Lance Strate (ed) *Communication and Speech Annual* 14, 63-80.

Logan , Robert. (2004a). *The Alphabet Effect: A Media Ecology Understanding of the Making*

*of Western Civilization*, Cresskill NJ: Hampton Press.

Logan, Robert. 2004b. *The Sixth Language: Learning a Living in the Internet Age*. Caldwell NJ: Blackburn Press.

Logan, Robert. 2006. Neo-dualism and the bifurcation of the symbolosphere into the mediasphere and the human mind. *Semiotica* 160: 229-42.

Logan, Robert. 2007. *The Extended Mind: The Emergence of Language, the Human Mind and Culture*. Toronto: University of Toronto Press.

Logan, Robert. 2010. *Understanding New Media: Extending Marshall McLuhan*, 2<sup>nd</sup> Edition. New York: Peter Lang Publishing (Second Edition 2016. New York: Peter Lang).

Logan, Robert K. and John Schumann. 2005. The symbolosphere, conceptualization, language and neo-dualism. *Semiotica* 155 (1), pp. 201-14.

Mir, Andrey. 2024. *Digital Future in the Rearview Mirror: Jaspers' Axial Age and Logan's Alphabet Effect*. Toronto: Popular Media Ecology.

Ong, Walter. 1991. *Orality and Literacy: The Technologizing of the Word*. London: Routledge Kegan & Paul

Pfeiffer, John. 1982. *Creative Explosion*. New York: Harper & Row.

Schumann, John 2003. "The Evolution of the Symbolosphere." UCLA Center for Governance.

Tattersall, Ian. 1997. *From Becoming Human: Evolution and Human Uniqueness*. New York: Harcourt.