Spoken Communication

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PREFACE

The GSCP (Gruppo di Studio sulla Comunicazione Parlata) organizes a Conference every three years in Naples. The Conference is considered as one of the highlights of the research work conducted by the GSCP, as it has the merit of bringing together the experiences of so many interest groups working in the field of spoken communication. The GSCP 2009 Conference was a great success, with contributions from both European and non European Countries. Topics ranged from linguistics to pragmatics, from philosophy to communication sciences, from pedagogy to psychology, from experimental phonetics to speech analysis tools.

Indeed, this volume is the result of such great interest. The eleven papers that have been selected mark the great diversity of approaches researchers have applied to the study of the many different aspects of spoken communication, but they also confirm the existence of the strong interconnection among the various fields. Furthermore, the articles that are part of this volume are more than just the written version of the conference talks. The authors, who have contributed generously to our invitation for an extended version of their talk, present a wider and thorough perspective on the subject matter. We are very grateful to them all.

As for the organization of the volume, it is divided into three parts: Theoretical aspects, Some case studies and Representing speech. The first part includes aspects of the cognitive and pragmatic perspectives of spoken discourse, the second part examines language pathologies, multimodal spoken dialog interaction and voice expressiveness, and the third part discusses sign languages, the representation of intonation and the automatic detection of disfluencies in speech transcriptions.

Hence, the overall goal of the present volume is to offer an extensive and qualified description of the current research that may stimulate genuine attention of those working in this field. Although the volume by no means covers all the topics related to Spoken Communication, it is an updated representation of our current understanding on the subject. We hope this volume will be beneficial to those interested in this new and exciting field of research.

—Massimo Pettorino and Antonella Giannini

PART I:

THEORETICAL ASPECTS

CHAPTER ONE

SPEECH:
A COGNITIVE PERSPECTIVE

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1. Introduction

Linguists (Voghera 1992; Sornicola 1981) commonly refer to three main meanings of the idea of speaking:

1. Speech as a form of spoken communication (eg. orality *vs.* writing);
2. Speech as socio-cultural diversity (language spoken, spontaneous, *vs.* cultured language, literary, etc.);
3. Speech as a mean of transmission (eg., oral language *vs.* Sign Language).

None of these three meanings is peculiar to the cognitive perspective although, obviously, it is often forced to draw in each of them. A cognitive action that plays an active role in an animal mind (and at present it is independent from the idea of an artificial mind) must be regarded as a specific form of thought (or intellective action), or as a mental pattern that uses mental development and produces *different knowledge* from those of all the other forms of cognition.

Of course it would be necessary to give a better definition of the term "form of thought", but at this rate we will never stop and we should get into a very old debate whether thought is based on language or language is based on thought, or whether thoughts may exist in an independent way from language, etc.

Currently we will consider obvious the mentalist assumption that is peculiar to the cognitive sciences according to which sensations,

perceptions, mental images, and formal logical reasoning, categorization, etc. can also exist without language and therefore, without speaking.

This negative definition has the advantage of excluding, even in the faculty of language, everything that has a conceptual nature different from that of speaking. For example, semantics, morphology, syntax certainly are not peculiar prerogatives of language. Giving meaning to any sign is, perhaps, the primary task of every cognitive activity. In the same way, the morphology is common to virtually every type of categorization. Any operation that provides modularity and decomposability of units (first, second or n-th articulation) is morphological: from the bio-physiological descriptions (from this the origin of the name of the concept of morphology itself), to any type of code of modular signs. Syntax, then, is the cognitive operation typical of the formal systems, of the symbolic logic, of the programming codes, etc. Generally, any mental activity that involves a hierarchy of units and their orderly arrangement in space and / or time is a syntax activity.

We can say that the grammatical and semantic components of animal cognition and artificial techniques are explicit techniques to regulate flow of data and/or notions of any kind.

Is it not superfluous to recall that this does not mean to flatten the diversity and complexity of these cognitive abilities in different forms of knowledge and in different species that are able to perform them.

What I want to say is that these skills have a more ancient origin than others, because, in their essential prototypical form–giving a meaning and distinguishing the elements by ordering them in space or in time–not only are specific to all codes that require some form of calculation, but probably, they pre-existed in previous species to those of *Homo sapiens.*

Chimpanzees, for example, are wonderful in executing transactions that involve an understanding and use of ordinal and cardinal numbers (Matsuzawa 2006). There is no doubt, however, that the application of morphology and syntax in human language and in the concrete historical-natural languages has turned them into sources of cognitive power of incomparable effectiveness.

However, this is, in absolute, the relevant evolutionary problem for a cognitive perspective on speech: semantics, morphology and syntax–existing procedures–are grafted on a new cognitive ability, however, which is unprecedented in evolutionary history: the phonetic articulation. The phonetic articulation is produced only through random mutation that has changed the original vocal supra-laryngeal tract of primates and hominids in that of the Sapiens one (permanent lowering of the glottis, elevation of the hyoid bone and their consequences); the phonetic

articulation is what first we mean by “speech”. The output of discrete sounds placed at the service of the meaning, the morphological and syntax categorization.

To this basic cognitive skill, related to the performance of vocal organs, it is obviously added the prosodic modulation, which, however, is also a clear antecedent in other species (like birds). It is probable that, as in the case of semantics, morphology and syntax, functional use of suprasegmental features in language model has increased enormously the complexity of the latter, but even in this case, the cognitive specificity of this model is not related to prosodic variation.

The difficulty of disentangling the specific contribution of each language component is linked to the obvious fact that no one considers language as a set of modules acting separately. To think that semantic prosody, phonetics, morphology and syntax (we’re ignoring stylistic and pragmatic), proceed in a self-sufficient way, is not only counterintuitive, but certainly wrong: the linguistic phenomenon is one and only one, because it occurs within an organism, in a man.

However, the modern scholar is now facing a functional unit, just the language, which is the result of a micro-evolutionary stratification lasted about 200.000 years. Two hundred thousand years are certainly few in the perspective of the evolutionary biology, which is focused mainly on the structural changes (i. e. physiological, morpho-anatomical changes). However, they are not that little for the cognitive paleoneurology: that is in the study of functional changes that led to the formation of different cognitive systems. From this point of view, studying human language from its beginning until today, despite the lack of materials and the use of certain speculative notions, can only lead to the need to assume the existence of modular units, certainly the existence of different cognitive *step*, the appearance of each one has restructured the earlier holistic organisms.

2. The speech as a form of ontological knowledge

If we want to understand what is the cognitive dimension of the Speech it is essential to consider that it is at the centre of a chronological sequence, but also of a functional one, in which prosody, morphology, syntax and semantics come first, while writing, and all cognitive derived technologies, come later.

The linguistic- phonetic articulation is the species-specific form of human cognition. From a cognitive point of view, however, the human cognition cannot be studied in the same way in non-literate societies and

in the post-chirographic ones. As the speech has given a specific ethological prosody, morphology, syntax and semantics, so the writing has given new features, that is to say, a new cognitive specificity to the linguistic- phonetic articulation. In relation to this, the way of thinking about speech in oral societies is very different from that of societies based on the mental technologies of writing.

It would take too long to address this issue here. Therefore, for the moment, we explain the cognitive relevance as exclusively of the speech in the way we live in our written culture. This hypothesis assumes that the speech is gifted even of "visual images" of words laid down in the form of lexicons, dictionaries, directories, manuals and anything else that pertains to storing long-term fixed concepts. It's important to underlie that this was certainly not the initial condition of speech. Starting from this condition we should try to understand the areas in which speech produces knowledge that are irreducible to those of any other form of thought, however extensive these areas are in relation to the whole field of knowledge of the human mind and what criteria we can take to formally define this kind of irreducibility.

In other words we have yet to know if speech produces some kind of "special" thoughts, how much of human cognition takes such "special" thoughts and how can we be sure that this "specialty" is not just a speculative assertion which is not able to be proved by experimental.

We will see that is not always possible to answer all these questions and that the answers often generate more problems than they solve. Something, however, can be said.

We will start from understanding the sense in which cognition produces spoken thoughts that are irreducible to those produced by other forms of cognition, the "special" thoughts. Imagine, for example, to think about what we have to say, having to support a discussion on a given topic with another partner or having to expose a university lecture to our students. Immediately in our minds, busy and tumultuous thoughts arise, silently waiting to take a structured, distributed and stabilized form.

We have already to face the first problem. The inner speech is a form of speech? What exactly is the inner human language made of? Defined phrases ready to be "copied" by the pronunciation or writing? Syntactically ordered strings of linguistic symbols? Deep structures in the chomskyan sense of the term? Semantic nuclei that are indicative but undefined compared to a non-linguistic content of thought?

Each of these solutions leads us to a dead end. Despite their apparently explanative charm, all of them can be traced to the same fundamental error: they require the precedence of concepts over words and the

essentially cognitive useless of speech. Either to "copy" the phrases in the way they come to our mind, or to transform deep structures into superficial structures, or to have in a grammatical order the units already equipped with semantic contents, it means that we are translating a thought into a form called "external" decode.

As we know since Saussure and Wittgenstein, the "ratchet" (Tomasello 1999: 24) of the modern semantics is the definitive renunciation of the nomenclaturistic idea of the meaning.

For Wittgenstein there are no thoughts, ideas, concepts, leaving their act of dialogic establishment. For Saussure in the "psychological" point of view there is nothing distinct in thought before the linguistic sign. Non linguistic thought is an amorphous and nebula mass. The specific role of language is to interface thoughts and sounds. In a sense, these are the axioms that have defeated forever what Popper called the "positivist dogma of meaning" (1934: 13-20). For J. Walter Ong this dogma is the result of written culture, of the "chirographic and typographic" man, who "tends to think about names as labels mentally posted to the determined object" (1982: 61). This is a fact entirely foreign to primary oral cultures where "words like these do not have a visual presence, even when the objects they represent are visible" (*ib.*: 59).

But I believe that this can no longer be sufficient in the present perspective of cognitive sciences. We must go further towards a theory of speech as a *specific form of ontological knowledge*. It may be seen well if we eliminate everything is phatic communication or pure tautology from our linguistics investigation corpora, and we strive on the analysis of complex speech. We should deal with what Bergson called "the thought that focuses" in opposition to the "thought that can enjoy life" (1919: 120). The last kind of thought is not yet grammaticalized or lexicalized, it is the dynamic thought in search of a step of stopping. In this direction we might take another solution to the problem of inner speech:

> the inner speech that positively occurs to us in the form of conceptual labels, isn't the speech yet, and cannot replace it as a form of "conclusive" cognition, because, negatively, it is just the set of all prohibitions, the sum of all that we exclude from the new idea that we would like to convey.

In this idea, still pre-theoretical, the role of the speech is to move in a competitive environment between the inner speech and the explicit articulation. This is an active role and it is irreducible to any other mental task. It implicitly requires us to move not in accordance with the beliefs–as we normally do–but in constant conflict with them. In the ontological physiology of the spoken cognition what it is needed to be carefully

evaluated is the competitive "weight" that words take: not what they assert, but what, meanwhile, they deny. Not every word encapsulated in speech matches to a truth-belief, but to a set of weights and limitations of various nature, which we will call "ontological." When we articulate them in speech we strive to build knowledge that is very restricted by this set of weights, but not enough to prevent the sentence to come out, that is to say to declare its match to the "truth" more than its aim or aspire to it.

Now we get to the point: what does "ontological weight and restraint" mean? How can we determine the nature of the limitations that we feel when we spontaneously speak? Not using the principle of truth that is embodied in the "pathological" idea (Pennisi 1998) according to which stating a given state of things, at the same time, we always declare the correspondence to an apophantic belief (or assertive).

In the same way, we cannot state its negation, ie with the exclusion of the programmatic specificity of the speakable. The ontological nature of the weight we feel when we talk is rather attributable to a kind of "principle of real" (Janet 1903). We have at least to suppose that the nature of the limits that we feel when we carved out the space of the speakable is more determined from the awareness of what we exclude that can be said rather than from what we include in what is expressed.

The ontology of speech, on the other hand, is not programmable: it is realized only in the moment we speak, not before or after. For this reasons it is a "special" cognitive activity, even different from the interior language. In one sense, in a different way from the Saussure's metaphor, which considers speaking as a shape cut out with scissors from a sheet of paper, from a cognitive point of view speaking looks more like sculpting with a chisel tip an amorphous block and turning it into an object with its own meaning. The accuracy of the directions and the edges of the scissors on the paper are predictable and in a sense programmable (eg the techniques of clipping games or origami). The stroke of the chisel, even when it is given by a great sculptor, cannot have the same kind of precision. What happens when the hammer strikes the chisel is that part of the subject of that block is excluded, it is no longer part of the block. The set of all the blows of the chisel produces a mass of residues that form the basis of the object that is been produced, and that no longer are part of it. The statue was never that of the Madonna, that discobolous, that wader that we had in mind . Less than ever is the Madonna, the discoboluous or the wader in themselves, their prototype, their own image. It 's simply the result of all the excluded fragments, of all stony flakes that are no longer part of the idea of that Madonna, of that discobulous, of that wader. The

triumph of the limitations and weights that hinder the freedom of thinking is exactly this one. To quote Wittgenstein:

> The sentence, the image, the model are in the negative sense, as a solid body that restricts freedom of movement of others in a positive sense, like space, bounded by a solid substance, where a body has a place (Wittgenstein, Tractatus, 4463).

Here, this is speech as an ontological form of cognition.

3. Speech as embodied cognition

We followed so far the philosophical formulation of the problem, which is not, however, acceptable in the strict terms of a cognitive model. Yet, it is an essential idea that is worth leading back to formalized rules.

Indeed, if the speech is a form of specific cognition, it has to deal with all the methodological requirements that cognitive sciences preliminarily impose to any other form of cognition.

Then we need to wonder if:

- is it domain-specific? is it modular? is it innate?
- Is it ethological species-specific?
- Is it biologically species-specific?
- Has it an evolutionary explanation?
- can it be investigated with experimental methods? Etc.

This is a set of questions too complex to have here (or elsewhere) a comprehensive answer. One can only say that at this point we are playing a decisive game in the cognitive sciences in which an anti-linguistic soul, not negligible, is meandering. Since in this general view my position is strongly anchored to the centrality of linguistic function in the reconstruction of species-specific cognitive form of *Homo sapiens*, I will try to summarize, quite briefly, a series of answers to the great questions posed here, with an eye to the experimental demonstrability of what I say, assuming the responsibilities of these views.

3.1.

The speech is based on morphological peripherical and central structures that are biologically and ethologically species-specific (Lieberman 1975, 1984, 2002, 2003, 2006, 2007, 2008). The vocal tract of the *Sapiens* is “technically” qualified to provide the cortical and sub cortical brain

structures an executive hardware suitable to the ontological function we first described. This ability of adaptation is characterized by: the speed of the sensory-motor control system of language; its particular physiological interface with all the systems of parallel recognition in the perceptive systems (Friederici and Kotz 2003a.b; Pinel 2006, etc.); its possibility to be adequate to the process of optimizing the shared attention in the cultural relations with co specifics (Edelmann 1992; Bruner 1983; Tomasello 1999). If we consider the writing as a exaptation of speech, then we must include among the ethologically species-specific characteristics of speech also the simultaneous irreversible processes of social learning, and the innovation that follows, which has made possible the development of technologies and systems of communication, and thus the spread of the complexity of social systems (Boyd and Richerson 2005; Diamond 1992, 1997, 2005).

3.2.

From an evolutionary point of view, we must distinguish between the structures and functions of Speech.

The structures have definitely evolved from a process of gradual evolution compared with the Primates and, more generally, to mammals. Both genetic traits so far identified as responsible for the motor oro-buccal coordination (FOXP2, cf. Enard *et al.* 2002; Scharff and Haesler 2005; Falzone 2004a-b, 2006), and central morphological traits as the hemispheric asymmetry (Crow 2000; Pennisi, Plebe and Falzone 2004), or the sub-cortical components (Lieberman 2003, 2006, 2007, 2008), and the morphological peripherical traits such as the lowering of the glottis (Fitch 2000a.b, 2002; Fitch *et al.* 2001) and, perhaps, the structure of the hyoid bone (Arensburg *et al.* 1989), were found in earliest stages and species.

As regards to the functions of the available data that we have till today, we can only be inclined to the chomskyan hypothesis of an evolutionary leap (but not-specific as Lenneberg 1967 would like). These data relate in an overwhelming way, to the times of the development of technologies, of art and other forms of symbolic culture that evolved so rapidly over the past hundred thousand years, after millions of years of stasis. Of course, it is not obvious, or at least has yet to be demonstrated in detail, the relationship between specific cognitive form of speech and development of: 1) forms of writing, 2) forms of logical-mathematical cognition, 3) technologies, 4) religions, 5) systems of legislative codification of rules, 6) forms of artistic creativity. It is not possible, however, to overlook the chronological data, which equate the origin of these forms with the

presence of forms of spoken communication (Leroi-Gourhan 1964; Tattersall 1998 etc.). The technical shape of this sudden evolutionary development of skills and the forms of upper knowledge should be that of the exaptation.

3.3.

From the point of view of the mental architecture of spoken cognitive form, it reflects what we said about its evolutionary processes.

Under the profile of the phylogenetic architecture the structures of speech are certainly innate. This is a given that becomes interesting if considered in the evolutionary biology's view. This is in fact the biggest lesson of modern evolutionism: the organisms and the individuals are those who fit and not their structures in isolation, as if they were self-sufficient. To study the vocal tract that can "technically" produce the speech, or to study the asymmetrical brain of a species, means to study also its relations with feet and hands, with the muscle-skeletal system, with the structure of the circulatory, respiratory, digestive, nervous systems: in short with all the patterns that have set during the evolutionary history of the physiological type of the species.

The same is true in terms of functions. An animal that is able to speak, not only communicates differently, but also perceives in a different way, thinks and remembers in a different way, wants, gets excited and acts in a different way, is differently related with its conspecifics: he came to this condition through the inexorable interplay between chance and natural selection operating in the course of those that Giambattista Vico called the "immense age".

Finally, it is necessary to add to this already complex architecture, the weight of the sociogenesis that speech introduces in an irreversible manner in the specificity of the human animal. No other form, in fact, of *social learning* occurs, through the introduction of an interactive *format* between co specifics based on the spoken explanation of the learning relationships, whether they are conscious or not. The exploitation of the ontology of speech goes far beyond the *shared attention*, as stated by Michael Tomasello.

First of all, because it is an interaction that at the level of prosodic structure and then at the level of the discovery of the suprasegmental semantics is already determined in the pre-natal period, as it is already demonstrated by a vast amount of studies (Eimas *et al.* 1971, Evrard, Lyon and Gadisseux 1984; Fernald *et al.* 1984, 1989, 1991; Tomatis 1972, 1981, 1987, 1991; Mehler 1989; Mehler *et al.* 1978, 1986, 1988, 1990;

Trehub 1990). This is a species-specific embryogenesis, that creates a kind of auditory-vocal cognitive "formatting" in human species (Granier and Deferre Lecanuet 1987; Pennisi 1994). Today this aspect is studied in a phylogenetic perspective (Falk 2009).

Secondly, because, even with intact phylogenetic structures human children need to listen to human speech to turn on the linguistic function. We know that the *enfants sauvages* not only do not speak, but they don't even walk on two legs. As they need to see someone walking, in the same way they must listen to some conspecific speaking to imitate him (Pennisi 2006).

Third, because through the speaking in turn acquired by the practice of speaking, the relation of "joint attention" is transformed into an interior discipline that, Tomasello, rightly, acclaimed evolutionarily based on: (a) the action that is being done in that specific moment, (b) the continuous inversion of the roles of communication, (c) the achievement of the sharing of the goals , (d) the intersubjectivity of the contextual comprehension. Without the specificity of *spoken cognition*, none of this would be possible.

Finally, it is necessary to consider that the specificity of the spoken cognition as a "social learning" is now connected to almost all the cultures of the written form, which can certainly be considered as its formal derivation. This form has a double ethological value : a) contributes in a definitive way to the final cumulative effect of knowledge and its transmissibility by the subjects that express it; b) the very way to practice the oral cognitive function changes, for being able to take advantage of an "infinite memory" (dictionaries, handbooks, databases, etc ...).

In any case, the functional architecture of the "spoken" mind can only be based on a " weak modularism" toward which today many currents of contemporary cognitivism converge . The question to understand is no longer this one- as claimed by some philosophers of mind–"how certain cognitive functions which have no linguistic nature, predominantly mediate the exercise of the linguistic function in exam" (Perconti 2006: 22), but exactly the contrary, how the species-specificity of linguistic function converts into a new mental organism the whole of the cognitive functions that are not primarily linguistic in nature. Speech, on this subject, is a form of a specific pervasive and formative cognitive activity (Hjelmslev 1943). The mathematical problems, the creative content, the artistic forms and the interactional activities, love life and the more strictly rational one, the ethical decisions, the religious and political beliefs, the "faith" can also have an "evolutionary history" or be seen as answers to problems of evolutionary nature (reproduction, defense, achieving fitness).

But since we recreate them and continuously exceeding them in the cognitive activity opponent to the speech, they finally lose any previous relationship and they become new epistemic-*emergency* items.

3.4.

The cognitive ontology of speech is, potentially, fully experimentally demonstrable because it is not connected to any dualistic assumption. Naturally, this is today a research project, that is, at the present, the most interesting of the cognitive sciences of language. For the moment, we can highlight only a few lines of research (among many):

1) Peter Hagoort's researches (2005, Hagoort *et al.*, 2004) on the processes of integration between semantic knowledge and knowledge about the world (Word Meaning and World Knowledge in Language Comprehension) based on the neurophysiology of the evoked potentials.
2) Yosef Grodzinsky's researches (2000, 2006, Grodzinsky *et al.*, 2003 and 2006) on the new theory of the Broca's area.
3) The new psychobiology studies on the speech circuits, based on non-brain-centric assumptions about the neurophysiology of the methods of transmission of the sensory data from emerging in the Eighties (but still ignored by linguists). See Pinel (2006) and Friederici and Kotz (2003a).
4) The studies on temporality in neurobiological processes and their strange diseases, which took off from the research of Benjamin Libet (2007).
5) The studies on domain-specific language areas identified by the research of molecular genetics of the school in La Jolla, California (Arshavsky, 2006).

4. Conclusions

What I have presented here is, of course, only a roundup of all problems and issues to be addressed, which has only the aim to bring clarity and organizing a number of future research programs. The direction of researches in cognitive sciences is now uncertain more than ever. The idea that cognitive processes can be fully simulated by algorithmic procedures belongs indeed to the prehistory of the discipline. There are, however, many reasons to believe that this idea survives in other forms, both in neuroscience and in neuropsychology, and in the same philosophy

of mind. The crisis of classical computationalism has not quite erased the notion that transcendent thoughts, independent perceptions, universal operations and procedures, mental states of a psychological nature do exist. Similarly, the modular ideal underlying software engineering has not ceased to exert its fascination in the Theorics of cognition. Computationalism forwarded to neuroscience the idea of a brain-monad which is divided into areas-monads producing function-monads and to the philosophy of mind the idea that the set of all the monads which make up our cognitive system is itself an unconscious meta-monad.

In the last twenty years, with these artificialistic and anthropocentric residues we are measuring the evolutionary biology that tried to move again the final objective by placing the brain–the ascendant metaphor of the current cognitive sciences–inside the living organism. This is the biggest lesson of the contemporary evolution: organisms and individuals fit, and not their structures in isolation, as if they were self-sufficient. This lesson has pushed to strengthen the investigation of the biological basis of language that find in the centrality of the speech one of the turning points of the future research program:

> We must succeed–in the words of G. Edelman–to include biology in theories of knowledge and language [...] developing an epistemology from biological basis, a description that explains at the light of the facts of evolution and developmental biology the way we know, and realize (1992: 390).

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