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Thought Sequences and

The Language of Consciousness

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Consider the following episode, to be referred to as (1):

It is early evening. I am on my way back from the supermarket, and I pass through a small public garden. "It is a shame that I cannot pick some flowers for H., because it is dark," I think to myself. It occurs to me, however, that "but it is possible to buy" (flowers, that is), and I note that "she will enjoy me bringing her some". Consequently, I decide to "buy", I turn back and I go back to the supermarket in order to purchase some flowers.

The episode is the story of one thought sequence. Sequences of this type, I presume, are familiar to everybody. At various occasions we find that a thought is "passing in our heads": There is a trigger, several phrase-like expressions follow, and then one feels a break, an end. In the previous paragraph, the thought sequence is triggered by the sight of the bushes; it consists of four thought states (marked by inverted commas), and it terminates with a call for action. This form is general, thought sequences are cognitive entities characterized by beginning and end points which are well-demarcated and between which there is an ordered series of discreet steps that usually consist of linguistic-like thought expressions. The present paper is a brief report on a few patterns revealed in a comprehensive investigation of a large corpus of thought sequences I have collected over a period of several years. Such an investigation is interesting, I believe, because thought sequences constitute a natural cognitive kind, a genuine expression of the workings of the mind, not a reaction imposed on it by the demands of an artificial task (other such natural kinds are linguistic expressions, common-sensical inferences and dreams).

The corpus was collected by means of introspection. While in some paradigms of modern psychology, the method of introspection has been regarded as "the most fundamental of all the postulates of psychology" "what we have to rely on first and foremost and always" (James, in the Principles of Psychology), the method is commonly regarded as non-scientific and unreliable. Such a critical judgement, I think, stems from misappreciation of the appropriate usages of the method, and a failure to distinguish them from its abuses. The most notorious of all critiques of introspection have been raised in response to the research conducted in Würzburg at the beginning of the century. The members of the Würzburg school used introspection as a method for the direct solution of psychological issues. They believed that in order to find out how concepts are represented and processed, it is sufficient to look inside one's head and to observe. If one is perceptive, careful and experienced enough, one is bound to find a factual answer to the issue at hand (the Würzburgian subjects, recall, were the leading psychologists of their time). Introspection, however cannot be used for the direct solution of psychological issues and the generation of theories, but only for the collection of data. The analysis and modelling that ensue do not depend on introspection; in the present case they are conducted in a manner employed in the linguistic study of texts. As a consequence, the investigation is objective in the sense that it need not be confined to the study of one person, the one who had furnished the sequences. In fact, the study is based on the analysis of se-

quences furnished by several informants, and no significant individual variations were noted.

The use of introspection does require precautions. In order to safeguard against contaminations of memory and interpretation, all the sequences in the corpus were collected at the very time of their occurance. More important, however, are the analytical (not the technical) precautions. The employment of introspection sets limitations on the perspective by which the corpus may be examined. Clearly, there is no way to compare the thought expressions to any pure thoughts which underly them. Hence the analysis cannot deal with the structure of individual thought expressions, but only with the patterns which are exhibited by entire sequences These patterns are to be evaluated in terms of intrinsic coherence, not extrinsic correspondence. In fact, the present corpus exhibits both a systematic coherence and a completeness in that at present the probability for any new sequence to reveal a pattern not already specified in the model is close to nil.

That the topic of the investigation is sequences of thought expressions, not thoughts in any pure form, need not be viewed as a shortcoming. On the contrary the formulation of expressions in an inner code, which is very much like a natural language is itself a cognitive phenomenon. Clearly, not all thought processes are amenable to introspection: reaction time psychology, as well as psychoanalysis, attest to this fact. On the other hand, however, it is conceivable that the human mind would have been cnizant only of thought states which have practica ramifications, such as the call for action which terminates sequence (1). That the degree of resolution exhibited by thought sequences is of intermediate order is itself of cognitive significance Following this line of reasoning, the study of thought sequences by means of introspection cum linguistic analysis may be viewed not as the limed study of the shadows of thoughts, but as the genuine study of the language whose totality constitutes human consciousness.

From the present perspective the grammar of the language of consciousness is the set of mappings defined by the sequences of thought expressions. Local mappings define the relationship between t successive states in a sequence, but it appears that the history of the sequence is itself a det minant of its progression and that global mappin also need to be postulated in the grammar. For lack of space, only general patterns regarding t local mappings will be noted.

The different local mappings, it was found, cons tute different patterns defined on a small numbe of parameters. Most significant of these is the level serving as the basis for the mapping. Loca operations may be based on the relating of thoug expressions by means of stored links, content, structure or particular symbols. The first of th bases defines associations. Associations relate items in stored representation by means of a lin which is also stored. Associations vary accordin to the types of the representation they relate, the scopes associated with them. Representations may be lexical, semantic, episodic, phonological modality-specific, or motor; whereas scopes may volve one constituent, several constituents, or tire thought expressions. Traditionally, the ter "association" has been used to refer to lexical-lexical mappings of a unitary scope. In the pres corpus, however, instances of all possible assoc iations were encountered. (2) for instance, is a example of an association relating one constitue in the perceptual domain to one entire episodic phrase.

(2) 0. Hearing a tune.
   1. N. introduced me to this singer.

Content operations relate thought states on the basis of one's knowledge of the world. The items related by the mapping may themselves be either stored or generated. The operations may either supply further information regarding a given item specify similar information regarding other items.

Formal operations relate thought expressions by form, not content, hence they are most useful in the generation of new information. They include: negation, interrogation, generalization, specification and conversion. While the terms noted are familiar from logic, the operations they denote are more general than the traditional formal ones. Generalization, for instance, is an entire family of operations, which vary according to the parameter and scope of both domain and range. (3) is a fragment in which two applications of generalization are noted; the domains and ranges of each appreciation are underlined:

   (3) 1. to ask R. about it
      2. to ask adults about it
      3. to conduct experiments on adults.

The move from "ask about" to "conduct experiments", note,would not be classified as generalization in traditional treatises.

Lastly, operations whose basis is the particular symbol involve a shift in the perspective (reading or level) by which the given thought expression is processed. Here are two examples:

   (4) 0. Eating spaghetti with a spoon.
      1. Why isn't there a tool that will keep the noodles and let the liquid pass.
      2. fork

In (4) the shift is from the definition of the symbol to its specification, whereas (5) the shift is from one reading of a given string to another.

   (5) 0. (reading) I draw my finger across her forehead.
      1. An image of myself drawing my finger across L.'s forehead.

The typology of local operations is only one face of the study of thought sequences. The richness of the thought machine, it appears, is a product not of the possession of a rich repertory of many, complex operations, but rather of the rapidity and flexibility of their dynamics. Most notably the following cluster of patterns will be noted:

a) Each constituent of a thought expression is a fuzzy designator, which may trigger a thought operation through its different aspects, some of which may be only partially specified.
b) The sequencing of mappings is driven by shifts of scope whereby a thought expression may be generated via one constituent, but serve as the basis for another expression via another.

c) Similarly, shifts of levels are encountered. Some shifts are recursive, whereby the very application of an operation serves as the trigger for the next state in the sequence.

d) Throughout, the application of operations involves interactions, both amongst themselves and with other psychological modules.

Together, these patterns suggest the metaphor exemplified by the following episode (for me, an habitual pattern):

I am at the top of a steep rocky slope. I have to descend it, but I am afraid. My solution is to run down as fast as I can. I jump from one stone to another, and by avoiding being stationed at any one of them, I manage to transverse the entire route through them.

Returning to the cognitive domain, this cascade pattern seems to be the one that enables not only the processing of given information, but also its generation de novo.

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