

THOUGHT, EXPRESSION AND HYPERMEDIACY

by

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THESIS SUBMITTED IN PARTIAL FULFILLMENT OF
THE REQUIREMENTS FOR THE DEGREE OF
MASTER OF ARTS
in the Department of Communication

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SIMON FRASER UNIVERSITY
August 1993

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Abstract

Hypermedia permits the possibility of combining video, graphic, acoustic and written data within the same computer controlled platform. Several new attributes are thus added to these media, namely, random access, interconnectivity and mass storage. Some authors have claimed that hypermedia constitutes a new major shift in human cognition, similar to the shift that occurred in moving from orality to literacy. This thesis discusses this possibility and examines the conditions under which this new shift can occur. A model for the analysis of the oral and literary paradigms, which focuses on the double role of language as both an instrument to express and to construct knowledge, is suggested. Analysis through this model will help unveil the mechanisms that led orality and literacy to become major stages in human cognitive development. The same model is applied to the study of hypermedia. Analysis reveals that, in addition to extending the elements of the conversation of gestures that can occur (notably through the introduction of acoustic and graphic elements), hypermedia can produce radical transformations in the processes involved in the formation of concepts. Finally, the issues of hypermedia's technical requisites and the social control of these requisites is addressed.

Acknowledgements

My work has a collective as well as an individual authorship. I wrote it but others provided the scholarship and the seemingly infinite kindness that made it possible for me to conclude it. I must first of all underline the inspiring and challenging atmosphere of the Department of Communication at Simon Fraser University, which provided the academic drone to which my ideas vibrated.

I am forever grateful to the members of my committee, in particular to my senior supervisor Prof. Barry Truax for a patient, wise, generous and long standing support, and to Dr. Jan Walls and Dr. Paul Heyer, also for their continuing and much valued support, encouragement and teachings.

I am also indebted to Prof. Liora Salter whose teachings I cherish and value, and who among other things showed me how to ask *the* question.

I am also grateful to the Fundação Gulbenkian, in particular to Dr. Pedro Tamen, and to the Fundação Luso-Americana para o Desenvolvimento for their support.

But this thesis would not be possible without the help of other people who, although not directly involved in the outcome of the work, certainly played a decisive role in making it possible. I therefore want to express my sincere thanks to my friends and colleagues at SFU and elsewhere (João Pedro Leão and Ian Chunn, in particular) with whom I have discussed many of the issues contemplated in this work and who also provided me with invaluable information, and to Dr. António Leitão de Sousa and everybody at S.P.G.C. and A&A.

And finally I want to thank my family. Without the support and generous sacrifice of my wife Madalena and son Hugo, and my parents Fernanda and Alberto Augusto I would never have been able to fulfill this desideratum.

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Chapter 1

Introduction

Hypermedia promises no less than this: our computers, in addition to being our pencil and paper, our sticker notes, our canvases, paint and brushes, our calculating machines, our letters and our letter carriers, our telephones, tape recorders and VCRs, will become our video clubs, our magazine stands, bookstores, and our libraries, our writers clubs, our university classrooms, and many things more. The goal of hypermedia is to integrate them all in one box, conveniently tucked away, your only connection with the world being, perhaps, your monitor and keyboard, or, simpler yet, a pair of special glasses, headphones and some sort of tracking device that will transform your gestures into binary code.

These are, no doubt, very tempting ideas. Some of these possibilities have been a reality for some time, while others are a blink away, or so the folks in the think-tanks of Silicon Valley warn us. Even if you try remaining relatively immune to these temptations, a cursory glance at this new reality does elicit some provocative thoughts. You wonder, for example, how it would have been if these technologies were available in other times and in other places. Imagine what changes it would have brought if, say, the Library of Alexandria were available on-line. What if Rousseau and Kant had met through the

'alt.18th.philosophy', or if Charles Peirce and William James had exchanged points of view in the 'alt.metaphysical.club' in 'Gopher space'. Anyone could follow the debate and maybe participate. What if a certain Diaghilev@ballets.montecarlo upon meeting a certain Stravinsky@musique.paris and agreeing to do a new ballet, had been able to send him the following message over the net: "Dear Igor, thanks for your music samples. We played them last night here at the theatre and everyone agrees they are excellent. I am including the video clip of yesterday's rehearsal for your commentary. The costume designs have finally been completed. We have looked it up in ftp.russian.folk and got the details we needed to complete them. We still have not heard from the young set designer. His name is Picasso. He is not on email". This is fiction, but, at the same time, it is how things are evolving in an increasing and irrevocable way.

Many have written about the issue of hypermedia and many case studies have been reported. Some hopes and many frustrations have surfaced in these writings, but there is a particular group of writers (McDaid, 1991; Brent, 1991; Barrett, 1991; Gillette, 1992) that places hypermedia within the continuum of evolution of the technologies for the expression of thought, ranging from orality to literacy.

This is a serious question and not a simple one to assess. The fact that hypermedia can be historically placed within a continuum of 'tools for thought' (Rheingold, 1985) deserves much closer attention. Could hypermedia be more than a new, marketable hype? What characteristics distinguish a technology for the expression of thought?

And if hypermedia is a higher state in this continuum, what provoked the changes in the earlier stages? If hypermedia is a candidate technology for the new expression of thought, what basic characteristics should it display and what new characteristics will turn it into a new stage in this continuum? What gains did orality and literacy bring and what gains can hypermediacy legitimately elicit? How did these technologies intertwine with our own mental processes? Such questions led me back to one of the most fundamental issues of communication, namely how does thought interact with its modes and forms of expression, that is, its technologies. The subject is admittedly a difficult one to grasp in its complexity. Two issues in particular contribute to this complexity. Firstly, the number of variables involved in this process. Goffman (1972) in analyzing speech behaviour summarizes the issue.

It hardly seems possible to name a social variable that doesn't show up and have its little systematic effect upon group speech behavior: age, sex, class, caste, country of origin, generation, region, schooling; cultural cognitive assumptions; bilingualism, and so forth. Each year new social determinants of speech behavior are reported. (It should be said that each year new psychological variables are also tied in with speech.)

Alongside this correctional drive to bring ever new social attributes as determinants of speech behavior, there has been another drive, just as active, to add to the range of properties discoverable in speech behavior itself, these additions having varied relations to the now classic phonetic, phonemic, morphemic and syntactical structuring language. It is thus that new semantic, expressive, paralinguistic and kinesic features have been isolated, providing us with a new bagful of indicators to do something correlational with (1972 : 61).

Secondly, the intertwining of thought and its technologies is a

dynamic and ever recurring process. The meaning of words, as Vygotsky (1986) points out, is always in the making. Concept formation, as he further observes, is a the result of a constant *movement* between lower and higher cognitive functions (1986 : 143). I must admit that, personally, I feel that our writing tools and the sequential/linear form of thinking they entail, do not ease the difficulty of fully understanding these phenomena. I am thus afraid that depicting this reality through words is a job condemned to only partial success.

For this thesis and for the purpose of answering some of these questions I developed a model which will be detailed in Chapter 2. This model draws chiefly upon the work of George Herbert Mead, Lev Vygotsky and Merlin Donald. Although the reviewed works by these writers form a coherent whole, there are specific aspects from each of their writings, of particular interest to the present enquiry, which draw my special attention. I am thus specially interested in Mead's theory of act and gesture, Vygotsky's account of concept formation and Donald's emphasis on the continuum of cognitive processes. My attempt to build this model has a twofold purpose. Firstly, to stress what seems, to my knowledge to be more or less accepted, undisputed, intransient principles in an otherwise controversial and transient area where consensus does not seem to reign. Secondly, to design a procedural lexicon, i.e., a conceptual model and a dictionary which will be used for the remainder of this study. I base this procedural lexicon on the following assumptions:

1. A basic cognitive apparatus predates expressed thought.
2. Expressed thought is a communicational process with a social essence.
3. Social interaction leads to an exchange or conversation in gestures.
4. A conversation in gestures originates in problematic situations and is led by and leads to action.
5. A conversation in gestures leads to the genesis of language.
6. Languages freely embody signs and symbols, which have an arbitrary nature.
7. Through the mediating effect of language concepts are formed and expressed.
8. This is a dynamic and non-sequential process.
9. There is a social control in the definition of an object of communication.

In Chapter 3 this model will be applied to the analysis of orality and literacy. Through the *modus operandi* it suggests, a review of the literature on this subject will be conducted which aims at characterizing these technologies for the expression of thought, the new states of mind they allowed and what role society played in their genesis and development. Finally, the process of how orality and literacy help create new states of consciousness, and how reality unfolds in a presumably more precise way will also be dealt with.

Finally, in Chapter 4, I will apply this model and draw upon the conclusions from the analysis of the oral and literary modes of

expression in order to examine hypermedia. Existing examples of the application of hypermedia in education, in business and in industry will be reviewed. An attempt will be made to study its characteristics in order to draw a more precise definition of this term. The possible contributions of hypermedia in the creation of a new, higher stage in the human cognitive process will be outlined.

A day does not go by without one hearing something about how one's business can improve with some new multimedia program, or how one can enhance one's knowledge by accessing such and such multimedia database. The words multimedia, hypertext and hypermedia have become "buzzwords" in the industry's jargon. If we think about the possibilities offered by these new technologies and the provocative ideas which they elicit, the word empowerment immediately comes to mind. Hypermedia seems to carry within itself enough power to allow us to predict that it can exert a powerful influence. Yet after assessing all these possibilities, and analyzing corporate reaction and the interests that may lie behind such a powerful medium, one wonders if and how we can, in an uncontroversial way, be entrusted with all this new power. If the power of hypermedia will serve the billions or if it will be just another trend for a few more billion to be served...

Chapter 2

Basic assumptions on thought, expression of thought and cognition.

2.1 - A model of analysis.

In the present chapter I will focus on the discussion of a workable model of thought and language which will help define the boundaries of the analysis of hypermedia. Thought and language are separate identities, "not connected by a primary bond" (Vygotsky, 1986 : 210), although mutually recursive. They may thus follow parallel or crossing paths and assume different forms not all of which are of interest to the present enquiry. As Vygotsky (1986) points out:

Schematically, we may imagine thought and speech as two intersecting circles. In their overlapping parts, thought and speech coincide to produce what is called verbal thought. Verbal thought, however, does not by any means include all forms of thought or all forms of speech. There is a vast area of thought that has no direct relation to speech. The thinking manifested in the use of tools belongs in this area, as does practical intellect in general. Furthermore ... thought can function without any word images or speech movements detectable through self-observation (1986 : 88).

Thought and language, as Vygotsky further observes, are two independent elements mutually connected in verbal thought by meaning. Meaning is the monad, if you will, the most elementary unit of analysis which pertains simultaneously to both the realm of thought

and language. Language and thought are thus two complex core elements of human cognition, relating in a complex way.

Here I am focusing on expressed thought. I use the term 'expressed' instead of verbal thought, because I consider that verbal thought can be a misleading expression. By establishing an implicit connection between thought and *verbum* important elements in the expression of thought like verbal gestures, for example, might seem to be ruled out *a priori*.

In the following sections I will describe each of the basic premises of this model and draw some conclusions from this description. In this discussion I am assuming implicitly that the development of expressed thought runs in parallel at both the phylogenetic and ontogenetic levels. As Donald (1991) observes "the process of fundamental linguistic invention is close to the phylogenetic roots of language" (1991 : 236). This model is thus viewed from an ontogenetic perspective which I take to be correct from the phylogenetic perspective as well, within broad limits.

2.1.1- A basic cognitive apparatus predates expressed thought.

I am focusing on cognitive processes that arise out of expressed thought, i.e., cognitive processes made possible by the interplay between thought and expression. But cognitive processes are not limited to these two elements, both at the ontogenetic and phylogenetic levels. Thought and expression are two implements of the mind, which form the core of the human being's conceptual

processes. A pre-existent cognitive apparatus in the development of subsequent cognitive stages is proposed by Donald (1991). This is one of the important aspects of the model I am attempting to develop and, therefore, it might be of interest to succinctly review Donald's proposed theory.

Cognitive processes in animals which do not possess any kind of expressive capacities have been demonstrated. Cognitive processes which do not involve any form of expressive thought have also been noted in earlier humanoids and even in *Homo sapiens sapiens*. Nonverbally mediated cognitive processes are detectable in birds and mammals. These animals appear to possess a rudimentary cognitive apparatus and demonstrate an ability to solve rudimentary problems. Positive evidence of some kind of cognitive process involving a representation of the environment has been unveiled in the study of apes. Apes appear to be capable of what might be called event perception, that is, the ability to successively map out episodes perceived from the environment, and to organize responses to these events (Donald, 1991).

Earlier humanoids demonstrated a capacity that went a step further: to represent reality through mimesis. Mimesis is not necessarily a communication-bound capacity. It represents not only the capacity to imitate reality (a capacity already present in apes), but also and most importantly, to represent, model or re-enact it even in the absence of the actual event. This particular trait is present in such activities as tool-making or the preparation of food, where language seems largely absent. Moreover, it might be tied simply to inner

referentiation, an inner act without any communicative purposes (Donald, 1991).

It has been suggested that early cultures depended on a mimetic capacity (Taussig, 1993; Donald, 1991). Mimetic cultures seem to have survived without resorting to any form of cognitive processes based on expressed thought (Donald, 1991). Mimetic traits of cognition can be detected not only in pre-oral societies and oral societies where it plays an important role, but also in developed literate societies. Ong (1977), for example, stresses the importance of mimesis, particularly in art.

Donald outlines the chief characteristics of mimesis as being *intentional* (the deliberate representation of an event), *generative* (it analyses and re-synthesizes in their essential aspects the events' characteristics), *communicational* (although not immediately focused on communication, mimesis has the potential to be used as a communicational tool), *referential* (the mimetic act is separated from the event which gave rise to it), *endlessly representable* (there is no limit to the number of events that can be represented), *autocued* (mimetic activity is generated from internal self-cues).

Mimetic-based culture represents a step forward in relation to simple event perception or what Donald calls 'episodic culture'. It is "inherently a concrete, episode-bound medium of representation" (Donald, 1991 : 173) in that it presupposes event perception capabilities, but as events are detected to be re-enacted it re-invents, so to speak, episodic cognitive processes. The result, according to Donald, is a continuum in these historically successive cognitive processes.

2.1.2 - Expression of thought: a communicational process with a social essence.

Communication is multi-directional and does not make sense in isolation. Individual participants in a communicational process may have a particular physiological and psychological makeup that makes communication and the probing of the environment possible. This individual makeup may even make it possible to establish a process of communication with the self, but its roots always lie on some sort of social interaction or collective agency. Mead (1934) described quite elegantly the way in which the social character of communication might be displayed. I will attempt to review Mead's stance on this subject briefly now.

Mead distinguishes two socio-physiological impulses or needs, namely the sexual or reproductive and the parental impulse, which play a decisive role in co-operative social behavior. To be sure, other related and inter-related elements which might be relevant to the development of further communicational processes could be added, namely food gathering, and particularly, at a later stage, meat-eating and bipedalism (Kendon, 1991; Donald, 1991). But Mead's point can be examined through the two above basic impulses and activities which have in the family the fundamental nucleus within which they are carried out.

Mead suggests that, given the fact that there are no radical differences in the physiological and psychological makeup of the individual members of human groups, interaction carried out within

this framework presupposes that individual members will respond in a similar fashion to a stimulus in the course of a co-operative act. An act, according to the behavioristic stance which inspired Mead's, is defined as an impulse which responds to this stimulus in the course of the preservation of the life-process. In the co-operative or social act, organisms producing these stimuli and impulses share the same forms of conduct. The objective of this social act is thus the preservation of the life-process of the group. I will be dealing with these social acts, acts of co-operation that aim at the preservation of the group's life-process, in the next section. For the moment suffice it to say that the kinds of elementary acts that further lead to the genesis of a full communicational process and to the development of the implements which intervene in this process have their origin in the social group and are unthinkable outside it. In an analysis of chimpanzee social life, Kendon (1991) has summarized the problem in the spirit I want to convey here. He claims that the absence of a language-based form of communication in chimpanzees is related to the kind of social life these animals lead. In chimpanzee society each individual member's behaviour is basically independent of any co-operation or complementary relationship with the other individual members of that society. Kendon thus concludes:

It is my suggestion that if you lead a life where each acts in parallel to the other, as chimpanzees largely do, though a sophisticated communications system may very well develop, until two or more individuals need to share a common goal, *communication about concepts* is not needed. For this to arise, a change in social organization is required in which there is both a consistent differentiation and a complementarity between the activities of different individuals within the group -- in other words 'division of labour'. This could provide the

circumstances in which conceptual communication is required, especially if division of labour were to involve a periodic spatial separation of group members who are otherwise dependent upon one another. Communication about matters not jointly present may thus become necessary [emphasis added] (1991 : 212-213).

Communication is thus a collective agency and it is absurd to think of it outside this collective framework. In the following section I will analyze the basic mechanisms through which this collective agency takes place.

2.1.3 - Social interaction leads to an exchange or conversation of gestures.

A gesture is a special kind of act. In general an act is an impulse which aims at the maintenance of the life-process. Conversely, the social act is a co-operative act which aims at the maintenance of the life-process within a group. In other words, an impulse of any individual within this group which sets the process going, serves as a stimulus to the response of another individual. Two important aspects must be stressed in regard to this subject. Firstly, within a common environment, both the impulse that serves as a stimulus and the response that is thus set free belong to the same class of conduct of the actors involved. Secondly, the social act is not the simple and sequential sum of observable stimuli and responses but a dynamic process, a continuous and recursive adjustment of responses and

stimuli.¹

As mentioned, a gesture is a particular kind of co-operative act. In Mead's position what distinguishes a gesture from a simple act is the fact that, while stimulus and response remain within the same sphere of conduct of the actors who perform them, as in the case of the social act, responses rely on a set of possible anticipated gestures which might also be performed by the actor responsible for the original stimulus. In other words, in performing an act that will stimulate a response, the actor knows what possible responses it might invoke in the actor or actors involved in a certain conversation. This is made possible, according to Mead, through an awareness of the self in which knower and the known are parts of the same process. In the Hegelian stance, which can be considered the remote reference of pragmatism and symbolic interactionism, it is posited that in the process of constructing reality, a consciousness arises which stands independently of that reality. Reality being the product of the processes of the mind, and mind being alienated from itself in these processes, such contradictions, could they be solved, would only be solved by attaining a higher degree of consciousness. This higher degree of consciousness is the self. The self thus arises out of the process of construction of knowledge in which the knower steps outside the process and becomes

¹ I should acknowledge at this point that I use the terms 'act' and 'gesture' following Mead's definitions of these concepts. An act is thus different from an 'act' as in Searl's 'speech acts' (1972) and a gesture is different from McNeill's (1985, 1992) 'gestures'. However, the latter are relevant to the present discussion and will be referred to hereafter, in accordance with McNeill's own terminology, as verbal gestures.

an object to itself.

The problem of self-awareness has also been dealt with by Tuan (1982). He stresses the importance of the symbol in the arising of the self in the child.

The world begins to lose a little of its enveloping and diffuse wholeness once the child starts to use his expanding lexicon to differentiate and structure reality, and to interpose a system of symbols between self and direct experience. The process ... is a gradual one. Words not recognized in childhood as symbols, are the things they designate. It is natural for the child, and indeed for the adults most of the time, to regard words as properties of the nature, not elements of a secondary nature created by human beings. Nonetheless the child in picking up a more sophisticated and specialized vocabulary lives increasingly in a segmented and differentiated world ... How far this process is allowed to continue varies with different human groups, but the trend is universal: it is what growing up means (1982 : 141).

In other areas such as that of comparative psychology and physiology this problem has also been analyzed. In reviewing this subject Donald (1991) refers to Oakley's theory concerning hierarchical structure of the brain. According to this theory there is a high level in brain structure which is found only in apes and humans that deals exclusively with self-awareness. This level of the brain permits "attention to be focused not only on representations of the outside world but also on representations of the self. In other words, the animal becomes the object of its own representations." (Donald, 1991 : 144)

In this event, gestures are special kinds of acts which are only performable through the play of the mechanism of self-awareness. In the social construction of knowledge a gesture leads to another gesture, and this in turn will lead to another gesture and so on, in a continuous

mutually adjustable movement. We then have a special kind of social act which Mead calls a conversation of gestures.

2.1.4 - A conversation of gestures originates in problematic situations, is led by and leads to action.

Problem-solving is a widely researched topic in the area of cognitive psychology. Radford and Burton (1974) in a survey of this topic quote Davis (1966) who in "reviewing an extensive literature, remarks that: 'Research in human problem-solving has a well-earned reputation for being the most chaotic of all identifiable categories of human learning.'" Radford and Burton go on to note that "we should consider what the category contains: '...virtually any semi-complex learning task which does not clearly fall into a familiar area of learning can safely be called 'problem-solving'" (1974 : 39). Problems and problem-solving have been subject to a wide variety of definitions. Kahney (1986), quoting Simon (1978) and Aitkenhead and Slack (1985), defines problems and problem-solving "as an interaction between a task environment (that is, a problem) and a problem solver, who is thought of as an information-processing system" (Kahney, 1986: 39). Problems and problem-solving have also been conceived as a threefold idea " that (1) the problem is presently in some state, but (2) it is desired that it be in another state, and (3) there is no direct, obvious way to accomplish the change." (Mayer, 1983 : 5). Moreover, problem-solving can be found to have a complex or simple nature (Sternberg and Frensch, 1991), and can involve lateral/creative or vertical/procedural

thinking (de Bono, 1967). But in any event a conversation of gestures is always purposeful and arises in problematic situations and in the attempt to solve them. This is summarized in Vygotsky's statement that "every thought moves, grows, and develops, fulfills a function, solves a problem" (1986 : 218).

For the purpose of the present discussion, and in accordance with the suggested lexicon, I propose a simple definition of a problem as an obstacle or set of obstacles that lead to co-operative social acts, and, accordingly, problem-solving as the collective surpassing of these obstacles. This seems a broad enough definition which encompasses the various definitions found in the literature on the issue of problems and problem-solving.

However, a bit more precision is required here. As seen, there are several types of problems, and human beings employ several distinct cognitive processes to solve them (Mayer, 1983; Bryson, Bereiter, Scardamalia and Joram, 1991, Hegarty, 1991; Sternberg and Frensch, 1991). In dealing with the surrounding environment, an animal prompted by any impulse or need may face an obstacle which requires the construction of a solution. A solution to overcome this obstacle might be devised which requires nothing but the animal's natural powers, without the help of any external implements, but some sort of implements may also be built. This is not unusual, even in the lower species where cortical activity is nonexistent. The use of some sort of tools by fish or birds is a well known and documented fact.

In any circumstance, though, problem-solving is essentially an individual activity. On the other hand, a problem may arise within an

animal community which calls for some sort of collective response, as in the case of danger warnings in vervet monkeys reported by Kendon (1991). This species seems capable of building what appears to be the rudiments of a signaling system by using "different alarm calls by which, so it seems, one member of the troop who perceives danger may alert the others not just to danger in general but to the kind of danger that it is. ... This showed that the monkeys can use different kinds of calls to make *reference* to different kinds of objects in the external world" (Kendon, 1991 : 204). In following Mead's above mentioned description of the act, in the former case we admittedly have an act which is performed in order to preserve the life-process, and in the latter case we have a social act which is performed in order to preserve the life-process of the group. This is not however the kind of situation I am trying to address here. My focus is on problematic situations that call for the performance of gestures among individuals in the group, which involve a *complementary relationship* (Kendon, 1991) between their behaviour, or in other words "anticipating another's line of action and reading another's intentions and foci of attention, [involving] the production of specialized communicative acts, [and] the production of specialized actions that serve not as indices of feeling states or intentions but as *representations or concepts* " [emphasis added] (Kendon, 1991 : 213-214).

I am referring therefore to a special kind of problem whose understanding and solution can only be carried out through collective endeavour, that is, through the collective re-enactment and modeling of the problem's premises and solutions through gestures. And

gestures, I reiterate, are special kinds of social acts which concatenate both stimulus and response.

The tools used in this kind of collective endeavour, namely concepts and communication, are unique human implements and communication thus becomes *communication about concepts* (Kendon, 1991). The analysis of the development and formation of concepts as implements of the mind to deal with problematic, socially driven situations will be dealt with later on.

2.1.5 - A conversation of gestures leads to the genesis of language.

Social interaction may have a problematic character and thus the solution of common problems leads to the exchange of a special kind of social acts: gestures. Gestures are particular social acts in that they contain a tacit representation of the response. It does not matter, for the moment, if a gesture belongs or not to a particular set of objects, whether it has a particular embodiment or special physical properties. What is important to retain at this particular point is that gestures may be subject to a *negotiation* (Hinde, 1985), which takes place during a conversation of gestures in the course of which the rules are set for particular gestures to acquire certain meanings and play certain roles. I am using the concept of negotiation here in a sense akin to Mead's, i.e., in the sense that having selves (being able to make indications to themselves), individuals are able to act and that "individual action is a construction and not a release, being built up by the individual

through noting and interpreting features of the situations in which he acts [and] that group or collective group or collective action consists of the aligning of individual actions, brought about by the individuals' interpreting or taking into account each other's actions" (Blumer 1969 : 82).

During any conversation of gestures rules are constantly being re-negotiated and tacitly accepted, re-used, dismissed or reformulated. Specific gestures are thus assigned certain meanings, lose a previously assigned meaning or gain a new one, or in fact new gestures may be picked out to fulfill certain roles.

This process, of course, does not take place in the abstract. Neither the negotiation, nor the rules or the gestures themselves have an unlimited or idle character. Furthermore, a conversation of gestures is a recursive and dynamic process, and negotiation, acceptance, dismissal or re-use of the rules and gestures takes place under specific constraints which necessarily affect the outcome of this conversation of gestures. The effect of these constraints on a conversation of gestures has nevertheless a wide degree of flexibility and the constraints can also be an active by-product of this negotiation.

The actors engaged in a process of negotiation display a well characterized physical and psychological makeup. And, conversely, a conversation of gestures takes place under commonly shared and favourable environmental conditions. Stimuli in which the gesture is embedded have to come to these actors in forms which lie within the grasp of this physical and psychological makeup. It is therefore inconceivable that a conversation of gestures might take place

disregarding the intervening actor's psychological traits, physical limits, intellectual capacities or environmental conditions. If we in turn accept that a gesture is a stimulus which re-enacts a response, these responses will also have to lie within the realm of the actors' physical and psychological makeup and shared environmental conditions.

In short, out of a conversation of stimuli and responses, as well as a negotiation of gestures taking place under a specific set of constraints, language arises. Languages are thus, in a broad sense, sets of stimuli and responses organized within externally and internally induced constraints, the result of the interplay between the rules negotiated among the intervening actors and the physical and psychological makeup of these actors and their environment.

2.1.6 - Languages freely embody signs which have an arbitrary nature.

It may seem difficult to imagine how a conversation in gestures might give rise to a language. There are however factors that will help unveil this process and there is some factual evidence on how it might have developed. But as I will argue in a later section, the whole process of development of human communicative processes is a dynamic and non-linear one. I believe that only a firm grasp of this reality will result in a thorough understanding of this process.

For purposes of the present discussion, we may conclude based on Donald (1991) that gestures and conversations of gestures become

languages -- i.e. standardized, mutually accepted sets of specific gestures and procedures -- as a result of the interplay between the following four factors: 1) The evolution of the features of human physique, and psychological traits, which allows gestures to be performed and perceived, 2) technical, environmental and social factors, 3) previous cognitive modes and, finally, 4) the results of a negotiation.

In the case of spoken language, it presumably arises directly as a result of, firstly, the evolution of the voice and hand implements and memory skills; secondly, certain social and geographical changes, and, finally, the influence of mimesis allowing the reenactment of the gestures and thus permitting the negotiation about the rules of the interaction to take place. Again based on Donald (1991) I will detail this process a little further.

Certain human features are the product of an evolutionary process which is of interest to our present discussion. The increase of the brain size of *Homo sapiens sapiens*, for example, might be the product of an increasingly complex social life, which led to the need to formulate more elaborate mental maps, which in turn reflected the increasing intricacies of the social connections (Donald, 1991). Increasingly complex social connections might also have been involved in the origin of changes in facial expression which, together with the lowering of the vocal tractus and the consequent optimizing of auditory skills, might have had an influence in the control of the voice. This capacity to produce sounds in a controlled manner with the vocal apparatus, as seen first in prosody, and the fine tuning of the physical apparatus necessary to produce and detect these sounds is

unique to human beings.

In addition to the vocal skills the role of verbal gestures must also be underlined. The role played by the hand in human cognitive processes is another well documented phenomenon (Napier, 1980) . The hand was also the product of the evolution that occurred as a result of bipedalism, itself the result of the developing of new forms of social organization in early humanoids (Kendon, 1991; Donald, 1991). Voice and hand are devices that are subject to our direct and conscious control. It is therefore not surprising to find that the earliest forms of language are embodied in the voice and the hand. Vocal and verbal gestures created a convenient system to engage in a conversation of gestures or, as Donald states, "a system which allows a more rapid, portable, and extensive semiotic use" (1991 : 206). McNeill (1985, 1992) suggests that hand and vocal gestures form a whole that shares the same psychological structure.

Oral language is thus the product of this interplay between vocal and verbal gestures. The importance of these gestures seems unquestionable from the point of view of tracing an evolution of expressed thought. Oral language plays an important and unique role in the development of an orally-based cognitive mode. Mead (1934) points out that insofar as language is a co-operative process it "has only a limited range of arbitrariness ... [although] there is a certain range possible within the gesture as to what is to serve as the symbol" (1934 : 74). On the other hand, Vygotsky (1986) recognizes that "Language does not have to depend on sound. There are for instance, the sign language of deaf-mutes and lip-reading, which is also interpretation of

movement In principle, language does not depend on the nature of its material ... since what matters is the functional use of signs" (1986 : 75-76). We may conclude from the above remarks that the medium itself is not a decisive factor in that any plastically moldable material can theoretically become the vehicle for the genesis of language. Therefore, there must be another factor which determines the limit of arbitrariness of a given language. This limit is structure. On this issue Sacks (1990) commenting upon Sign language, observes:

Language and thought, for us are always personal -- our utterances express ourselves, as does our inner speech. Language often feels to us, therefore, like an effusion, a sort of spontaneous transmission of self. It does not occur to us at first that it must have a *structure*, a structure of an immensely intricate and formal kind. We are unconscious of this structure; we do not see it, any more than we see the tissues, the organs, the architectural of our bodies. But the enormous, unique freedom of language would not be possible without the most extreme grammatical constraints. It is grammar, first of all, that makes a language possible, that allows us to articulate our thoughts, our selves in utterance

There is, indeed, a paradox here: at first Sign looks pantomimic; if one pays attention, one feels one will "get it" soon enough -- all pantomimes are easy to get. But as one continues to look, no such "Aha!" feeling occurs; one is tantalized by finding it, despite its seeming transparency, unintelligible (1990 : 75-77).

In summarizing this question, I underline that, in my understanding, a conversation of gestures becomes a language: 1) within a certain set of constraints which affect the way this conversation of gestures is performed, and 2) after being subject to a collective process of negotiation which assigns meaning to the performed gestures and thus sets the rules of performance. Moreover, language, as will be demonstrated later, seem to have a threefold

purpose: 1) in organizing thought, as will be seen in the next section, 2) depicting the products of our thinking, and 3) distributing these products through space and time.

2.1.7 - Through the mediating effect of language, concepts are formed and expressed.

I will now focus on the issue of the relation between thought and language. Once gestures, and the several constraints within which they are performed, are molded from their individual constitutive parts into a complex and agreed upon system, thus forming a language, language itself will exert a determining influence on thought processes themselves. Language is instrumental in the process of constructing the models through which we construct reality. This is in fact a very complex issue to frame due to the very dynamics of the process.

I will attempt to explain this issue by adopting as my point of departure the work of the Russian psychologist Lev Vygotsky (1986) on the formation of concepts, which "should be required reading by developers of hypertext systems," as suggested by Barrett (1989 : xvii).

Vygotsky singled out the basic elements which intervene in the formation of concepts: 1) Sensory material; 2) Intellectual operations; 3) problem-solving, and 4) Functional use of signs. Sensory material, intellectual operations and the emergence of a problem are triggering factors which are mediated by the functional use of words in different ways, at the different levels of the concept formation.

Vygotsky distinguishes three stages in the formation of concepts:

1) a syncretic stage, 2) a complex stage and 3) a concept proper stage. Again this is a dynamic process, there being a permanent linkage between these stages in the formation of concepts.

The *syncretic stage* is the earliest most elemental. During this stage words are used to denote vague classes of categories in a process based on trial and error, continuity of perception and re-combination of previously combined elements. This trial-and-error stage, typical of the young child, seems to match Changeaux's brain model according to which "the young brain proliferates new connections fairly indiscriminately, that is, invents many possible routes of development, of which only a few will survive, due to the selective effects of experience" (Donald, 1991). Next comes what Vygotsky calls the *complex stage*. This stage is characterized, primarily, by the establishment of bonds between different categories of elements available to experience. The process starts through simple association, proceeds by establishing collections, in which common elements of experience are singled out and goes on to what Vygotsky calls chaining. This is a process in which a detour might be carried out leading to the addition of new elements forming complex chains which have no bearing to the initial collection which set out the process. Next come diffuse complexes. During this stage bonds which unite the elements of the chain, appear to have a fluid and evanescent character. This in turn leads finally to pseudoconcepts. They represent a mimicry, if you will, of a full concept. The origin of pseudoconcepts lies in the fact that the words that denote them come to us with a certain ready-made meaning which impinges upon us through social interaction. This makes the

pseudoconcept appear as a full mature concept, but in fact the mechanisms which lead to it are typical of complex thinking.

The final stage in the formation of concepts is *concepts* proper. This stage is characterized by the introduction of mental operations of abstraction and re-synthesis. Firstly, elements which are maximally similar in a set of objects are singled out. In potential concepts, one characteristic is singled out in consequence of the influence of habits and, finally full concepts emerge when not only the mechanisms of abstraction but also the mechanisms of reconstruction are employed.

I noted earlier in this section another important aspect in regard to the formation of concepts, which has to do with the role of the word. Vygotsky (1986) observes in this respect:

From our point of view, the processes leading to concept formation develop along two main lines. The first is complex formation: The child unites diverse objects in groups under a common "family name"; this process passes through various stages. The second line of development is the formation of "potential concepts", based on singling out certain common attributes. In both, the use of the word is an integral part of the developing processes, and the word maintains its guiding function in the formation of genuine concepts, to which these processes lead (1986: 144-145).

In moving from inner speech to oral speech and further to written speech, or from concealed to overtly expressed speech, there seems to be an inverse movement from practically pure concepts (not embodied by the word) observed in inner speech, through abbreviated speech, as in oral speech, to fully worded concepts as in the case of written speech. Vygotsky further posits that "thought must first pass through meanings and only then through words." (1986 : 252) The

relation of thought and expression is therefore an evolving, self-recurrent one, mediated by a dynamic use of the word.

One final commentary on Vygotsky's view on the relation of thought and language. These are, as I have written earlier, independent categories connected through meaning. Thought and expression evolve in independent ways both at the phylogenetic and ontogenetic levels. Their interdependence, as Vygotsky points out, is the product of "the historical development of human consciousness" (1986 : 210). Vygotsky claims that "meaning is such a close amalgam of thought and language that it is hard to tell whether it is a phenomenon of speech or a phenomenon of thought" (1986 : 212), and contends that meaning does indeed belong to both the sphere of language and thought. This is illustrated in what Vygotsky defined as the phonetic and semantic meaning of language.

From the point of view of the outward development of language, meaning is assigned to a gesture or set of gestures, as I have argued, as a result of a negotiation that takes place during a conversation of gestures. This negotiation will lead to choosing the most adequate gesture or gestures, and the rules under which they will be used. But language functions, as I described earlier, also inwardly in the formation of concepts. I will therefore be referring to this concept of language functioning inwardly in the formation of concepts, and outwardly in the expression of thought processes and conversation as an 'object of communication', an expression borrowed from Mead.

From the point of view of the development of concepts, meaning or concept is the result of a complex set of operations which I

describe in section 2.2 as the Synthesis-Abstraction-Resynthesis (SAR) process. The *process*, not a mechanical correspondence, as Vygotsky keenly stresses, of adjusting semantic (inner, conceptual) and phonetical (outer, grammatical) meaning is continually going on. But the main point I want to illustrate here is that there is an inner, intellectual process of concept development, which leads to the assigning of meaning to objects of communication, and an outer, social process of negotiation which also assigns meaning to these objects. In either case it is carried out through the use of words. Or, should I say, the use of objects of communication.

2.1.8 - This is a dynamic and non-sequential process.

The process that leads to the relation of thought and expression is a complex one, which by reasons of the limitations of the written medium itself has to be analyzed sequentially. But this is not a sequential process. Every variable in this chain acts recursively upon the others. There seem to be three levels of dynamics: 1) the whole process from interaction to the formation of objects of communication, through concepts is in constant recursion within itself; 2) the influence which each of the variables appears to exert on the global process, and, 3) the dynamic process to which each variable is subject to in its own internal evolution.

We may thus conceive of a primary chain of processes in the following manner: interaction -> problematic situation -> conversation of gestures -> language -> concepts -> thought -> objects of

communication. In reality, objects of communication immediately affect the interaction and the whole process in successive iterations. The same can be said for any of the elements in this basic chain. Each of them will have an effect upon the others and thus affect the basic chain. But each element in the chain will also be subject to its own internal dynamic process. Vygotsky stresses:

It would be erroneous ... to imagine that [the] transition from complexes to concepts is a mechanical process in which the higher developmental stage completely supersedes the lower one. The development scene turns out to be much more complex. Different genetic forms coexist in thinking ... Such a structure is not an exception, but rather a rule of behavior. We know fairly well that human actions do not belong necessarily to the highest and most advanced level of development. Developmentally late forms coexist in behavior with younger formations. ... Even adults often resort to complex thinking. Moreover, even conceptual thinking in adolescents and adults, insofar as it is involved in solving daily problems, does not advance beyond the level of pseudoconcepts. Possessing all characteristics of conceptuality, such thinking, viewed from the dialectological perspective, remains complex.

... When the process of concept formation is seen in all its complexity, it appears as a *movement* of thought within the pyramid of concepts constantly alternating between two directions: from the particular to the general, and from the general to the particular [emphasis added] (198: 140-143).

2.1.9 - Social control in the definition of an object of communication.

None of the processes described above takes place in the abstract. Earlier in this chapter I mentioned the social essence of communication. I would like to clarify this topic. An object of communication arises out of specific social settings but its use is also subject to other external, socially induced, contingencies. Donald (1991)

summarizes this in saying that language is a “public, collective invention” (1991 : 216), but “market driven” (1991 : 234).

There is, to be sure, a fine line dividing these two concepts, but the distinction has to be made for the purpose of our future discussion. “Public, collective invention” may be interpreted as the free-flowing process of negotiation and the inner conversation which leads to meaning and concepts. It presupposes the possibility of freely performing the gestures of the object of communication, the capacity to produce and respond to them.

But, in practical use, an object of communication forges artifacts and elicits the construction of new knowledge. This object, thus, becomes prone to a commerce similar to that of any other object. I will bring this subject up in the discussion of hypermedia. If a metaphor can be used, competence must be universally shared, whereas performance may be subject to market constraints.

2.2 - Conclusions on thought, concepts and objects of communication.

In the previous sections I attempted to establish what will be the main lines of force of the remainder of this discussion, drawing mainly upon the work of Mead, Vygotsky and Donald. I will now outline some conclusions from this preliminary endeavour which will also help situate my argument.

New cognitive processes stem from those which precede them. But there appears to exist a cumulative process through which traces of

previous cognitive processes subsist and play a decisive role in the formation of new ones. "One of the basic principles of evolution is previous gains in adaptation", as Donald puts it (1991 : 165). This fact can be interpreted to mean that changes in technology *per se* will not determine the rise of new cognitive modes. Technology forms a complex unit with several other factors in the genesis of new cognitive modes.

One other important aspect is that communication arises and develops out of the needs of society and can only be understood within the bounds of these needs. There has to be a complete understanding of the total ramifications of the communicational act. The figure of the author and certain modern forms of passive transmission of information obscure the fact that communication is indeed a social product, but all communication has in fact a social essence and it is within this essence that ultimately an analysis of its implements must be carried out.

I spoke earlier of acts and gestures. An act in itself is a simple phenomenon that can reveal simple individual life-processes. Acts can, as we have seen, differ from but are encompassed by social acts, and social acts in turn differ from but are encompassed by gestures. To become objects of communication, gestures are subject to a certain negotiation which sets the rules of their use. This is a process that takes place under certain physical, psychological and environmental constraints and presupposes self-awareness.

There is no unidirectional communication and, similarly, there is no idle communication. The idea of a phone line without any

exchange of information taking place is absurd. Communication is prompted by problems or drives. "Thought is engendered by motivation, i.e., by our desires and needs, our interests and emotions. Behind every thought there is an affective-volitional tendency, which holds the answer to the last 'why' in the analysis of thinking. [Moreover] a true and full understanding of another's thought is possible only when we understand its affective-volitional basis" (Vygotsky, 1986 : 252).

McNeill's model of simultaneous interplay between the voice and hand opens up interesting possibilities of enquiry. McNeill hypothesizes that:

Gestures are not the product of a linear-segmented verbal plan, not translations of speech into visual-kinesic form, not like photographs, and not the tip of a linguistically structured iceberg. They are closely linked to speech, yet present meaning in a form fundamentally different from that of speech. My own hypothesis is that speech and gesture are elements of a single integrated process of utterance formation in which there is a synthesis of opposite modes of thought -- global-synthetic and instantaneous imagery with linear segmented temporally extended verbalization. Utterances and thoughts realized in them are both imagery and language (1992 : 35).

This point is particularly important. McNeill suggests that there are two concomitant modes of expression of thought, working inwardly and outwardly but coordinated by a single centre. Moreover, verbal gestures acquire meaning in the context of the utterance and are re-invented each time they are produced, there being no 'lexicon' of verbal gestures *per se*. Verbal gestures retain a mimetic quality (Donald, 1991) and are thus re-enacted during each conversation in gestures.

McNeill's hypothesis raises an interesting question in our discussion, namely, whether these concomitant but singularly coordinated processes take place in other modes of thought expression, written, printed and computer mediated speech, and what forms they acquire in such cases. I will attempt to detail this in the following chapters.

The subject of the interplay between thought and the modes of expression is a difficult one to tackle. Jenkins (1969) has observed that:

The major positions on the relations of thought and language can be characterized (or perhaps caricatured) in a series of brief answers to the multiple-choice question: 'What is the relation between thought and language?'

1. Thought is dependent on language.
2. Thought is language.
3. Language is dependent on thought.

The fourth answer might be fittingly cast in the devilish mode of the fourth alternative that one uses when he has run out of good responses:

4. None of the above. Or perhaps , all of the above (1969 : 212).

Jenkins concludes that all of the above answers are correct since:

Thought does depend on language to the extent that it uses that subsystem of its much more extensive and complex machinery. Thought is language to the extent that natural language is a universal meta-language that can, in principle, capture any nuance of thought in any domain whatsoever. Language does depend on thought to the extent that it is one manifestation of the general universal rule system that governs all thought, and to the extent that it uses inputs and constructs from all other systems operating under the general guidance of the universal system (1969 : 235).

Regarding this subject we learn from Vygotsky how concepts are formed and the role they play in cognitive processes. But we further

learn from this author how the word mediates in this process. He observes how concepts built upon written speech may engender more complex concepts. I hypothesize, and will explore this hypothesis in the following chapters, that this mediating role should be extended to the full object of communication. But this hypothesis deserves further explanation. My interpretation of Vygotsky's stance, which this model tries to re-enact, is that there is a movement from synthesis to analysis, back to synthesis in the formation of concepts -- which I will call Synthesis-Analysis-Resynthesis (SAR) -- and that this constitutes the essence of concept formation. At every stage of this SAR process words play a decisive role. Vygotsky concedes that the written word will permit attaining a higher degree of complexity in the formation of concepts. Even though he does not explain exactly how this is done, I hypothesize that this may bear on the very characteristics of written speech: reduced burden on the memory and the possibility of a higher precision in the use of words. These characteristics would in turn give rise to a more complex full concept. This idea can be best illustrated by pointing out the difference between a word and a book, for example. A simple word or a phrase can convey a full concept and a thesis conveys a more complex full concept.

If we accept Donald's principle of a preexistent cognitive apparatus in the development of new cognitive processes, and Vygotsky's principle of the functional use of signs in concept formation, some further aspects might be suggested. In my interpretation of Vygotsky's work, he is suggesting that a capacity to generate full concepts is there from the outset. In this case higher

forms of language merely give support to more complex full concepts which are more precise because their constituent elements can be better detailed through language. If we were to accept that the formation of concepts was not functionally but organically dependent upon language, this would mean that full concepts would be impossible to form within the kernel of spoken language, for example. Moreover, it would mean that full concepts could only be formed through written language, or that a more elaborate form of expression of thought could further lead to some other category different from full concepts. Yet the SAR paradigm appears to be present from the lowest stages of concept formation to the highest, suggesting that it relies on thought processes rather than on language processes.

Gestures are performed by actors in response to certain goals. When released, these gestures are subject to a process I have described as 'negotiation'. Out of it a fully agreed upon language may arise. Moreover, a language seems to display a certain degree of flexibility in regard to the role it plays in the communicational process. This substantiates the possibility of some sort of "lingua franca" being created which does not depend on the artifacts themselves, but which must always be socially induced and problem-driven in addition to fulfilling precise goals such as organizing thought, both inwardly and outwardly, recording and transmitting the results of this process of organization. In this case we have a full 'object of communication'.

Finally, one of the chief conclusions of this analysis is that the relation between thought and expression is dynamic and non-sequential. This is one of the most salient features of my approach in

the analysis that follows.

Chapter 3

Objects of communication.

3.1 - From orality to literacy.

In the previous chapter I attempted to describe a model which traced the social essence of communication, focused on its problem-solving character and illustrated the relation between the objects of communication and thought mechanisms. The “functional” use of language, as Vygotsky points out, is the determining element in the formation of concepts. The oral and literary objects of communication (including script and printing) admittedly determine key stages in human cognitive development, and form a continuum in this development.

In this chapter I will review the main traits of orality and literacy, distinguishing between scripted and printed media. I will briefly trace the social kernel from which they evolved, the problems they are trying to address and examine their influence on the formation of more precise mental processes.

3.1.1 - From mimesis to orality.

Donald (1991) has argued that prior to the emergence of an oral

culture, another earlier stage must have occurred, based on what he refers as mimetic skills. He calls this stage "the missing link" (1991 : 162). Mimetic skills consist fundamentally of adding representation to imitation. The presence of a capacity to perceive single events can be found in various species of mammals not possessing cortical activity. Imitation, on the other hand, is a trait which reveals in its most basic form the capacity to single out events, and is found only in the cognitive apparatus of higher mammals and some birds.

Mimetic skills are, Donald argues, the basis of early hominid cultures. "Mimetic skill is autonomous, isolable from language, and sufficient for the cultural achievements of *erectus*" (Donald, 1991 : 202). The features of mimetic culture passed to the emerging oral culture and remain detectable even today. This also illustrates another of Donald's arguments, namely, that features from previous cognitive modes remain active in subsequent, more advanced cognitive modes, are encapsulated by them and can be retrieved, so to speak, in these advanced cognitive modes. Oral and written cognitive modes can elicit mimetic cognitive processes, but a mimetic culture could not employ the more advanced modes, not without passing through the evolutionary states that led to them (Donald, 1991).

A number of important features characterize mimesis which should be pointed out here. Event perception is the kernel within which mimesis operates. Still, according to Donald, once an event has been singled out, mimetic skills allow it to be acted upon. This can be done in various ways, but some sort of 'visual-motor' action was the most frequently used at this earlier stage. Mimetic skills thus permit

the creation of a representation of the actual event, which retains the distinctiveness of the event without necessarily involving the event itself, a representation which further permits detached, shared or individual experience, upon which either its creator or others may further act or reflect. It is interesting to note that the 'visual-motor' nature of mimesis seems to yield to a 'verbo-motor' nature in orally-based cultures, these having become increasingly dependent upon sound (Ong, 1982 : 78).

Mimesis is not an automatic process, as when one turns away one's hand from a red hot iron. Even if it were a reaction it would be an intentional, self-cued reaction, which might not have any immediate communicative purpose. It is an analytic/syncretic process in which each element of the act is divided into its component parts and then rebuilt or re-enacted in whatever seems to be the appropriate way. The ways in which such an act can be re-enacted have no limit.

If we accept this mimetic stage in human cognition, what would then be the particular features which have relevance to the present study? In which ways does a mimetic cognitive culture extend its influence upon an oral culture? Donald has distinguished several. Firstly, the mimetic act is a creative one. Each mimetic act is, as mentioned above, a representation, a cartoon, if you will, of the actual event, re-enacted in whatever seems to be the most appropriate way. Secondly, it reveals the capacity to analyze events and to synthesize them into a new whole. Thirdly, mimetic acts are self-cued and lead to and are led by action, a fact which reveals both their purposefulness and an awareness of self and others.

However unclear it may seem, the precise mechanisms under which a mimetic culture turns into an oral culture, mimesis -- through this tripart creative, analytical/synthetical and purposeful character -- undoubtedly appears to play a decisive role in the genesis of an oral cognitive mode. In addition mimetic skills, together with the earlier described alterations in the vocal-auditory apparatus, must have had a profound influence on the genesis of the spoken word. Through mimesis of the vocal gestures an early basis for the negotiation phenomenon I described earlier may have been provided. Ong (1977) points out that "the entire oral noetic world relies heavily, even fundamentally, on copying not just nature but oral utterance itself in its management of knowledge" (1977 : 284) .

The influence of mimesis is still found in advanced societies which again underlines the dynamics and recursiveness of the process. Ong observes that mimetic skills go on playing an important role even in a literary cognitive mode as well. "Through the sixteenth and seventeenth century", he notes, "schoolboys such as William Shakespeare and John Milton were still programmatically drilled in imitating the Latin Classics" (1977 : 286).

3.1.2 - Social character and problematics of orality.

In the first part of this work I argued that communication is a process that stems from society. This can best be demonstrated *a contrario*. As Kendon (1991) notes, chimpanzees do not need a language. A division of labour would be a major requirement

according to this author (1991 : 212).

It seems undeniable that the advent of the speech-based language followed dramatic environmental changes that probably occurred between 75,000-10,000 years ago. Whether spoken language sprang directly from climate changes, which led to migrations and to facing new environmental challenges, or from the need to form a cohesive group behaviour within a particular hominid group, among those competing in this species' niche, it seems clear that whatever the origin of orality, its social character and socially-prompted action look undeniable.

Donald (1991) advances the hypothesis that selective pressure between different hominid groups might have given rise to a new and more advanced cognitive mode. The group that developed that mode would have been better equipped "to act as a cohesive society" (1991 : 209). Whether we accept the 'selective pressure' factor or not, it seems inarguable that a new cognitive mode based on language would constitute a valuable asset in dealing with the problems posed on the species.

In a typical early oral culture, language was not used in all areas of social activity (Donald, 1991). There are however areas in which language played a crucial role. Early changes that possibly occurred which might have influenced the development of new cognitive processes leading to language, included establishing a "home-base" (Wyner, 1982) which provided protection and where food could also be shared. Food sharing activities "demanded some form of communication; signs, gestures and grunts would hardly have sufficed

even at this primitive level of human existence" (1982: 51). Stone tools might also have required some sort of elaborate communication in their development. Simak (1971) notes: "It is highly probable that language extends as far back as the day when tools were first made. The technology of tool-making, if it were to be passed from generation to generation, would have called for oral instruction rather than simple dumb-show demonstration" (1971 : 50). This is further illustrated by Marshack (1991) who observes, in regard to the use of materials from different origins by the Peking Man, that "once again these skills require an evolved level or capacity for kinesthetic and relational understanding, learning and teaching, with or without a large use of words ... But the cultural and cognitive capacity revealed in our analyses would seem to indicate also that by the time of the Peking Man there must have been a range of communications adequate to maintain that cultural complexity" (1991 : 115).

Simak notes that "it is certain that by the time man began hunting big game, necessarily a cooperative project involving not a single hunter but a band of hunters, a fairly adequate language must have been in existence. To have planned a hunt, to have assigned each man his particular task, to have given the necessary field orders, would have required a comprehensive language" (1972 : 50).

Although the exact moment at which language was born can hardly be possible to trace, it seems safe to assume that it must have originated in activities that involved group coordination in general or that demanded the control or development of some technology. Language would thus have evolved and played some role in such

activities as hunting, food gathering, shelter building and tool-making,

In addition to serving as a vehicle for the flux of information regarding the learning of practical knowledge, language would also have played a major role in regulating and determining social interaction, in "watching the activity of the others, keeping records of interpersonal relationships [and] regulating interactions" (Donald, 1991 : 213). It is within this evolutionary framework that spoken language arises and will attain its peak.

3.1.3 - The oral conversation of gestures.

I observed in the previous chapter that an act is a response of an organism to a stimulus that affects the life-process of that organism. Accordingly, a social act is an act that lies within the same sphere of conduct of the intervening actors, and is carried out among the group as a response to a stimulus that affects the group's life-process. In human societies a particular exchange of stimuli and responses -- gestures -- takes place under the presupposition that a stimulus contains some sort of representation of or re-enacts the response. Gestures lead to a conversation of gestures and to the genesis of objects of communication. An object of communication is an intricate conversation of gestures that takes place within a complex set of constraints, and is subject to a negotiation of gestures in order to have an agreed upon meaning assigned to it. This takes place under the specific physical and psychological makeup of the intervening actors and under certain environmental conditions.

How then can the oral gesture and the orally-based conversation of gestures be characterized and what is the oral object of communication? I have signaled how the 'visual-motor' based channel in mimesis gave way to a 'verbo-motor' based one in oral culture. I also stressed -- based on McNeill (1985, 1992) -- the importance of the symbiosis between the hand-gesture and sound in the definition of the oral gesture which is thus the result of the interplay between the phono-auditory apparatus (optimized to produce and perceive sound within a certain frequency range) and the hand gesture.

Donald (1991) argues that mimesis might have influenced the genesis of a conversation of oral gestures, firstly through the use of sounds of vocal origin to accompany the mimetic act and later in the very genesis of oral utterances produced through the phonatory apparatus. The oral conversation of gestures might thus have originated in the process of responding to certain oral gestures through imitation. A conversation of oral gestures, in turn, led to the conception of the oral based language in the definition of which the following elements take part: 1) the impulse to produce utterances, which is unique to human beings and is a result of important anatomical transformations which took place prior to the appearance of *homo sapiens sapiens*, 2) the mimetic element which enticed responses to the vocal stimulus through imitation and representation, 3) 'verbal gestures' which as McNeill (1992) shows, play a decisive role in the definition of the global oral conversation of gestures, and 4) a negotiation which takes place within the physical reach of the actors involved and leads to the institution of the rules of the conversation.

Thus oral language arises from a conversation of oral gestures. Oral gestures are 'verbo-motor' based, i.e., they include an acoustic vocal-auditory component and a visual component which I have called the 'verbal gesture'. The latter is not subject to any negotiation and seems to be created in real-time during an interaction (McNeill, 1992). The vocal-auditory component is subject to constraints that lie within the actor's physical and psychological makeup: it conforms with certain capacities of the vocal and auditory apparatus, and to certain psychological traits which set the conditions under which the acoustic material is processed by the brain. This exchange of oral gestures is symmetrical, i.e., one sending-receiving unit corresponds to another sending-receiving unit. According to the model I proposed earlier, the exchange of oral gestures serves to organize thought, record and transmit these gestures.

The problem-driven conversation of oral gestures thus leads to a negotiation that takes place within the reach of each of the actors involved. In other words, the oral conversation of gestures is not mediated by any extraneous components, outside the realm of the actors involved. The recording of the gestures is made in the actors' own minds and transmission is direct from one actor to another.

Only in more recent times have telephones and tape recorders allowed the recording and transmission of an aural conversation of gestures. And only even more recently has on-line video allowed the inclusion of the verbal gesture, permitting an exchange or conversation of gestures by proxy.

3.1.4 - From utterance to myth.

How does oral language exert its power in the construction of a new cognitive world view? If we accept the theory of a pre-existent cognitive apparatus proposed by Donald, and the fourfold stage in concept formation proposed by Vygotsky, we may safely assume that the rise of an oral language aimed at embodying a pre-existent cognitive mode but also at unleashing a new one. Donald (1991) seems to corroborate this idea when he posits:

Although language was first and foremost a social device, its initial utility was not so much in enabling a new model of collective technology or social organization, which it eventually did, or in transmitting skill, or in achieving larger political organizations, which it eventually did. Initially, it was used to construct conceptual models of the human universe. Its function was evidently *tied to the development of integrative thought* -- to the grand unifying synthesis of formerly disconnected, time-bound snippets of information. Where mimetic representation was limited to concrete episodes, metaphorical thought could compare across episodes, deriving general principles and extracting thematic content [emphasis added] (1991 : 215).

Integrative thought in Donald's terminology appears to further substantiate Vygotsky's theory of concept formation, which I detailed in the previous chapter. Integrative thought is at the core of the syncretic stage and is thus an earlier phase in the formation of concepts. Spoken words appear to have the power to serve the purpose of sustaining the mechanisms of this earlier phase of concept formation. A single word can easily embody a complex world of meanings, as demonstrated in Vygotsky's analysis of concept formation in children. "The first words of a child play the role of generalizations" (1986 : 143). It is not

inappropriate to think that a similar mechanism takes place at the phylogenetic level of language development. The first words undoubtedly played the role of generalizations. To be sure, pictures can also play this role and in fact they did, as shall be seen in the following sections. But the spoken word seems to possess properties that permit this role to be carried out more effortlessly. This is seemingly a consequence of the characteristics of vocal sound such as its omnidirectionality and its centripetal nature (Tuan, 1987), i.e., sound 'touches' and reaches out for the listener. It has a non-mediated nature, i.e., vocal sounds emanate from virtually the same source as thought itself and do not rely upon any external implement.

Spoken words also seem to perform adequately during the complex stage of concept formation. It is interesting to note, for example, the detailing nature of language in oral peoples. In his analysis of the oral languages of North American Indians Lévy-Bruhl concludes that "perhaps the most salient characteristic of most languages of North American Indians is the care they take to express concrete details which our language leave understood or unexpressed ... The primitive's mentality needs to differentiate between two, three, a few, or many subjects or objects, to indicate they are together or separate ... It has no *general* terms for 'tree' or 'fish' but special terms for *every* variety of tree or fish" [emphasis added] (1984 : 140). This appears to illustrate the fostering of the bonds which characterize the formation of concepts at the level of complexes. Lévy-Bruhl further notes, and this he considers one of the essential theses of his observations, that "the collective representations and interconnections

which constitute [the mentality of 'primitive peoples'] are governed by the law of participation and in so far they take but little account of the logical law of *contradiction*" [emphasis added] (1984 : 361) .

Spoken language should of course permit the formation of full concepts. I speculate that in his example, Lévy-Bruhl is simply acknowledging an obvious difficulty in advancing into higher stages of concept formation through spoken language. Myths, poems and rhetoric illustrate the degree of development that the orally based cognitive mode reached. It is true however that the more we travel through this three-stage continuum of concept formation, from synthesis, through analysis to re-synthesis, the more demands we find are to be put on memory and mental operations.

Myth occupies a particular place in the genesis of concepts. It appears as the most elaborate attempt to develop full concepts through oral discourse. The analysis of myths illustrates with particular clarity the path of the formation of concepts described earlier. Cook (1980) in his account of the phases of myth distinguishes four stages. Each stage, Cook asserts, subsumes the earlier ones. The first stage is unicity. This stage is represented in the cult of the mother and is symbolized in the countless figures of the so-called Venuses which have been found all over Europe and Asia. A second phase in myth creation is distinguished by the introduction of what Cook calls 'dualisms'. During this phase thought proceeds by discriminating between continuities and discontinuities. This phase is tied to the cycles of nature and is typical of the agricultural societies of the neolithic. During the third stage, characterized by abstract separation, the analysis of continuities

and discontinuities revealed by myths, although present, is broken. The analysis thus focuses on the frontiers of these continuities and discontinuities. One example is the Egyptian Book of Dead, where the focus is placed not on life or death but on the river that leads from life to death. The fourth stage rises “when the act of language consciously allows for and virtually names, instead of merely subsuming, the unconscious element in the mythic process “ (1980 : 57). Cook mentions Renaissance myth as an example of this stage. It seems interesting to note that these phases seem to correspond roughly to the revolutions introduced by technology in the expression of thought. The ‘unicity’ phase evolves during the oral stage, the second and third evolve during the process of evolution of writing and, finally, the fourth phase seems to correspond roughly to the introduction of printing (Cook, 1980).

While conceding that in early society different aspects of “the difference between myth and literature is one not of kind but of degree” (1980: 38), Cook further asserts that within this continuum revealed in the creation of myths “changes in the interaction between language and myth determine its transition into writing Literature constitutes an elaborate repository of achieved techniques for articulation and coordinating in language some of the more advanced stages of the interaction between the human psyche and myth” (Cook, 1980 : 37).

Through myth and other higher forms of orally-based concept formation, oral language becomes an object of communication.

3.1.5 - The genesis of literacy.

Orality made it possible to pass from the *disconnected, time-bound snippets of information* referred by Donald, to higher stages of concept formation to the more elaborate stages of complexes and finally to the formation of concepts proper. To be sure, the necessary mental operations to attain these higher stages of concept formation, i.e., abstraction and re-synthesis, could be performed through the use of the spoken word. But the sequentiality of spoken discourse, and its dependence upon memory make this exercise in analysis and re-synthesis a difficult one. To help the natural powers of the mind a countless number of myths, poems, songs, etc., were created. I described myths in the previous section. Poems have played a similar role. They also form a bridge with the next phase. Havelock (1982) in his analysis of Greek literacy stresses the importance and long tradition of poetry in supporting thought processes in oral cultures. He stresses the role of rhythm and the reinforcing role of dance, musical instruments and melody in this process. "A poem is more memorable than a paragraph of prose; a song is more memorable than a poem" (Havelock, 1982 : 186). Poems survived long after the alphabet was introduced in Greece. In fact the first examples of alphabetic writing are transcriptions of poems, hence the lyrical character of Greek early literature (Havelock, 1982).

The mental operations involved in full concept formation seem to be better performed through the aid of writing. Havelock (1982) analyzed the new possibilities brought about by emerging writing in

Greece, and noted that a shift occurred with the introduction of writing because “a visible artifact was preservable without recourse to memory. It could be rearranged, reordered, and rethought to produce forms of statement and types of discourse not previously available because not easily memorizable” (1982 : 8). Tradesmen and craftsmen defeated poets, as will be seen in the next section.

3.1.6 - The purpose of literacy.

“Nowhere do we find a case where a society first developed a systematic form of writing and then increased its level of social and economic efficiency. Scripts do not create civilizations or new forms of society, but societies can create a new form of information storage” (Gaur, 1984 : 16). What kinds of societies then gave rise to a writing system? And what problems would this system have to cope with?

We can distinguish two types based on the two existing forms of script. Gelb (1952) proposes the term ‘representational’ writing, sometimes called ideographic or pictographic writing, and phonetic writing. Representational script, i.e., a form of scripting based on the direct transmission of idea or thought, offers the advantage of not being bound to a particular language. Direct communication is achieved by decrypting the graphical symbols. However this process requires a great number of these symbols which, in turn, demands a prolonged apprenticeship. Phonetic script, i.e. a form of scripting where conventional signs represent sounds, depends on speech and decrypting is a twofold process, meaning that there has to be an

intermediary stage of translation of the graphical signs into that speech. But the number of signs is considerably reduced and therefore phonetic writing is a more portable, swifter process. Phonetic script first evolved as a result of the difficulty in adequately conveying certain names in pictographic form (Gelb, 1952), a difficulty perhaps still experienced today in Korea. Ong (1982) notes that "in Korean books and newspapers the text is a mixture of alphabetically spelt words and hundreds of different Chinese characters" (1982 : 92).

Gaur (1984) observes that there are societies in which a form of centralized organization was institutionalized, where property and trade are valued and as a result of the diversity of their productive activity, a coordination of labour is necessary. Such societies give rise to some type of state which rules all trading and administrative activities. "Trade and administration are transient affairs which have to be carried out with a reasonable amount of speed and a reasonable amount of unambiguous exactness. For this purpose a small number of signs which can be quickly learned, written ... and read, offer definitive advantages" (Gaur, 1984 : 17).

Writing, like orality, does not have a precisely traceable point of creation. Rather it is a complex process which at a certain point was subject to several detours. From these detours arose the different examples of representational and phonetic script. Writing was, at these early stages in any case, an activity practiced by a narrow elite of specialists. Their craft, which they exerted up to the fifteenth century, focused on matters that related particularly to administration and property, especially in the form of lists, contracts, letters and religion

(Gaur, 1984). But as Ong (1982) observes, "long after a culture has begun to use writing, it may not still give writing high ratings" (1982 : 96). This may indeed be the case of Greece. The guided evolution of the Greek alphabet is considered a cultural achievement of the highest importance. Tradesman and craftsmen supposedly invented it and were their sole users for a long time (Havelock, 1982 : 187). But as Havelock (1982) notes, the acceptance of literacy in Greece was slow. Education remained orally based long after the alphabet was introduced and was centered on poetry, practice of rhetorical principles, performance of musical instruments, dance and singing. *Grammatikus* was the Greek word that designated those who knew how to read, but this did not necessarily have a laudatory character. Only with the Romans did writing slowly start acquiring that character and the *litteratus* becomes a venerable figure. However, until at least the thirteenth or fourteenth centuries written documents did not carry the weight we may conceive them to bear today. The role of the spoken word is illustrated by Riché (1976) in his observation on the way Gregory the Great insisted, in his letters, that his colleagues *preach* so that "the unlettered learn what God wants" (1976 : 483), or in the analysis by Clanchy (1979) which covers a period up to the twelfth century, where the distrust in written documents even at the level of the administration in England is well documented. He notes that "people had to be persuaded -- and it was difficult to do so -- that documentary proof was a sufficient improvement on existing methods to merit the extra expense and mastery of novel techniques which it demanded" (1979 : 231). The same, of course, can be said today about

digital communication. To be acceptable a facsimile message has to carry a *written* receipt that authenticates it. However, the situation with digital communication might be changing. Recent interest by the American administration in the Internet might presage a new era of digitally-based communication (cf. Appendix A).

Meanwhile, of course, writing became an activity of considerable importance illustrated in the number of libraries, bookstores and shops. Scripting materials become more readily available. The availability of paper, for example, had an important role in speeding up this process. "Paper production served the needs of merchants, bureaucrats, preachers and literati; it quickened the pace of correspondence and enabled more men of letters to act as their own scribes" (Eisenstein, 1983 : 18).

Writing became a conspicuous activity when printing was created. It is certainly difficult to pinpoint what were the exact causes for the birth of typography. McLuhan (1967) points out that typography created the first commodity which is the book. Perhaps mechanization finally started to take command. We should however analyze the causes for the appearance of the products that typography generated. Maybe the exact origin of the invention of printing lies, at least in part, in pressures from the market.

At the time of the appearance of printing, literacy had already risen to a non-negligible level, no doubt chiefly in urban areas (Eisenstein, 1983). As Eisenstein further points out, printing caused a shift and although the majority of the population was not affected by it "nevertheless, within this relatively small and largely urban

population, a wide social spectrum may have been involved" (1983 : 32). Preachers are distinguished by this author for giving "the most vigorous impetus to popularization before printing came [as a result] of the felt need ... to keep their congregations awake and also to hold the attention of diverse outdoor crowds" (1983 : 33). The picture Bible which was allegedly aimed at the mass audiences, may have been on the contrary aimed at the "poor preachers who had a mere smattering of Latin and found scriptural exposition easier when given picture books as guides" (Eisenstein, 1983 : 33).

3.1.7 - The literary gesture.

Primacy of sound over sight was the dominant feature of an orally based culture. Ong (1982) points out that from oral to written discourse, and above all printed discourse, there was a shift into the visual. But this was not the only shift. Seen from the point of view of the nature of the gesture and the exchange of gestures, the shift from oral to written and printed discourse was more profound and complex.

I shall analyze the nature of written and printed gesture and conversation of gestures under the guidelines of the earlier proposed formula encompassed in the object of communication paradigm. Written and printed language serve, as pointed out, a manifold purpose of organizing, recording, transmitting and distributing gestures, thus enlarging the scope of a conversation of gestures.

3.1.7.1 - Written gestures.

The gestures involved in written discourse are visual and external. In order to organize discourse and thought itself, gestures have to be formalized externally first. This takes place through the use of certain tools: alphabets and writing artifacts. This process was subject to an historical evolution. At the earliest stages of the development of written language, in its initial phase, when writing artifacts were not readily available and writing was a specialized activity, there was a large amount of mediation. Thoughts had to be communicated to a scribe who would, in turn, materialize these thoughts into some sort of written 'object'. With the introduction of new more portable writing utensils and the diminishing role of the scribe, thoughts could be turned into written objects more easily. Once thoughts were materialized, or gesturalized, if you will, they could be subject to a conversation of gestures. Materializing thoughts into some kind of object or written gesture is recording and transmitting them.

But the written conversation of gestures takes place without the direct interaction of the actors. In order to engage in an external conversation of gestures written gestures have to be distributed, i.e., they have to physically reach the other actor or actors involved in a conversation. These actors have to decrypt the writing gesture and their reply, in turn, has to be subject to the same process. Written gestures are admittedly more precise because they can be subject to a much more detailed scrutiny. However precise and far reaching, written gestures generate a conversation which is slower than an oral

conversation of gestures. In time, writing artifacts became universally available and permitted new forms of swifter distribution. This is the case in the use of the telex and more so in the case of the computer. An exchange of written gestures can take place now in real time as if it were a conversation of oral gestures.

Unlike a negotiation of oral gestures (which began as a fast, real time, and space bound process, later becoming possible as a non-real time and non-space bound process, as well), a negotiation of written gestures began as a slow non-real time, non-space bound process, involving a complex production, reproduction and distribution of gestures. Later it became possible as a real-time space-bound process as well.

A written object of communication is thus the result of a conversation involving the writing gesture -- itself the result of the use of a standard repertoire of visual signs (alphabet) and certain writing artifacts, a reading gesture and a more or less complex process of distribution over space and time.

3.1.7.2 - Printed gestures.

This case is naturally more complex and has also suffered some alterations throughout its evolution. The printed conversation of gestures involves, at least at its earliest stage, going through the different phases of the written conversation of gestures. From then on another phase starts which involves the reproduction of the results of the initial written conversation of gestures. This phase has effects on

the organizing stage as well. The results of the written conversation of gestures have to be confronted with the production requirements and strategies of the actors involved in the printing process. From this conversation of gestures arises a product, usually in the form of a book. Books are produced according to certain procedures and involve the use of certain artifacts. Once produced the book is then distributed. It reaches the other actors participating in this exchange of gestures, and this process generates yet another exchange of gestures with new actors, which has to do with the distributing process. The reply of the former actors, in turn, is channeled either directly (to the actor or actors who set the process going, in writing or through oral conversations of gestures which have a special character), or indirectly through a mediated process involving yet another set of actors and new conversations of gestures in print.

Again the evolution in the artifacts involved in this process has produced some changes. Some of the stages in the printed conversation of gestures can be eliminated. Through the use of computers and networks, for example, the original written conversation of gestures can take place directly without being mediated. This means that distribution can be made directly to the other actors involved in this conversation, either because the printing process is limited to specific number of required copies, or because the printing process is eliminated altogether by distributing directly to the other actors via their terminals thus eliminating some traditional printing artifacts.

In regard to the nature of the literary conversation of gestures, we have seen how this conversation is externally mediated,

asymmetrical and asynchronous. In the oral conversation of gestures it might be argued that 'sending' and 'receiving' are parts of the same gesture, and that to each of these binaries corresponds another binary. Competence in the oral conversation of gestures is but one concept. Given the fact that they are mediated by an external implement, writing and reading are not parts of the same gesture. Havelock (1982) points out their diverse nature. He distinguishes different degrees of literacy dependent upon the degree of readership: craft-literacy, semi-literacy, recitation literacy and, finally, scriptorial literacy. "Waiting in history's anteroom there was still typographical literacy, dependent upon the invention of movable types, and it should be noted that in the intervening centuries, after the fall of Rome, most of Europe reverted to what in effect was a period of craft-literacy employed by clerics" (1982 : 59). The point made by Havelock is important: competence in a literary exchange of gestures has a diverse nature and because it is externally mediated is asymmetrical.

Finally, another issue that deserves attention is 'verbal-gesture'. McNeill (1992) posits that 'verbal-gestures' are an integral part of oral discourse which receive direct input from thought. Whereas vocal gestures are encapsulated within a fixed repertoire, 'verbal gestures' are not. 'Verbal gestures', McNeill contends, give the oral discourse its "imagistic, instantaneous, nonsegmented and holist" (1992 : 2) dimension. He further posits that verbal gestures "look upward into the discourse structure as well as downward into the thought structure" (1992 : 2). Verbal and vocal gestures form a multi-channel communicational tool, acting upon different levels but sharing, in

McNeill's view, the same computational stage.

It seems legitimate to enquire if it should be possible to detect a similar multi-channel tool in the other technologies of thought expression. It should first be noted that the oral object of communication is based upon processes that originate within the actor's own physical and psychological makeup. When we proceed along this continuum from oral to printed gesture there seems to be an increasing detachment of the actors from their gestures and these gestures are conversely increasingly mediated through external implements. However the issue seems important to the future of our enquiry.

A parallel might be found in the so called 'iconotext' (Montandon, 1990). 'Iconotext' may be defined as a "strategic occupation of the [writing] space" (Imbert, 1990 : 155). This is not to be confused with illuminated manuscripts which served a decorative purpose. During the advent of the written object of communication the role of images and other signs was scarce. "After all", Eisenstein (1983) observes, "how else save by using words could one dictate a text to assembled scribes?" (1983 : 38) However, she notes, the role of the printed image was tremendous. For practical reasons faithful illustration was lost during the age of scribes. "After the advent of printing, visual aids multiplied, signs and symbols were codified; different kinds of iconographic and nonphonetic communication were rapidly developed. The fact that printed picture books were newly designed by educational reformers for the purpose of instructing children and that drawing was considered an increasingly useful

accomplishment by pedagogues also points to the need to think the simple formula 'image to word' " (Eisenstein, 1983 : 38).

There is thus a tradition in the use of illustration that goes to the earliest stages of the print. This tradition seems to fulfill, within reasonable limits, the role of the 'verbal gesture' in the oral object of communication as a second channel of information not tied to sequential discourse. An image or illustration seems to correspond to the three characteristics which McNeill points out as corresponding to the character of 'verbal gesture', namely its "imagistic, instantaneous, nonsegmented and holist" character, its role in the thought process and its non-fixed character.

Particularly illustrative is the use of 'iconotexts' in newspapers. Imbert (1990) claims that the newspaper 'iconotext' established a macrostructure which builds a reality, not forcibly coincident with the reality of the referent. Krüger (1990) also notes that the "juxtaposition of text and images is automatically interpreted as an enunciation of the possible relations between text and images" [my translation] (1990 : 29).

Within the limits imposed by the tools used I find it possible that the "iconotext" might be regarded as a similarly functional tool in the printed language.

3.1.8 - Writing, printing and full concepts.

Vygotsky underlines the importance of written speech in attaining higher cognitive levels. In dealing with this issue Scinto

(1986) remarks:

Written language, not as some abstract entity but as embodied in given cultural practices, is a contributory factor in the growth of the mind. Written language ... is a factor that intervenes to complete the process of linguistic growth begun when the child utters his first words. As such the written language norm is the natural concomitant of the oral norm.

If we properly regard cognition not as something that is out there but as a way of interacting with the material and cultural world, then we can begin to construe the role that the written norm plays in such a constructive process. The nature of interaction with the world is never direct, except perhaps in very early stages of development, but mediated. What mediates our interaction with the world is the representational system at our disposal. When a shift or change occurs in this representational system, the nature of interaction with the world changes. Such a shift in the nature of representational systems occurs when the child moves from the almost exclusive use of the oral norm to the use of the written norm. Thought becomes truly autonomous when the system of representation that mediates between the individual and the world is characterized by a degree of decontextualization. The prime candidate for such a system is indeed the written norm as instantiated in a textual mode of monologic discourse (1986 : 160).

Whereas in the oral mode, the analytical operations which are typical of the complex stage are easily performed within the oral kernel alone, when we consider the operations which are involved in full concept formation, we find increasing difficulties. The example provided by Lévy-Bruhl illustrates this point. Ponka Indians are surely capable of developing full concepts. Yet their discourse seems to be limited to the complex stage. To be sure, it took the intricacies of Greek society to develop a spoken discourse that could cope with the demands that society put on thought processes. We may thus conclude that such societal pressures were not felt in Ponka society. But the

Greeks who elevated the technique of public speaking into perhaps its highest peak developed the kind of society which called for this development. However a further step in this development would have to await the introduction of writing. Ong (1982) observes that Aristotle's *Art of Rhetoric*, which set the parameters for proper public speaking, could not have existed without writing. Only writing could have provided the necessary analytical tools to produce such a work.

In comparing visual symbolization of quantities with symbolization of speech, Havelock (1982) observes that "many of the 'objects' that are described even in common speech are not such as to be easily visualized" (1982 : 46). Writing and printing provide an easier way to perceive these objects and therefore the operations of abstraction and re-synthesis which are involved in full concept formation become easier. Written and printed materials alone may not suffice (charts, diagrams, lists, still have to be 'interpreted'), but they provide an easier way to carry out these operations.

And indeed there might be other steps in psychogenesis that are yet to be triggered by undiscovered cultural factors. However, within this continuum from orality to literacy, Vygotsky's stance regarding the functional role of the word and the importance of these cultural artifacts in stepping up the ladder of cognition appears as an immensely rich point of departure.

3.2 - Conclusions on orality and literacy.

There is abundant literature dealing with the oral object of

communication. But the lack of recognition that the written object of communication plays an important part in the evolution of cognitive processes has resulted in a paucity of studies dealing with this issue (Scinto, 1986; Kao, Van Galen, Hoosain, 1986).

A continuum in the technologies for the expression of thought appears indeed to be observable, from oral to printed. These technologies emerge anchored in a previous stage in cognitive development. But it seems that their emergence is triggered by the need to refine the cognitive kernel from which they stem. There are gains but also side-effects as a result of the introduction of these new technologies, which reflect back upon the process. It might be the case that the introduction of these side-effects, in turn, plays a role in the introduction of a new technology.

Upon their introduction and initial development, new technologies for the expression of thought are used in a restricted way and subject to the control of 'specialists'. It takes time before a new technology pervades the society within which it arose. Gradually, 'specialists' no longer control these technologies, and they thus come to acquire a 'democratizing' character. The use of oral language retained a regulating character and was not universal in all spheres of society (Donald, 1991). By the time writing-literacy first arrived, oral discourse had evolved into a highly elaborate form of communication. In Europe the Greeks were responsible for this transformation which took place through the practice of rhetoric and poetry. The object of communication which we now take for granted, orality, was once an elitist and reserved form of communication.

Writing was also a highly reserved activity in the beginning of its introduction, and forms of highly elaborated oral discourse and early tentative writing may have co-existed for some time. As writing became a widespread activity, the evolution of printing started. Today printing yields to digitally based forms of communication and printing has become comparatively widespread. Curiously enough, the computer is responsible in this case for both processes. Restrictions imposed on writing started to disappear when printing was introduced, and, similarly, restrictions imposed on printing are now disappearing as well. With word processors, men and women of letters become their own scribes again.

The management of the powers of these different technologies for the expression of thought seems to be entrusted to certain specific figures in society. The importance of myths in oral societies was underlined earlier. Myths encapsulate full concepts. Their management was attributed to the 'story-teller'. The story-teller holds the power of managing this element in cognitive development. In writing-literary societies that power appears to belong, as was also mentioned, to the copyist. Indexes, contracts, religious and administrative texts are managed by copyists. Gradually this control is yielded to 'printer shops' (Eisenstein, 1983). The rise to literacy gave birth to a new artifact: 'theory' (Donald, 1991). Theories encapsulate concepts which would not be easily disclosed without books. Books were the locus of action of a restricted circuit of print shops which at the beginning dominated their production and circulation.

When we advance in this continuum of technologies two things

become noticeable. The first is an increasing distancing of the actor from its gestures. Secondly, there is an increasingly complex and mediated process of the exchange of gestures.

An oral exchange of gestures takes place within the direct reach of the actors involved. But as oral discourse becomes less adequate as we move into the full concept stage and the less it becomes possible for natural powers alone to cope with the increasing demands that are put on them, external technologies are introduced. External technologies such as writing and printing must be seen first and foremost as ways to overcome these inadequacies. As Scinto (1986) suggests:

Higher mental functions must make reference to the distinctive features of written language for their explanation. If oral language forms the initial ground for the formation of mind and self, written language brings that initial development to a further plane of development. The distinctive form that mind assumes must be seen as arising, within the empirical matrix of social exchange and communication, through the process of successively acquired representational systems that mediate between the individual and reality and that are themselves the product of a social-cultural evolutionary process. (1986 : 172)

But the introduction of these technologies turns the process of the exchange of gestures into an increasingly complex one, with a further distancing of the actors involved in the conversations of gestures and the creation of parallel processes. Interestingly, as will be discussed in the following chapter, the computer seems to remove these distances and to engage once distanced actors back into direct interaction.

Finally, what defines orality and literacy is the fact that they are indeed objects of communication, i.e., that within the constraints posed

by the societies in which they are used, and the problems they need to address, they do seem to fulfill that double requirement which distinguishes, in the Vygotsky stance, expressed thought. Oral language, i.e., spoken words, is used outwardly, in an external, social exchange to fulfill problems of communication and is subject to a negotiation between the actors involved in that conversation, in order to define its structural or grammatical meaning. But at the same time, oral language is also used inwardly, through an individual process based on specific intellectual operations to define concepts. Oral language is limited both in its outward and inward usage only by the very limits of the object of communication itself. Thus, oral language can only go so far, the discussion can only reach so many actors, and the intellectual operations involved in the formation of concepts can only be so complex. Literacy, which is based on the written or printed objects of communication, is also subject to this outwardly directed negotiation and to these inwardly directed intellectual operations. The analysis reveals that, in each case, these objects of communication fulfill a specific role in these different processes and can thus legitimately be considered objects of communication.

In the following chapter I will analyze the characteristics of hypermedia, place it in the context of the evolution of the technologies for the expression of thought, and analyze the possibility of hypermedia fostering yet another distinctive mind form.

Chapter 4

From orality and literacy to hypermediacy

4.1 - Review of the commentaries on hypermedia.

Notions about hypermedia are probably as diverse as its applications. This is a problem further complicated by the fact that this corpus of notions is encompassed in a myriad of titles and definitions out of which it sometimes appears difficult to extract exact meanings. For example, the use of integrated media through computers is often termed interchangeably as hypermedia, hypertext, multimedia, computers *tout court*, interactive systems, communication or information technologies. The profuse terminology denotes the vagueness of the concept.

For the moment I will leave aside the need to clarify this terminology. In all its diversity, which may very well also signify its vitality, there seems to exist an implicit or explicit belief in what is often referred as the 'promise' (Gygi, 1990; Devlin and Berk, 1991; Duchastel, 1990; Wessells, 1990) of hypermedia. Dictionaries define 'promise' as an assurance of what something (human or not) will or will not do. This acceptance suggests that hypermedia will do certain things and will not do others.

There are basically three types of commentary which stem from a review of hypermedia analysts. One focus is on specific applications

and on what hypermedia can do, without further speculation. Hypermedia works and works now. Another stance focuses on what hypermedia cannot do. Hypermedia, the critics say, can only go so far. This type of commentary has two variants. One is based on the implicit idea that, conceptually, hypermedia may be taking a wrong route, the other is based on the analysis of current technological constraints. Both focus on the market. Yet a third commentary, which seems more important for the sake of our discussion, places hypermedia within the larger framework of human cognitive processes, and enquires about its effects and potential from within this perspective.

4.1.1 - Some applications of hypermedia.

The first group of analysts of hypermedia-based solutions is found in fields as diverse as education, industry and business. Corporations have been increasingly favouring solutions based on hypermedia techniques to tackle their problems in documentation handling, technical training, procedure manuals, etc. Parunak sees hypermedia technology as offering "a powerful mechanism for solving common problems of information management faced by large commercial and industrial organizations" (1991 : 381). The problem, as this author observes, is that information can be considered as much a part of the business as the products or sales, and handling this information has become quite a challenge. The volume of information which has to be processed reaches in some cases incredible quantities. Winters et al. (1991) were involved in the preparation of an

'Accounting and auditing knowledge-base system' based on hypermedia techniques for a large auditing firm. They report that "there has been a veritable explosion of new accounting, tax, legal and securities rules, and pronouncements. The volume of material that an average CPA has to be cognizant of has gone from 2,000 to 8,000 pages in the past ten years We also realized that the written word, to date has bound us into sequential presentations. Using the computer as the tool, different pathways could be created for different readers" (1991: 469).

Another project reported by Diaz and Minor (1991) gives us an example of the new possibilities which open up through the use of hypermedia as a replacement for printed procedure manuals. Still another example of the use of hypermedia techniques in procedure manuals is presented by Boy (1992) in regard to NASA. Drawing upon the examples of the computerized flight manuals already available for larger aircraft from Airbus or Boeing , NASA created the Computer Integrated Documentation system, again based on the need to handle the enormous amount of documentation that is made accessible in space missions in an integrated way. Barrett and Paradis (1988) report the use of hypertext-based programs in corporate training in such areas as "conferencing and problem-solving, document creation and review, in-house short-course training, and management of documentation groups" (1988 : 226). Another area which has been gaining interest is computer aided, hypermedia-based support for face to face meetings (Elwart-Keys et al., 1990). These authors have set up the Capture Lab which focus on the "support for meetings of business people (who are

often novice computer users) without requiring an additional person to serve as a computer technician or facilitator" (1990 : 295). Industry has also taken advantage of the use of hypermedia in such areas as technical training. Cotton and Oliver (1993) report the use of hypermedia-based training programs in train driving, engine and computer maintenance. Gartshore (1990) in turn describes the design of interactive videodisc training packages.

One of the areas in which hypermedia and hypertext techniques have gained considerable impetus is education. Analysis carried out in this area, as a rule, stems from concrete applications which cover practically all domains of education. One hypermedia-based project, the Perseus Project, is reported from Harvard (Bannon, 1991). Perseus is aimed at stimulating new types of enquiry about Greek literature and culture, by providing a wider range of research material than would be possible through simple literary research. In addition to literary material, Perseus includes images, maps, site plans, and architecture catalogues. These provide a variety of approaches in the study of a particular theme of Greek literature or culture. Hartman et al. (1992) report the results of an experiment which started in 1989 at Tulane University, involving the integration of interactive multimedia into the university's programs. The experiment focused on the development of interactive multimedia programs by members of the faculty in the areas of education, medicine, civil engineering, history, and others, and proved that "interactive multimedia clearly has the potential to take advantage of principles of effective learning and teaching" (1992 : 188). These authors describe the results of this

experiment as having had profound consequences in “the transition of students from passive learners to information travelers [and in the change of the faculty member] from lecturer / teacher / ultimate authority to coach and facilitator or guide “ (1992 : 190).

Slatin (1992) in turn sets out to “explore the role of technology in the social construction of knowledge in the humanities generally and English in particular” (1992 : 27). He describes an experience in English studies which took place within a “computer networked classroom, [focusing] on 20th-century American poetry” (1992 : 27). All of the intervenents’ -- both teacher and students -- interactions both with course materials and with each other was computer mediated. Slatin’s proposal is based on the premise that there is a necessity “for developing new kinds of knowledge and a new relation to ... work” (1992 : 50). Landow (1991, 1992a), Landow and Delany (1991), Landow (1992b) and Kahn (1991) report on the the IRIS Intermedia project developed at Brown University in relation to English studies. Intermedia is a Unix authoring system which permits the development of hypermedia documents. It includes word processor and drawing utilities and the necessary networking and linkage and webbing tools between documents, as well as the networking tools between authors and readers. The outcome of the several pedagogic initiatives, which went on within the realm of the Intermedia project, gives a better understanding of the nature of the conclusions outlined by Slatin’s course on twentieth-century American poetry. In one of the Intermedia webs created for one of the courses offered at Brown, in addition to the course materials provided, students were encouraged to

contribute to this body of materials through not only additional library materials, but also their own original writing. This, Landow points out, "created an ongoing relation of the student-author both to the course for which the materials were created and other courses that make use of them. These student-created documents turned the student-author into a continuing virtual presence on the system" (1992 : 209).

One exemplary hypermedia educational program is Grapevine. This program is aimed at students and teachers at high school and college levels and provides information about the "major social, economic, political, and cultural issues of the United States in the 1930s as approached from the perspective of John Steinbeck's *The Grapes of Wrath*" (Campbell and Hanlon, 1991). In addition to containing a knowledge-base of textual, audio and graphic material, Grapevine contains a presentation utility.

One other example reported by Holmes (1991) of the use of hypermedia techniques is the *Electronic Music Lover's Companion*. This product, which is available for Macintosh computers and is based on the Hypercard authoring tool, features information about the different aspects of the history of electronic music, ranging from the technology to composers' testimonies on their own works, and includes three types of information: "seven textual components (history of the technology, history of the aesthetics, biographical notes, discographies, quotes from the composers, quotes from their critics, and running commentary to an audio compact disc companion); audio samples (digitized demonstrations of classic electronic music sounds); visuals (illustrations of instruments, inventors, composers, performers

and scores)" (1991 : 514).

4.1.2 - Caveats.

The second group of opinions has two variants, both of which are critical. One is based on the implicit idea that hypermedia may be taking a "wrong route", the other is based on the analysis of current technological constraints. Both base their analysis on the market.

Gillette (1992) presents a view based on the benefits and drawbacks of multimedia. He notes that multimedia is a powerful medium, yet it creates high expectations. It has a potentially high impact on audiences, but can overwhelm the senses. It allows interactivity but this is an unknown for producers and users. He carefully warns that "for all its promise, for those who would become producers, computer multimedia is not an easy mode in which to work. We've found that multimedia is not a self-evident method of communication that will somehow build itself on the software stage. Even its advantages and freedom of possibilities lead to complications for the producers" (1992 : 21). Herrstrom (1989) notes that often technology and not the needs of the users drive hypertext design. In these situations "often hypertext seems to be a solution searching for a problem" (1989 : 45). Meyrowitz (1989) admits that hypermedia has been around for over a quarter of a century, but does not seem to have "caught on as fundamental tool for daily knowledge work" (1989 : 107). His explanation for the failure of numerous systems created to date is that "virtually all systems have been insular, monolithic packages that

demand the user disown his or her present computing environment to use functions of hypertext and hypermedia" (1989 : 107). In an insightful analysis of the current trends of the multimedia market, Feldman (1992) claims that "multimedia is not an issue of technology [but one of] human values" (1992 : 56). He acknowledges the technological and commercial enthusiasm which multimedia is raising but wonders why users are not asked what they want. He concedes that the industry will have to be fuelled on some financial success, but warns that current blind enthusiasm may lead to a lack of understanding about the needs that consumers may want to see fulfilled. He warns that "the acid test will come over the next few years as commercial systems increasingly influence information delivery and we find out whether anyone wants multimedia enough to pay for it" (1992 : 61).

Hawkins (1992) manifests his concern for a lack a mass market for multimedia products citing the lack of, on the one hand, proper standards, and, on the other, more powerful hardware. He recognizes that the "multimedia industry is a mess today [when] more than 30 different hardware systems, all incompatible, including CD-ROM, CDTV, and CD-I are aimed at the market" (1992 : 13). Developers, he claims, spend more time porting their programs from one platform to another than designing new programs.

In general, it should be stressed that the critique of hypermedia does not, in any case, focus on the medium *per se* . The very few voices that have moved away from what seems to be a general trend of spreading enthusiasm aim at analysing the several constraints that

prevent it from attaining its full potential.

4.1.3 - Hypermedia as a new cognitive tool.

Finally, there is a group who sees hypermedia as a socially-driven phenomenon, emerging from within the continuum of cognitive processes which have their starting point in orality.

Barrett (1989, 1992) recognizes that "hypertext, hypermedia, and multimedia are unlike their cousin, the book, in that they are still too young, too close to their etymological root meanings to support the truth behind a book -- that is an address to an audience, an address which over time and space develops ideas out of information and (and this is easy to miss) sheds information from the development of an idea" (1992 : 9). Barrett advocates the importance of the sociological dimension of knowledge and language. A hypertext for this writer should thus be a "sort of topography of social construction" (1989 : xvi), more than a simple link. The manipulation of the text that the link represents is more than a connection between objects. It has a "communicative function" between ourselves and others, or within the private dimension of the self. It is a language which is used to construct meaning and that meaning is being communicated to others or back to the individual. Barrett notes that through his experience as an educator and a writer his commentaries and writings are the product of his thinking. Language, he claims, allows him to externalize his ideas for inspection. And language is more than the "representation of knowledge", it is the very instrument to produce it.

But, he also relies upon the structure of his language to create meaning. This is done through thinking which in its more advanced state is more than a mere association, or link, of parts that are being analyzed.

McDaid (1991) proposes the idea of the “media ecosystem”. He notes that media theorists have identified three paradigm technologies in the history of communications: orality, literacy, and electronics. “These technologies shape the epistemologies, rhetorics, and social structure of the cultures which employ them” (1991: 446). McDaid draws on McLuhan, who claims that “electricity points the way to an extension of the process of consciousness itself, on a world scale, and without any verbalization whatever” (1964 : 83). He further posits that “hypermedia has grown out of (but is more than) intertextuality and reader-response theory Hypermedia environments make possible texts which can be reorganized by readers as they desire. Hyperdocuments can, in at least a rudimentary sense, be queried, finally putting to rest Plato’s often cited denunciation of texts as fixed unresponsive objects” (1989 : 452,453).

Brent (1991) warns against the hasty character of certain commentaries that see digital technologies as the upcoming of a secondary orality. He notes that McLuhan’s concept of electronic media focused on media not tied to the alphabetic text, whereas digitally-based media may well follow another path. He posits that the electronic revolution is leading us, “not to a secondary form of orality so much as to a secondary form of literacy from which earlier forms of audio-visual media had begun to alienate us” (1991 : line 531). The special

characteristics of digitally preserved knowledge allow the text to be recreated, or re-enacted, in ways that resemble the subtle transformations the story-teller introduced in order to capture the audience's attention. "Here we may recognize the communality of oral knowledge, the close union of the knower and the known, but for all that we cannot recognize primary orality. We can never get all the way back there again" (1991 : lines 562-564). Brent, however, concedes that there was a shift from orality to literacy and that "the information revolution intuitively feels like a third stage in this process, a revolution as great as the shift from orality to literacy" (1991: line 44).

The previous analysis reveals that there is indeed, in an implicit or explicit form, a fundamental belief in the potential of hypermedia as a tool for the expression of thought. While the examples that have been briefly outlined above illustrate potential uses of hypermedia systems, the warnings of the second group reveal that the 'promise' is possible but it has yet to be attained. But the 'promise' is made real, and in an exuberant way in many cases. And not only as an alternative to, but in some cases as the only alternative. In education and industry situations often arise in which computer-based solutions appear to be the only viable solution. This is the case, for example, in hypermedia-based networks developed to access remote areas. Although not documented, at least to my knowledge, there are hypermedia applications of virtual classrooms in the University of Alaska, connecting teachers and students located in remote sites, and the use of hypermedia-based knowledge-bases in remote mining sites, which provide access to technical references needed on location.

However, the observations of the third group deserve further analysis. These observations suggest that hypermedia is more than a simple, more or less neutral, application of a new and flexible technology. To use my proposed terminology, the authors reviewed elicit the conclusion that hypermedia is turning into a new 'object of communication'. An analysis using the methodology followed earlier in relation to orality and literacy might help reveal the soundness of this possibility.

4.2 - Towards a definition of hypermedia.

The moment of the exact origin of the oral gesture is impossible to trace. A similar difficulty occurs when we face the written and printed gestures. In both cases we have to reconstruct the facts from secondary evidence. Computer based technologies seem in this respect much easier to characterize.

Hunters developed oral language which was later to be perfected by poets, and tradesmen developed the phonetic alphabet whose possibilities were later fully exploited by writers and scientists. Mathematicians developed the computer. Indeed in the first attempts at the creation of computer technology a new paradigm emerges which seems to voice Havelock's statement that "mathematical skill, as it is practised today, calls for a degree of intellectual sophistication which appears to lie beyond the competence of the majority of literate populations" (1982 : 46). The direct origins of present day computer technology, even if part of a continuum in the development of

mathematics that would lead us further back, can be traced to the early nineteenth century. In over 100 years, from Babbage, Boole and Turing, through the advances of von Neumann, Wiener, Shannon, Vannevar Bush, and even more recently from Licklider, Engelbart, Kay to Nelson, computer technology seems to have evolved towards the goal of integrative media (Rheingold, 1985).

Ted Nelson coined the term hypertext. He argues that the sequential character of spoken and written text has led us to tie text to sequentiality. "But sequentiality is not necessary" (1987 : 1 / 14). So he proposes a definition of hypertext as "non-sequential writing". And, conversely, hypermedia is the non-sequential writing of texts not based on the written alphabet such as audio or video "texts". Slatin (1991) has proposed a more encompassing definition of hypertext, namely "an assemblage of texts, images and sounds -- nodes -- connected by electronic links so as to form a system whose existence is contingent upon the computer" (1991 : 56).

Applying this definition to the examples described earlier a more precise picture of hypermedia begins to emerge. In the following sections I will try to analyze, as thoroughly as possible, the elements that make up this picture, the problematics in which each of these elements is currently involved and will attempt to synthesize a concept of hypermedia.

4.2.1 - Human-computer interface.

Computer interfaces are one fundamental concern in computer

systems design. "When the concept of the interface first began to emerge, it was commonly understood as the hardware and software through which a human and computer could communicate. As it has evolved, the concept has to come to include the cognitive and emotional aspects of the user's experience as well" (Laurel, 1990 : xi). Traditional solutions in computer-user interface have included the command line, the menu and the graphical user interface or GUI (Crawford, 1990). In addressing the problem of GUIs Rubens (1989) notes that:

A significant portion of direct manipulation interfaces relies on some type of graphic or iconic "vocabulary" to achieve its success ... Despite the success of these graphic elements several issues remain unresolved that can compromise future graphic interface design. The major issue is the size of the graphic "vocabulary". ... Future developments towards standards in the computing industry should consider the creation of iconic vocabularies and grammars, perhaps based on the already extant iconography developed by the International Standards Organization, as a primary concern.

The problems prompted by iconic interfaces represent a particularly compelling issue primarily because it impacts basic education and the education of information developers (1989:16).

But in hypermedia this problem appears to carry its own particular importance. Blattner (1992) claims that "it would be a mistake to think of multimedia only in terms of navigational techniques and integration of multiple media in computer architecture" (1992 : 16). She further asks if "multimedia interfaces [are] just more complex type of graphical user interfaces (GUI), to conclude that multimedia is a genuine shift of paradigm ultimately changing the way we think and work requires a deeper understanding of human-to-

human communication than we now have" (1992 : 15). This author describes five types of multimedia interfaces which include the conversational model which deals with time varying phenomena such as audio and video; the interface as drama as proposed by Laurel (1991), which introduces "life-like characters with personality of their own [who] bring to the interface a whole range of new problems and possibilities" (1991 : 17); the audio interface which aims at representing data in acoustic form; gestural interfaces which are based on the important role of the gesture in verbal communication (cf. previous chapters on McNeill) and incorporate them particularly in the development of systems aimed at collaborative work, and, finally, virtual reality interfaces.

4.2.2 - Easy accessibility.

This attribute has much in common with the above described problem of the computer-user interface. However, in this case it carries a more precise meaning. As described by Duchastel it is the "effort-to-interest factor" (1990 : 223), in other words, the degree of action which is reasonably necessary to take in order to benefit from the available resources. In a hypermedia system the unavailability of or poor organization of materials, or access to storage devices may condition its use, and, therefore, affect its accessibility.

4.2.3 - Non-linearity.

The key to the successful access to hypermedia systems lies in their ability to provide non-sequential communication; examples include multiplexed synchronous communication and the asynchronous retrieving of data. In the latter case nonlinearity involves yet another important aspect, namely, the issue of hyperdocument links. The term does not seem to be universally accepted. Parunak (1991) however proposes a clarification of this topic. In a hyperdocument about the human body, for example, the topic *synapse* could be made up of pictures and texts. Each of the pictures and texts is connected in the topic *synapses*. Parunak (1991 : 300) thus calls these texts and pictures 'nodes' and their connections 'links'. Together they form the hyperdocument. A set of 'links' is a 'graph'. Similarly, *neurons* could be another topic. Both could be contained in a 'hyperbase' called *nervous system*. 'Graphs' have also been called 'webs' (1991 : 300), when the links form a set which is separate from the hyperdocument. The *nervous system* web could thus be applied to several different hyperdocuments (*mammal nervous system, bird nervous system, etc*). Finally, a node can belong to different hyperbases. *Brain*, for example, could be in *neurophysiology* and also to *cognitive science*.

Parunak notes that navigation can be performed both by humans and through automatic text retrieval operations, hence the importance of properly structured links. "The addition of hypermedia links can make this retrieval both faster and more accurate if there is

some reasonable structure to the links ... The use of standard, well-ordered structures in graphs opens the door to exchanging hyperbases between different systems, and even to integrating them into a larger network of information" (1992 : 302).

Externally mediated intellectual processes which lie at the very core of a hypermedia-based conversation of gestures, may well constitute the single most prominent feature of hypermedia. These processes have been often as referred to as 'navigation'. Observing that hyperdocuments "have neither beginning nor end", Gay and Mazur (1992) define 'navigation' as the possibility to "access and annotate information, create ... paths through the material, and construct webs of information with a minimal amount of effort" (1992 : 271). These authors distinguish several characteristics which navigational tools must possess: learnability (they should be easily understandable), usability (they must fulfill a definitive purpose), consistency (portability between and within applications), and flexibility (they should fulfill a variety of purposes and users). Meyrowitz (1989) also comments upon the IRIS Intermedia (cf. section 4.1.1). He defines the "paradigm of Intermedia [as] that of the navigational link. The link adds an additional level of integration [in that] where previously, one could simply copy information from one desktop to another, with Intermedia, one can create links between any selected information in one document and any selected information in another document. These ties are persistent: they survive for the lifetime of the document, both in memory and on disc" (1989 : 109).

Fox et al. (1992) note that the "steps involved in searching and

browsing hyperdocuments should be hidden behind a task-oriented interface that lets readers search at a conceptual, descriptive level instead of at either a word-oriented or a procedural level" (1992 : 332). While criticizing certain search modes which "force users to think in terms of the mechanics of search algorithms", they emphasize the need to "explore a range of conceptual dimensions easily and intuitively [through] metaphors and abstractions that encourage the integration of these access techniques" (1992 : 333).

In respect to data retrieval methods in hypertext systems, Rubens (1989) posits that these methods should follow and anticipate the reader's procedures. He proposes that:

For instance, if the user initiates a search for a particular item, the response should include all those items that represent 'hits' on the specified search condition. However, the program should continue to monitor the user's response to the hits offered and delete those records from the hits associated with those the user seems to be discarding and bring in more hits associated with those the user seems apt to retain. In addition the system should offer the user a real-time account of this operation (1989 : 8).

Garzotto et al. (1991) propose a browsing method based on a "predetermined navigation pattern or tour through the hyperdocument". They further observe that "a key promise of hypertext is its ability to provide paths tailored to a wide variety of audiences" (1991 : 192). A.I. techniques may help in this domain (Littleford, 1991), in structuring a document, and in focusing or structuring the search.

Bernstein (1992) posits that a "discussion of the merits of hypertext, both in the research community and in the trade press, has

frequently been dominated by discussion of the efficacy with which various systems address the navigation problem" (1992 : 286).

4.2.4 - Synchronous or asynchronous operation.

Digital technology forms the basis of modern telecommunications. The adoption of standards such as the ISDN, for example, basically means that, within limits, certain operations that go on inside a computer can be extended to other computers remotely connected to it. The computer hub thus provides the possibility of accessing or exchanging information in real or non-realtime. An oral discourse naturally takes place in realtime and became possible in non-realtime only due to tape recording technology. The written medium, however, operates in non-realtime. But a computer mediated exchange of written gestures may take the form of a synchronous conversation. This is an extension of the possibility that was already present in telex or autograph machines.

Asynchronous access means access to previously produced information. A reader may be accessing pre-existing picture files or texts, or both, on a certain topic, for example. The existence of properly structured databases which provides the necessary accessibility thus becomes a central condition.

4.2.5 - Local or remote.

"The trend in modern computing is towards networked,

distributed processors” observes Littleford (1191: 364), while Landow and Delany (1991) posit that “the development of literary hypertext will take place in an emerging global information environment of the archive, the computer and telecommunications” (1991 : 41). The networking capabilities of the system is a major issue of hypermedia. Networking capabilities are here taken in the sense Landow (1992b) refers to as:

An electronic system involving additional computers as well as cables or wire connections that permit individual machines, workstations and reading-and-writing-sites to share information [in the] form of local area networks (LANs), such as Ethernet, that join sets of machines within an institution or a part of one [and] wide area networks (WANs) that join multiple organizations in widely separated geographical locations (1992b : 24).

I mentioned earlier that hypermedia should be a universal, easily accessible, non-linear system. Networking capabilities are therefore a condition *sine qua non* for these attributes of universality, easily accessibility and non-linearity to be fully possible. “This virtual environment of the hypertext is most completely evoked within the larger context of a networked, online environment” (Barrett, 1989 : xvi). Full networking capabilities do not seem, however, quite a burgeoning reality yet. As Yankelovich (1991) observes:

Hypermedia-based electronic document systems today run either on personal computers or workstations connected to a local area network. In order to make sharing linked collections of multimedia documents with colleagues across the country and around the world as easy as sending electronic mail, substantial technological advances must be made ... To make hypermedia a wide-area technology, computer manufacturers must include a linking protocol as part of the standard computer environment. Documents must be uniquely identifiable across the wide area network, and links must be

represented in a way that supports their distribution across many sites. Once links can be shared across national networks, electronic mail applications must be modified to support linking functionality (1991 : 134).

Although these problems are being addressed at the moment, they constitute one of the central issues in hypermedia development. As Landow (1992) observes: "Complete hypertextuality requires gigantic information networks of the kind now being planned and created. The vision of hypertext as a means of democratic empowerment depends ultimately upon the individual reader-author's access to these networks" (1992 : 187).

4.2.6 - Multi-representational capabilities.

Hypermedia can integrate a whole range of representational elements. In the following sections I will analyze the characteristics and perspectives of the use of each of them.

4.2.6.1 - Audio.

I have referred in the beginning of this section to the use of audio in the human-computer interface. In addition, some workstations already integrate a microphone and some processing and storing capacities which permit a non-linear, synchronous or asynchronous, remote, oral exchange of audio-based gestures. In addition, the relative ease with which sound files can be manipulated already permits the hypermedia workstation to become a suitable

substitute for audio telecommunications devices such as the telephone and the answering machine.

4.2.6.2 - Written.

Since one of the chief uses of the modern digital computer is the handling of ASCII code, the alphabetic based exchange of gestures is, of course, performable through the computer without any adaptations. However, there are some extra possibilities, not entirely new, which become available. A written exchange of gestures is possible, for example, in local or remote, and synchronous or asynchronous modes.

4.2.6.3 - Graphic.

Graphic capabilities have been available through the use of computers for some time. Hypermedia extends the use of these capabilities. Some workstations already permit a graphic exchange of gestures, local or remote, synchronous or asynchronous. With the increasing speed in data transfer rates it is natural that some of these graphic interfaces will soon become standard in applications such as electronic mail. The increasing importance of graphical elements in a computer-based exchange of gestures has suggested to some authors (e.g. Rubens, 1989) the need "to add visual literacy" (1989 : 16) to academic curricula. Jones (1993) observes that hypermedia and virtual reality represent a new, more direct, mode of communicating inner life, and underlines the importance of graphic media in this context.

He observes that while "images are becoming the chief currency of all that we individually and collectively are ... we beckon to new significancies rendered in our time, but we are able to do so only to the extent that we learn to give them our attention" (1993 : 116).

4.2.6.4 - Videographic.

The notorious difficulty in incorporating full-motion video in hypermedia workstations stems from the tremendous amounts of data required and the relatively incipient state of present compression techniques. Applications are therefore still scarce or provide an output of lesser quality. Some workstations however already integrate a camera and some signal processing and storing capacity which permits a non-linear, synchronous or asynchronous, remote, visual exchange of gestures. One of the most interesting and early examples of the use of computer-mediated video is MediaSpaces, a project which aimed at creating a unique workplace from two geographically separated spaces, created by at the Xerox PARC (Bly, Harrison and Irwin, 1993). The video-based exchange of gestures is one of the aspects that creates the highest expectations. Hodges, Davis and Sasnett (1989) in commenting on the introduction of video in the production of hypermedia programs have noted that a video representation is irreplaceable in displaying information that is impossible to represent through text. Video is also faster to produce than text although for the moment it may be slower to review. On the other hand, video presents some difficulties in referencing operations, since an un-indexed "stream of

video images cannot be searched easily for patterns as one searches text" (1989 : 88).

From the above description a more comprehensive definition of hypermedia emerges. Hypermedia does not represent a significant, major departure from previous technologies for the expression of thought just because it merges sound with graphics, or video with text. After all, as noted in Chapter 2 (cf. Eisenstein, 1983), the use of 'iconotext' has been with us for over 400 years. Theatre, cinema, and television combine different forms of representation. If it provided nothing but this possibility of merging different forms of representation, the computer would differ from previous media simply because of the speed it introduced in the process of accessing information and the amount of data it stored. The exchange of gestures it could permit in this mode would be only quantitatively different from what we obtain using other media, a fact which in itself is not radically significant. There are however two possibilities that differentiate the use of hypermedia. One was already briefly referred to, namely, the possibility of externalizing intellectual operations, and the other is connectivity which opens up the possibility of new types of conversations of gestures. I shall deal with these aspects in the following section.

4.3 - Outer and inner processes in hypermedia usage.

As seen in previous chapters, an object of communication

functions both inwardly and outwardly. In the former case objects of communication become a tool used in the development of concepts. This is what Vygotsky (1986) referred as "functional use of words". Written language, according to this author, is an instrument which can result in superior forms of concept formation. But an object of communication works outwardly through a negotiation in the expression of the thought processes and in the social construction of meaning. I will attempt to assess the ways in which hypermedia works in these inward and outward modes.

I mentioned earlier that a gesture leads to a conversation of gestures. This conversation of gestures will take place externally in normal conversation, and internally through inner speech. The external conversation of gestures is subject to a negotiation which sets the rules under which this conversation takes place. In an oral culture, the complete gesture has a binary (sending and receiving) nature. An oral conversation of gestures takes place in a non-externally mediated, direct mode and in real time. The inner conversation of gestures leads to the formation of concepts. The results of this intricate process, the products of the oral object of communication, are stored in individual or collective memory, through the creation of meaning and the structuring of language, and through formulas, myths and poems. They are used in further action.

In a writing-literary culture gestures have a more diversified nature. A reading gesture will correspond to a written gesture which sets the conversation of gestures in motion. As we have seen this has an asymmetrical nature. The writing-literary gesture leads to a reading

gesture which, in turn, leads to immediate or delayed action or none at all, to another writing gesture or even to an oral gesture. In a writing-literary mode gestures are thus asymmetrical and mediated, take place in non-realtime and in a direct or indirect mode, in which case they involve a restricted number of actors. Again this conversation of gestures can be externalized or internalized. The product of this conversation of gestures is stored in external, fixed devices, manuscripts or groups of manuscripts.

In a printing-literary mode, gestures become even more complex. The printing-literary mode encompasses the writing-literary mode and further evolves into an asymmetrical, mediated, non-realtime, indirect conversation of gestures. External and inner conversations of gestures go on at more complex and diffuse levels. The product of these conversations of gestures is stored in the form of books. Books embody theories or theses, contain already some simple "navigating" mechanisms -- e.g. indexes, headings -- which facilitate the operations of the mind that are involved in the inner conversation of gestures, and are also contained in libraries, themselves aimed at facilitating intellectual operations. I bring back this topic to help situate the analysis of hypermedia.

Hypermedia incorporates audio, video, graphic and written representations within the framework of the computer. It permits a computer mediated exchange of oral and written gestures, for example, through the computer's screen and loudspeaker. It also brings in music and other sound sources, graphics and images in motion, mixes these and thus creates the possibility of new combined gestures. Finally it

provides a convenient and integrated way of recording and distributing these different gestures which again creates new gestures.

Hypermedia thus enables new possible exchanges of gestures and, by allowing their easy combination, enhances the extension of the previous ones. But at the same time the computer is the environment within which the different conversations of gestures take place. There is a major difference between the computer and the environments of the oral and literary objects of communication: the computer is not static and its characteristics do not remain unchangeable. The interface is responsive. To overcome this seeming difficulty which leads Grice (1989) to admonish "don't force people to fit the interface -- design it to fit them!", the question of standards has often been raised.

With or without standards, an initial negotiation therefore exists between the user and the software developers, even if, for all practical reasons, it remains one-sided. To be sure, this problem exists in all computer usage, be it in hypermedia or any other, but it becomes critical in a communicational channel such as hypermedia.

Once this initial problem of the user interface has been overcome, it must be said that the hypermedia hub introduces significant alterations in the conversations of gestures that it allows. Hypermedia permits an audio-based conversation of gestures, including an oral conversation. Moreover, a hypermedia workstation will handle an asynchronous, non-realtime, remote conversation of audio-based gestures, analogous to those made possible in radio or through the use of tape recording devices. An interesting example of this is the Internet Talk Radio project (Appendix B) in which 8-bit

resolution sound files, focusing on the news or computer related topics, are exchanged through the network. The written gesture is, of course, an old acquaintance of the computer-based medium. However some significant changes are introduced. The difference between the writing and reading gesture, which I outlined in the previous chapter, is considerably enhanced. While the writer loses much of his/her authority in that the individual contribution to a networked document is diluted and the token of this authorship (the book or any other written object) is lost, the reader is the one who settles the final shape of the text.

One other possibility introduced by hypermedia is that of employing video and graphics. This is an important aspect since, as I described earlier, the introduction of these elements brings about new communicational possibilities. Video can supplement spoken language with gesture and together with sound can give a complete dimension of the spoken language as Hodges et al. (1989) have noted. Although currently there are still technical limitations, graphics or new symbolic graphisms can be added to a remote conversation of gestures in realtime. They can function as 'iconotext' or, perhaps, create the foundations of a new form of hybrid representation, if the conditions for direct 'negotiation' of these gestures are created.

However, in my view another most important element that hypermedia introduces is the possibility to externalize and objectify (semioticize) intellectual operations and subject them to some type of negotiation.

In the oral mode, as described by Vygotsky, intellectual

operations involved in the formation of concepts are internally carried out and rely solely upon memory. The shift from a vocal-motor based oral mode to a visual-motor based literary mode encouraged a reliance on external implements to carry out these operations. The units of literary discourse were externally objectified, but the intellectual operations involved in the formation of concepts relied on internal, mental operations. Hypermedia's intellectual operations still remain in the realm of audio-visual, external units of discourse, but a major difference should be noticed: these operations may be objectified and performed externally. This makes it possible to keep track of these operations, also through external memory, and to automate them (Parunak, 1992) or, at the very least, determine to which extent and under which criteria it will be possible to carry them out. Thus, not only the elements of discourse are externally and objectively present, as in the written or printed media, but the very intellectual processes that were hitherto carried out internally become also objectifiable and externally performable. A link is more than a simple connection between disparate subjects. It can denote the type of relation between these subjects. And, conversely, a graph (see section 4.2.3) suggests the ensemble of operations that lead to a concept. Links and graphs resemble in this aspect a sort of meta-language which denotes not the properties of the objects, but the operations that lead to the recognition of these properties. This is a change of formidable importance. It is useful to keep in mind Vygotsky's explanation of the mental processes that occur in the formation of concepts and confront that with what hypermedia theorists have to say about this subject.

Duchastel (1990), while recognizing hypermedia as a growing phenomenon, analyzes the cognitive processes “that come into play in hypermedia browsing and how those processes can support learning” (1990 : 220). He distinguishes four cognitive processes which play a central role in the course of a hypermedia interaction. Browsing is the first operation and a most prominent one in hypermedia. It is a dynamic process which consists of a more or less focused scanning of the hypermedia collection, performed in conditions that can range “from open curiosity ... to constrained search” (1990 : 220). Searching is another operation which may range from looking for a straightforward answer to a specific and clear enquiry, to a more elaborate operation aimed at providing the answer to a loosely posed enquiry. Duchastel regards “integration” as a result of “the global process of learning [through] the structural character of knowledge as knowledge by the learner”, and further observes that “the interplay of assimilatory and accommodatory mechanisms are a constant driving force behind integration” (1990 : 228). Lastly, he recognizes “angling” as a process which permits one to gain different perspectives of a topic and which thereby may lead to critical thinking.

Hypermedia’s navigation techniques are tools developed not to enhance the communicational value of the object, but the relations and the cognitive value that these operations present. As Shneiderman (1989) posits, “learning theory would predict that hypertext should improve meaningful learning because it focuses attention on the relationships between ideas rather than isolated facts. The association provided by links in a hypertext database should facilitate

remembering, concept formation and understanding" (1989 : 129). Hypermedia allows for the first time these operations to be carried out externally to the mind and even automatically. Furthermore, it allows them to be 'semiotized', i.e., on a purely theoretical plane, a conversation of gestures can take place exclusively at the level not of units of discourse, but at the level of the mental operations that lead to concept formation. A chess metaphor might be appropriate in illustrating this point. In chess the rules that define the movement of the pieces and the space of the chessboard constitute the kernel within which the mental operations and the intentions of the players become objectified. In hypermedia the necessary condition for this new type of conversation of gestures to take place is the existence of a properly organized knowledge-base and a clearly defined navigational technology. As Carlson (1989) notes "the invention of cross referencing accelerated the accumulation of knowledge because old concepts could then be connected in new ways ... Hypertext may be the beginnings of a paradigm shift in human information processing" (1989 : 73).

Chapter 5

Conclusions

What has made orality and literacy 'objects of communication'? And what has led these objects of communication to become keystones in the genesis of new cognitive modes? What will, conversely, turn hypermedia into an object of communication and will it entail a new human cognitive stage? We have seen that the mechanism through which orality and literacy became objects of communication lies in the fact that they can function inwardly in the formation of concepts, and outwardly in the external expression of thought, and in the creation of collective meaning. But the origins of this mechanism are to be found in the sphere of the social. I dealt with this issue briefly in Chapter 2 when I spoke of the social control in the definition of an object of communication. This control is performed at two levels: firstly, society, not any individual or particular group, is the depository of the products that make up the oral and literary legacy and the processes that led to them. Secondly, these products in becoming externalized, turn out to be as marketable as any other products of human invention, and as subject to market contingencies.

In the oral mode, the constitutive elements of language are not anybody's property. This is the result of their being subject to a

negotiation, the outcome of collective endeavour, and the result of their being based on the innate capacities of the vocal-auditory apparatus. They are not external commodities. The learning of the *modus operandi* of orality, the negotiation of meanings and the intellectual operations involved in the formation of concepts are free-flowing operations that do not depend on anything but the problematic situations that give rise to them. The products and the constitutive elements of orality are not marketable. Words cannot be marketed *per se*, but the techniques to produce them properly in order to convey a certain concept and the concept itself can.

The constitutive elements of literacy, in the sense that they are the product of a similar process of negotiation, are nobody's property either. But they become commodities in the sense that they need an external support to bring them to life. This support has to be produced and mastered, and also in the sense that it is designed to convey a certain concept. The alphabet and the literary vocabulary are a collective endeavour. But writing is not a natural operation which can undergo a spontaneous process of apprenticeship, and writing and reading materials are external devices, products that can be subject to some type of commerce. Nevertheless, literacy is a technology that is simple to use. What makes literacy a more or less widespread phenomenon is the relatively easy availability of the commodities in which it is based, and the lack of special impediments to attaining its full potential. In other words, all obstacles, technical or otherwise, that prevented the full flourishing of literacy, and a widespread exchange of gestures have been removed.

There seems to exist a certain balance in the oral and literary modes between these two processes of social negotiation and appropriation. In other words, objects of communication function in such a way that the products of collective endeavour and creation and their commerce is kept within a reasonable balance. The invention of the phonetic alphabet was not "patented". The negotiation that leads to establishing the meanings of words is not taxable. Being literate means, for example, that I read and buy books and that I would have to engage in a certain commerce to write them. But it also means that I can use writing at my own free will for my own personal and professional needs.

There is no simple authoritative answer to the question 'Can hypermedia become a new object of communication?' The answer must be carved in the form of the most appropriate series of 'if/then' statements. On the other hand, a new object of communication is a process and hypermedia is in the early stages of this process. We can only therefore 'sense' the possibilities. Potential hypermedia techniques are common in the everyday use of computers, in such ubiquitous applications as text processors or spread sheets. Heim (1987) has shown how the new word processor techniques, though employed in a literary sense, strategically affect the forging of a new mindset. And the same is true in other areas where computers have replaced 'analog' methods. Basic concepts in which the concept of hypermedia is embedded, such as 'graphics', 'databasing', 'networking', 'searching' and many, many others are everyday concepts in modern computer practice. But these concepts have a unco-ordinated nature. A 'word processor' does word

processing. If one wants to send someone else a text produced with this word processor, one has to call a 'communications' package and send the file. Similarly, a 'graphics' program produces graphics. If one wants to integrate these graphics in one's text, an operation with occasionally uncertain results, 'copying' and 'pasting' has to be performed. And if one wants to send such a file that mixes text and graphics it is more than probable that this will be impossible. Hypermedia has thus a much larger potential: that of integrating previously scattered concepts in a coherent manner.

I argue that new cognitive processes do not wipe out previous ones. They simply replace them in those aspects in which they constitute a true gain. Hypermedia, as pointed out in the previous chapter, can, first, help to create new, richer representations by allowing the simultaneous presence and the synergetic effect of different media forms, and, secondly, can facilitate, externalize and even objectify the intellectual operations involved in the higher processes of concept formation. It can simplify and even automate them. Since hypermedia encompasses, at least in part, both the oral and the literary object of communication, it draws upon many previously negotiated gestures and it arises within a corpus of pre-existing concepts. It does not wipe out myths and theories. But it can eventually help build new conceptual formulas. The mediacy of the computer and the addition of both new and newly combined gestures can create a new environment, under which new gestures and interactions, leading to new negotiations and new intellectual operations, can take place. In other words, the computer can create an environment within which

hypermedia can attain its full potential.

Here the first 'if/ then' statment can be placed. There are as yet innumerable obstacles that prevent hypermedia from attaining its full potential. When I analyzed the characteristics of hypermedia in Chapter 4, I mentioned a few that, it could be argued, represent the 'promise' of hypermedia. These are accessibility, synchronous or asynchronous, local or remote operation, and finally the combination of new representational modes, namely, graphics and full-motion video. These are characteristics that can lead to the widespread exploration of hypermedia's full potential. But the present state of technology is far from adequate. Storage devices are not completely satisfactory and the incorporation of telecommunications technologies is still limited in many aspects. The use of graphics is primitive. Processing power, although progressing at a fast rate, is not sufficient for the full exploration of hypermedia's possibilities.

These limitations prevent the collective endeavour that leads to the definition of a new object of communication. New conversations of gestures that hypermedia potentially forges are difficult or simply not possible as yet. It should come as no surprise, thus, that the first examples of working hypermedia can be found in texts in the written form. These seem to work reasonably well and clearly demonstrate this potential (cf. the descriptions of Slatin and Landow's examples in the previous chapter). One possible initial answer to the first 'if/ then' statement therefore is that, yes, it may become possible that hypermedia evolves into a new object of communication, provided that the technology supports it. This is clearly not the case yet.

That leads us to the second aspect of this social dichotomy. The social constraint is market driven. Hawkins (1991) underlines the existence of more than 30 'standards' in hypermedia hardware. Feldman (1992) notices that even though multimedia delivery platforms come from U.S., Japan and Europe, and that development has been contingent upon "hardware interests" (1991 : 56), "the development of multimedia to embrace full-screen, full-motion video along with other types of data has been so far largely been the gift of American technological genius" (1992 : 56, 57). He warns that "if it is to become one of the most pervasive forms of information delivery in the twenty-first century [hypermedia] will need to do more than merely inform" (1992 : 61). Soloway (1993) enumerates what in his opinion are the necessary characteristics of a suitable, universal, reading and writing system for interactive documents. He further notes that regarding these "the only issue is the price point: for education, the cost of a personal appliance must be in the \$250 range, the cost of a bicycle. There are about 60 million school children in the U.S. ... The consumer electronics industry knows how potent such a market can be; they will surely find a way to produce an appropriately priced box" (1993 : 23). Although this is important the problem appears to be more complex still.

To attain its full potential, hypermedia has to do better than simply praise its 'promise'. The intricacies of the technologies involved place this problem on a level of far greater complexity than those which involved the oral and even the literary modes. Orality had its 'controllers' and so did literacy. We eventually find the story-tellers

and the scribes of hypermedia in the marketers. The warnings of the critics of hypermedia point to this direction.

The power with which the computer invests the individual or group is enormous. The potential of autonomy, flexibility and 'portability' of hypermedia has no parallel in any of the other technologies for the expression of thought. But to attain its 'promise', the grasp of the full resources of hypermedia lies far beyond the power of the individual or group. The recent interest of the American administration in networks such as the Internet is not accidental (cf. Appendix A). Characteristics like ample connectivity will only be attainable at a different level of commitment, and thus raise the degree of complexity in dealing with this new technology to unprecedented levels. Hypermedia undoubtedly has the potential to allow us to grasp the complexity of the realities around us in a way that no other technology for the expression of thought ever allowed. But from the simple vocal utterance to the sophisticated digital link lies a path of increasing individual vulnerability which we must acknowledge.

This analysis does not by any means exhaust the subject of hypermedia as a technology for the expression of thought. Other important aspects come to mind as a consequence of the present enquiry, which necessarily complement it and need further enquiry. For example, within the continuum of technologies for the expression of thought, how to deal with the problem of the progressive detachment of the self through the use of these technologies. What would be the role of hypermedia in this regard? We know how a dominant mode of expression influences the way society depicts itself,

its institutions and its internal connections. How will hypermedia exert its influence, if any, on society? What will be the “products” of hypermedia? Scholars have defined the ‘oral’ mind and the ‘literate’ mind. What will the ‘hypermediate’ mind be like? And, as David Gelertner (1992) puts it, what will become of us once reality is perceived only through the narrow perspective of a computer screen?

Appendix A

Date: Mon, 5 Jul 93 14:28:25 -0400
From: hearing-info@trystero.malamud.com
To: com-priv@psi.com
Subject: On-Line Congressional Hearing

Station: Internet Multicasting Service
Channel: Internet Town Hall
Program: On-Line Congressional Hearing
Release: July 5, 1993
Content: First Announcement/On-Line Congressional Hearing

On July 26 at 9:30AM EDT, the Subcommittee on Telecommunications and Finance of the U.S. House of Representatives will hold the first Congressional Hearing ever held over a computer network. The oversight hearing on "The Role of Government in Cyberspace" will take place in the Grand Ballroom of the National Press Club at 14th and F Streets, N.W., Washington, D.C. The hearing is open to the public. An open house will be held from 3-5PM on the same day in the same location and is also open to the public.

Chairman Markey has asked that this historic occasion demonstrate the potential and diversity of the global Internet. Thirty Sparcstations will be in the hearing room, allowing members of Congress, staff, and their guests to read e-mail, use Gopher menus, read testimony in WAIS databases, browse the World Wide Web, and otherwise use the resources of the global Internet as part of the hearing.

Some witnesses for the hearing will testify remotely, sending audio and video over the Internet. Audio and video of the hearing will also be multicast over the Multicast Backbone (MBONE). We are hoping that C-SPAN and other traditional media will also carry the event. *MORE DETAILS ON MBONE AND OTHER WAYS TO WATCH THE HEARINGS REMOTELY WILL BE FORTHCOMING SHORTLY.*

One of the primary points that we are hoping to demonstrate is the diversity and size of the Internet. We have therefore established an electronic mail address by which people on the Internet can communicate with the Subcommittee before and during the hearing:

congress@town.hall.org

We encourage you to send your comments on what the role of government should be in the information age to this address. Your comments to this address will be made part of the public record of the hearing. Feel free to carry on a dialogue with others on a mailing list, cc'ing the e-mail address.

Your cards and letters to congress@town.hall.org will help demonstrate that there are people who use the Internet as part of their personal and professional lives. We encourage you to send comments on the role of government in cyberspace, on what role cyberspace should play in government (e.g., whether government data be made available on the Internet), on how the Internet should be built and financed, on how you use the Internet, and on any other topic you feel is appropriate. This is your chance to show the U.S. Congress that there is a constituency that cares about this global infrastructure.

If you would like to communicate with a human being about the hearing, you may send your comments and questions to:

hearing-info@town.hall.org

Support for the Internet Town Hall is provided by Sun Microsystems and O'Reilly & Associates. Additional support for the July 26 on-line congressional hearing is being provided by ARPA, BBN Communications, the National Press Club, Xerox PARC, and many other organizations.

Network connectivity for the Internet Town Hall is provided by UUNET Technologies.

Appendix B

Internet Talk Radio
Carl Malamud (info@radio.com)

The following article is reprinted with permission from ConneXions. ConneXions is published by Interop Company. More information on ConneXions can be obtained from the address ole@interop.com.

Over the past few years, two trends have come together to present an opportunity for a new type of journalism. On the one hand, the trade press has focused on marketing and product reviews, leaving an ever-larger gap for a general-interest, technically-oriented publication focused on the Internet. At the same time, the Internet has made great progress in supporting multimedia communication, through standards such as IP multicasting and MIME messaging.

Internet Talk Radio attempts to fuse these two trends and form a new type of publication: a news and information service about the Internet, distributed on the Internet. Internet Talk Radio is modeled on National Public Radio and has a goal of providing in-depth technical information to the Internet community. The service is made initially possible with support from Sun Microsystems and O'Reilly & Associates. Our goal is to provide a self-sufficient, financially viable public news service for the Internet community.

Head: Flame of the Internet

The product of Internet Talk Radio is an audio file, professionally produced and freely available on computer networks. To produce these files, we start with the raw data of any journalistic endeavor: speeches, conference presentations, interviews, and essays.

This raw information is taped using professional-quality microphones, mixers, and DAT recorders. The information is then brought back to our studios, and edited and mixed with music, voice overs, and the other elements of a radio program. The "look and feel" we strive for is akin to "All Things Considered" or other programs that appeal to the general interest of the intelligent listener.

Our goal is hit the topics that don't make it into the trade press. Instead of SNMP-compliant product announcements, we want to present descriptions of SNMP. Instead of articles on GOSIP, we want to describe the latest Internet Drafts and place them in perspective. Instead of executive promotions, we want to give summaries of mailing list activity and network stability. Instead of COMDEX, we want to cover the IETF.

Head: Town Crier to the Global Village

The result of Internet Talk Radio's journalistic activities is a series of audio files. The native format we start with is the Sun Microsystems .au format, closely related to the NeXT .snd format. This format consists of the CCITT Pulse Code Modulation (PCM) standard of 8 bits per sample and a sampling rate of 8000 samples per second, using the u-law [ed. use greek letter mu] encoding (a logarithmic encoding of 8 bit data equivalent to a 14 bit linear encoding). A half-hour program would thus consist of 64,000 bits per second or 15 Mbytes total.

Programs are initially spool on UUNET, the central machines of the Altnet network. Files are then moved over to various regional networks for further distribution. For example, EUnet, a commercial network provider for Europe with service in 24 countries, will act as the central spooling area for the European region. The Internet Initiative Japan (IIJ) company will provide the same service for Japanese networks.

The goal of coordinated distribution is to reduce the load on key links of the network. Transferring a 15 Mbyte file over a 64 kbps link does not make sense during peak times. On the other hand, a leased line has the attribute that a bit unused is a bit forever gone. Transferring large files at low priority in non-peak times has little or no incremental cost.

Files thus move from the UUNET central spool area, to regional spools, to national and local networks. We anticipate most of this transfer to be done using the FTP protocols, but some networks are discussing the use of NNTP news groups and MIME-based distribution lists.

It is important to note that Internet Talk Radio is the source of programming and does not control the distribution. These files are publicly available, subject only to the simple license restrictions of no derivative work and no commercial

resale.

Distribution is controlled, as with all other data, by the individual networks that make up the Internet. We intend to work closely with networks all over the world to ensure that there is some coordination of distribution activity, but ultimate control over this data is in the hands of those people who finance, manage, and use networks.

We don't believe indiscriminate use of anonymous FTP is the proper method for distributing large archives. Previous experience with ITU standards, with RFC repositories, and with large software archives such as the X Windows System indicates that setting up a top-level distribution hierarchy goes a long way towards alleviating network load.

Even with a top-level hierarchy, however, there will always be anonymous FTP sites and there will always be people that go to the wrong FTP server. This behavior is largely mitigated by setting up enough "local" servers and publicizing their existence. Like any large distributor of data, we are mindful of the load on the transcontinental and regional infrastructures and will take aggressive steps to help minimize that load.

Head: Asynchronous Times, Asynchronous Radio

Once files have made their way to a local or regional network, they are moved to the desktop and played. Once again the individual users of the network decide how to present data. We hope to see a wide variety of different ways of having our files played and only list a few of the more obvious methods.

The simplest method to play a .au file on a Sparcstation is to type "play filename." If the file is placed on a Network File System (NFS) file system on a central server, the user simply mounts the file system and plays the file. Alternatively, the user copies the file to a local disk and plays it.

More adventuresome playing of files uses multicasting. A simple multicast program called "radio" for a local Ethernet is available from CWI, the mathematics institute of the Netherlands. A more sophisticated approach, IP multicasting, allows a program to reach far beyond the confines of the Ethernet.

IP multicasting might be used on a local basis, or can have

a global reach. There is a consortium of regional networks that have formed the Multicast Backbone (MBONE), used for audio and video programming of key conferences such as the Internet Engineering Task Force.

Internet Talk Radio does not assume use of the MBONE for playing files. Needless to say, the operators of the MBONE are free to play Internet Talk Radio files (and we would be delighted if this happens), but it is up to the local network affiliates to determine how and when they distribute this audio data.

In many cases, people will want to play files on a wide variety of different platforms. The Sound Exchange (SOX) program is a publicly-available utility that easily transforms a file from one format to another. Using this utility, the Macintosh, Silicon Graphics, DECstation, PC, and many other platforms can play Internet Talk Radio files.

Head: Geek of the Week

In the spirit of dignified, conservative programming, the first production from Internet Talk Radio is dubbed Geek of the Week. Geek of the Week features technical interviews with key personalities on the Internet. Some of the people who have agreed to appear on Geek of the Week include Daniel Karrenberg of the RIPE NCC, Dr. Marshall T. Rose of Dover Beach Consulting, Milo Medin of the NASA Science Internet, and Daniel Lynch of Interop Company.

Geek of the Week focuses on technical issues facing the Internet. This initial program is sponsored by Sun Microsystems and O'Reilly & Associates. Their support makes it possible for Geek of the Week to be produced professionally and then to be distributed at no charge.

One of the issues that Internet Talk Radio faces are the vestiges of Appropriate Use Policies (AUPs) that linger from the original ARPANET days. While Sun Microsystems and O'Reilly & Associates view Internet Talk Radio in terms of an investigation of on-line publishing, of multicasting, and other engineering issues, we feel it important that our sponsors are given due credit in the programs.

At first glance, this smacks of the crass and commercial. Indeed, it smacks of advertising. Jumping to that conclusion,

however would be a simplistic mistake. The Appropriate Use Policies were formulated to guarantee that networks are used for the purposes envisioned by the funding agents. In the case of an AUP-constrained networks such as the NSFNET, this means that use of the network must benefit U.S. science and engineering.

We feel that an in-depth interview with Internet architects clearly falls within the purview of all AUP policies. However, we understand that certain networks may not accept certain types of programming. For this reason, our central spool areas are carefully picked so they are AUP-free. This way, if a network feels the programming is inappropriate, they can simply inform their users not to obtain or play the files.

It should be noted that one advantage of supporting the professional dissemination of news and information up-front is that the user is not directly charged. Somebody has to pay for information to be produced, and the sponsorship model means that copy protection, accounting, security, and all the other complications of a charging model are avoided and that high-quality news and information becomes increasingly available on the Internet.

Head: The Medium is the Message

While Geek of the Week is our flagship program, we intend to intersperse mini-features throughout. The Incidental Tourist, for example, will feature restaurant reviews and other travel information for sites throughout the world. The Internet Hall of Flame will highlight non-linear behavior on mailing lists, and we will have periodic book reviews by Dan Dorenberg, one of the founders of Computer Literacy Books.

The logical extension to Geek of the Week is to begin coverage of industry functions. To date, we have received permission to tape for later rebroadcast sessions and presentations at the European RIPE meetings, the IETF, and at the INTEROP Conferences. We are negotiating with other industry forums to try and establish permission to cover additional conferences.

Our hope is to begin providing news summaries of these key conferences. If you can't make it to the IETF, for example, Internet Talk Radio would like to provide a half-hour news summary describing what happened on each day.

The next logical step is to begin producing analysis of key technical topics. Here, we look at in-depth (e.g., 15 minute) summaries of technical topics such as MIME, proposals for the next IP, SNMP v. 2, or the architecture of the Global Internet Exchange (GIX). We would also furnish analysis of political topics, such as the POISED effort to reorganize the Internet standards process, or the background of the IPv7 debate.

Eventually, our hope is to combine all these reports together and form a daily news broadcast to the Internet. When you walk in and start reading your mail, you simply click on the "radio" icon and listen to Geek of the Week while deleting messages from the more hyperactive mailing lists.

Head: Tomorrow is the Future

The "radio" metaphor was carefully chosen. We wanted an alternative to plain ASCII files, yet did not feel that the Internet infrastructure was ready for regular video feeds. Production of video or true multimedia required an order-of-magnitude higher investment in production facilities. After all, we know bad TV since we see so much of it.

Eventually, Internet Talk Radio wants to go beyond the confines of the simple radio metaphor. Already, we describe the service as asynchronous radio, recognizing that our listeners can start, stop, rewind, or otherwise control the operation of the radio station.

As a multicasting infrastructure gets deployed throughout the Internet, we see the opportunity to expand the radio metaphor and begin the creation of a truly new news medium. Multicast groups and videoconferencing tools allow the creation of an Internet Town Hall, a moderated forum with a very wide reach or games shows like Name That Acronym where everybody gets to play.

Because we are on the Internet, we can add a wide variety of different programming techniques. While listening to a series of interviews about MIME messaging, for example, you might also scroll through a series of Gopher menus that hold more information about the MIME standards, or search a WAIS database for a biography of the speakers.

We hope that Internet Talk Radio will be the first of many

such information services on the Internet, supplementing the random anarchy of news and mailing lists with professionally produced news and information. Indeed, we hope that Internet Talk Radio forms the first of many "desktop broadcasting" efforts.

Internet Talk Radio debuts at the Columbus IETF at the end of March. Stay tuned for more information.

Head: For More Information

Guido van Rossum, FAQ: Audio File Formats, <ftp.cwi.nl:/pub/AudioFormats2.10>. An excellent introduction to audio formats, encoding, and other information about sound files on different platforms. This same site also has copies of the SoundExchange (SOX) program for translating files into different audio formats, and the Radio program for playing a sound file on an Ethernet.

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