SOME SPECULATIONS ON LANGUAGE

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ABSTRACT

Artificial intelligence as well as neurophysiologlcal studies of recent decades suggest a unitary view of language, in which natural language constitutes only part of the total language of the organism; the latter is a single but complex structure containing also the symbol-systems and their transformations responsible for mental processes. Following Sloman, the dogma that communication is the main function of language is opposed, and implications of the unitary thesis in respect of a number of linguistic and psychological questions are briefly discussed.

1. INTRODUCTION

In his "Computers and Thought" lecture David Marr has dealt with the language of visual processing. He has presented hypotheses, a theory, of what at least parts of it may be and of transformations which take place in it in the process of vision. The language is not English or Japanese or French or whatever - when we see we are not speaking or even conscious of primal sketches or of stick figures, but a language nevertheless it is- And the existence and nature of such a language is not only theoretical, for physiologists have started to discover experimentally the alphabet of languages at work in the visual processes of animals. Not being a biologist myself, I shall rely for my remarks on such matters on a fascinating article published in 1977 by Horace B. Barlow [1].

According to Barlow, work on recording the responses of single nerve-cells in the visual pathway of animals like fish or monkeys when the visual input is manipulated, has shown that the eye is using an alphabet of only one or two dozen different symbols. The referents of these symbols are so-called "trigger features," such as the appearance of a small dark spot, or the movement of *an object upwards in a particular region, in the visual field.

Of course it is not only in vision that a processing language is at work - examples abound in all other areas of artificial intelligence. Thus for example, the English-paraphrase programs of Schank and his collaborators employ outlandish words like MTRANS and PTRANS, which by no stretch of the imagination could be considered to be English or any other natural language, but nevertheless are an essential part of the working system.

Now, in their narrow man-centered way, people have generally considered natural languages as the languages "par excellence," and thought of other symbol-systems that may be employed as rather secondary to these. It is true that in electronic digital computer systems we have become familiar with other "languages" such as Algol or an assembly language or a machine code, but in biological organisms little recognition has been given to the existence or importance of a wider dimension to language. This is because, in Barlow's words, "human consciousness resides at the interface between internal and external language," and since we seem to be clearly conscious only of the external one - the one we talk in - we have assigned a pecking order to languages. Very distinguished scholars, for example, have denied any kind of language whatsoever to other species of animals. And distinguished philosophers have even claimed that thought is synonymous with language (natural language, that is to say), ignoring - for example - dreams and daydreams, obviously intelligent behaviour of animals, the way music "speaks" to us, etc.

2. A PROPOSAL

The work of the last few decades in artificial intelligence, as well as the work of neurophysiologists of the kind described by Barlow, and - especially - some recent philosophical analysis of Aaron Sloman, of the University of Sussex [2], lead me to make the suggestion that a new view of language is emerging, one that is essentially biology-based. Namely, language is not to be thought of as being primarily natural language, nor even is it to be thought of essentially as being of two different kinds, viz. external (i.e. natural) and internal (i.e. processing), but in any biological or computer system, whether a man or a rat or David Marr's program it is one thing, which we in our anthropocentric way arbitrarily and misleadingly divide into external and internal.

Though It Is one thing it is not a simple thing. This is obvious in a computer program, where the language might, for instance, be hierarchically organised into many parts:

first, say, a so-called top-level part, e.g. Algol, which is the only part the writer of the program uses and is usually aware of, then an interpreter which converts to the assembly code of the machine, then a translator which converts the result into its machine code. However, even in computer systems the organisation of the language need not be quite so neat as this. For example, in the days long ago when I wrote programs and did not merely talk about them, 1 remember the beautiful language of Lisp, which 1 used, having a facility whereby one could (usually for efficiency's sake) Interpolate in one's top-level Lisp program slabs of machine code.

But in biological systems it is quite certain that the structure and transformations of the language are more complicated than a stratified hierarchical scheme with neat transformations level by level.

Let me give a rather simple example of the close association and continuity between external and internal languages. (1 shall continue for convenience, in our present state of knowledge of these things, to use the terms "external" and "internal," although my present thesis is that epistemologlcally this distinction is misleading.) Consider the change that occurs in our learning of elementary arithmetic as children. When we are first taught how to add, we do it in terms of the teacher's instructions, consciously using natural language words and phrases such as "carries" or "two threes are six," but when we become proficient and do such sums in the usual almost automatic, "unthinking" way, there are practically no remnants left in our consciousness of these instructions and expressions. But nobody can doubt that, though we are not conscious of it, symbolic processing is taking place: the activity has very largely passed from the external to the internal language. But note how easy and "natural" the transitions between the two are: if, after attaining proficiency, we are faced with a specially hard or long sum, we will sometimes make the opposite transition and revert to the external part of the language, perhaps saying to ourselves "1 must remember to carry 2 when I've finished adding this column."

The claim, the hypothesis, I want to make then is the following:

<u>All mental processes in any biological system are merely transformations that take place in its single language, and this language may be activated</u> at, and <u>"level."</u>

(I put "level" in inverted commas, since - as I explained before - I do not wish to imply that the language has a strictly hierarchical structure.)

I make the further claim that this view will throw new light on a number of interesting Issues and puzzles, such as:

The semantics of natural language.

The Interaction of our different modalities of cognition, such as vision and understanding of language.

The origin and development of human language.

How the arts, such as poetry and music, act on us.

The nature of hypnotism, dreams and so-called "inspiration."

Elucidation of theories of the unconscious of the Freudian type.

The understanding and modelling of purposlveness.

Later in this talk I shall say a little about some of these applications of my thesis - a little only, I'm afraid, partly because of the limitations of time allowed me here, but mainly because my ideas on these matters are still embryonic, or even sub-embryonic, whatever that might mean! But first I want to consider briefly why the view I am presenting may appear a very strange one to many in the field of linguistic studies.

3. IS <u>COMMUNICATION THE MAIN FUNCTION</u> OF <u>LANGUAGE?</u>

Perhaps the reason the view of language I am expounding has taken so long to reveal itself Is that linguists, philosophers and others have assumed as a dogma that the main or sole purpose of language Is communication. I would say, on the contrary, its main purpose is for enabling effective and meaningful action to occur, whether overtly, e.g. in commands, or not overtly, e.g. in the stimulation of a muscle fibre in an organism. To demonstrate this convincingly and in detail is beyond the scope of this lecture and involves some careful philosophical analysis, on which a very notable start has been made by Aaron Sloman in the paper I referred to earlier. He there discusses the two opposed views, the usual one which Insists on the primacy of <u>communication</u>, and the new one which insists on the primacy of

representation. The former, of which Wittgenstein was the most distinguished and extreme exponent, holds that language Is essentially a social phenomenon and meanings are essentially things to be communicated, so that It Is Impossible for anything to use a language solely for private purposes* The second view holds that the essence of language Is storage of Information for use and manipulation by an Individual, and communicative potential Is only an evolutionary side-effect of this function.

Even Barlow, In the otherwise so lucid a paper which 1 cited earlier, seems to have allowed himself to get quite confused by clinging to the communication dogma. For Instance, In discussing WInograd's famous program for the understanding of English, he expresses the hope that - as is not the case In that program - an Isomorphism would be found to exist between the Internal and external languages in the case of our brains. There seems to me to be absolutely no reason to expect this, and I would think Barlow, at the time he wrote the paper, must still have thought that natural language by itself is so fundamental that the internal languages must in some sense merely mirror it.

4. THE BASE AND SEMANTICS OF LANGUAGE

I said earlier that language is for enabling effective and meaningful acts to occur. Now, as Sloman writes, "The most basic and primitive type of symbol-use is the execution of instructions." By the base of a unitary language I shall signify that part of the language which consists of instructions for some act to occur. The following are three examples which spring to mind: (a) In ordinary computer programs the machine-code would be part of the base, (b) In WInograd's language program I referred to earlier, which dealt with the manipulation of toy blocks of various shapes and colours, the base would include instructions like CLEARTOP, used for clearing off anything lying on top of a particular block to enable it to be used for some construction or other purpose, (c) In animals the base would Include, for example, instructions to muscle fibre to twitch.

Now the claim is, and it is a very large one, that all the functioning and meaning of language ("external" and "internal") is dependent on this base. It is a very large claim, and to substantiate it one must show how descriptive meaning can evolve out of so-called "procedural" meaning (the kind of meaning representation that was characteristic of WInograd's program). This is the main theme of Sloman's paper - in fact, he appears to consider this the central problem of the semantics of language.

I think the study of mental processes in general could benefit from a mathematical study of the properties of the class of languages possible with a given base. To some extent it might be modelled on the Turing theory of a universal computing machine, in which the base typically consisted of only four Instructions, say, "move to the left," "move to the right," "print 1," and "stop." But the theory would differ considerably from Turing's, because - firstly - much larger and more interesting bases would need to be considered, and - secondly - the languages to be considered would have complex structures and transformations like compiling, interpreting and others.

So much, or rather so little as far as this lecture is concerned, for the semantics and base of language. I now wish to say a little too about other consequences and aspects of the unitary view of language.

5± SOME ASPECTS OF THE UNITARY VIEW OF LANGUAGE

5#* Interaction of Modalities

It is inconceivable that the functioning of different modalities do not share a common language, for otherwise how could we envisage a cow when we hear a moo? Poets who compose sentences like, "the morning light creaks down the stairs," which make perfectly good sense to us are trying to re-create this common language. By the way, I am slightly inclined to think that poets and musicians may be readier to accept the views 1 am espousing than many biologists and computer scientists!

5.2 Origin of Natural Language

It has been notoriously difficult for linguists and other scholars to make progress on explaining how human language came Into being, and the fact that in spite of the large number of different languages all over our globe, there is much structural similarity in their grammars.

on the present view, language existed in man and animals long before so-called human language, and the question takes on a new form: how and when did our ancestors hit on the marvelous technical devices for bringing out their language "into the open," both by visual means (cave paintings and signs) and by aural ones (spoken words)? If this is indeed what

happened, then of course there would be o mystery about the similarity of our languages since presumably evolution would have generated substantially the same "internal" language in all members of our species.

5.3 Functioning of Art

Poetry is particularly interesting to consider since while it uses natural language exclusively, it seems - In so far as it Is poetry and not prose - to be attempting to evoke "deeper levels" of the internal language. It sets up resonances which are quite Indescribable in natural language and at best can only be conveyed by analogy* Some of the most effective, the most moving poetry is notorious for having no discernible "meaning" in the ordinary discursive sense, and yet clearly a very great deal of meaning in terms of mental process. It seems that, as in the example of "creaking light" I mentioned earlier, poetry tries to re-create, to mirror, to represent in natural language very significant parts of our "internal" language.

Music (I.e. pure music) eschews discursive language altogether, and so - not having to act through that pathway - appears able to make a more direct and often more powerful evocation of our "internal" language.

I shall say no more about the other arts, apart from remarking that the study of dance and the "language" of gestures generally, from the present point of view, might be particularly rewarding, because comparative studies of other animal species would be more feasible than for the aural, graphic and plastic arts.

5.4 Hypnotism, Dreams and "Inspiration"

The basic phenomenon in hypnotism must be the transfer of commands from the "external" to the "internal" language. It would therefore be a promising subject of Investigation for getting to know more about the relationships between different parts of the organism's language.

Dreams and the phenomena of "inspiration" are to be interpreted as relatively autonomous activities of the internal language and should therefore be able to throw light on its nature.

5.5 Psychology of the Unconscious

Freud of course Initiated the study of the internal language of human beings, in a bold, broadly categorical but crude way. In the field of artificial intelligence a start has already been made In the work of Colby and others to tease out, in much more detail than that of Freud, the internal languages at work in different kinds of mental disorder. But, from the present point of view, psychopathology becomes only part of the wider issue of the study of human language (especially Its "internal" part), and is likely to make more solid progress when the latter is better understood.

6. CONCLUDING REMARKS

Nobody could be more aware than I am myself of how sketchy this discussion has been. I have given little solid guidance on how one is to unravel the details of the structures and transformations of the unitary languages. But of course that is precisely one of the main objectives of the more basic types of research in artificial intelligence, and I may perhaps have succeeded in clarifying a little that objective and its import for understanding ourselves. Nor have I indicated that the paradigm I have been expounding is a fairly natural sequel to the work of the last decades on transformational grammar, with its emphases on "deep structure" and transformational schemata - in fact a view not so very different from the present one has been developed by a distinguished member of the "Chomsky" school, namely J.A. Fodor [3]. But perhaps the best way to end this talk and suggest where it is pointing is by an anecdote.

Some years ago, at the University of Edinburgh, before I pensioned myself out of it, the late Jacques Monod - the very distinguished French scientist - was invited to open officially the first university department of molecular biology in Britain. At a sherry party I was introduced to him, and by way of making conversation, and with my tongue largely in my cheek, I remarked, "I think that in fifteen or twenty year's time biology and artificial intelligence will have conflated into one subject." I thought such a controversial suggestion was good for a reasonably extended discussion. But Monod immediately flashed back, "Of course!" End of conversation, while I recovered my breath. Tonight's talk can appropriately end there, with my tongue now only half-way up my cheek.

REFERENCES

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[3] Fodor, J.A. The Language of Thought, Hassocks, Sussex, 1976.