

postulated the Synergistic Ecpory Model of Retrieval as a new framework which accounts for some of the findings of recognition and recall. In his earlier paper (Tulving 1976), recognition and recall are assumed to differ only with respect to the nature of retrieval information. However, the earlier hypothesis has been revised, based on the direct comparison experiment of recognition and recall. The Synergistic Ecpory Model of Retrieval is a framework which explains the findings of the direct comparison experiment. However, I will comment on two points: (1) the possibility of an alternative interpretation of the findings of the direct comparison experiment; and (2) the relation between the Synergistic Ecpory Model of Retrieval and the classical strength theory of memory.

(1) Effects of copy cues and of associative cues are found in the direct comparison experiment of recognition and recall. The former effects can be obtained from the fact that recognition performance is better than recall performance, and that a positive correlation between recognition and recall is shown. The latter is concerned with a negative correlation between false positive responses to associative cues in recognition and correct responses to those in recall.

To explain these results, Tulving proposes the Synergistic Ecpory Model of Retrieval, which integrates ephoric information and conversion thresholds. It seems to me, however, that there are alternative explanations for the results of the direct comparison experiment.

For example, one of the possible explanations is that retrieval attributes in recognition and recall are different (Tajika 1980). Tajika conducted a factor analytic study to extract retrieval attributes in recognition and recall. Two factors emerged. One is a discriminative attribute which associates with performance on tests of the explicit targets, the other is an associative attribute which is involved in generating the targets implicitly. This means that recognition and recall differ not only with respect to the nature of the retrieval information, but also with respect to the retrieval attributes. The copy cues task Tulving has used in the direct comparison experiment can be associated with performance on tests of the explicit targets, regardless of recognition or recall. As a result, recognition and recall will show a similar pattern of responses in the copy cues task. These results suggest a positive correlation between recognition and recall. Moreover, subjects process retrieval information better from copy cues in the recognition task than in the recall task, because the task may draw more on the discriminative factor. Therefore, recognition performance exceeds recall performance.

Let me turn to effects of associative cues. Tulving emphasizes that there is a negative correlation between the valence of associative cues and their false positive recognition rate. However, the recognition rate involves false positives. The correct recognition rate to associative cues is not shown in Table 14.2 of Tulving's book (1983b). Judging from the results of associative cues, the pattern of responses in the Recognition Group is similar to that in the Recall Group. If the results of the valence of associative cues and their correct recognition rate are analyzed, they will be positively correlated.

(2) Tulving insists that thresholds derived from the Synergistic Ecpory Model of Retrieval are different from those derived from the strength theory of memory with respect to retrieval information. I am impressed with the similarity of both kinds of threshold in Tulving's schematic diagram of the Synergistic Ecpory Model of Retrieval (Tulving 1983b, Fig. 14.3).

In the strength theory of memory, the threshold for recall is assumed to be higher than that for recognition. On the other hand, the name threshold is higher than that for the familiarity threshold under ephoric information, as Tulving states. As a result, both the Synergistic Ecpory Model of Retrieval and the strength theory of memory view recognition and recall as a single-stage process. It seems to me that both kinds of threshold

are similar, though Tulving points out that the thresholds he refers to are grasped regarding ephoric information, whereas in the strength theory of memory they are grasped with respect to the strength of the memory trace.

## Just how does ecpory work?

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It is now about twenty years since Tulving proposed distinguishing between accessibility and availability in memory. He has since systematically developed all the implications of this fruitful insight. The results of this theoretical work are impressive and his book, *Elements*, is certain to remain for a long time a reference not to be ignored by anyone who attempts to elucidate the mechanisms of memory. Nevertheless, although I agree with most of the author's basic tenets I cannot, for the moment at least, go along with the view that semantic and episodic memory are functionally *completely* independent one from the other. A priori, for the time being, although we cannot decide empirically, I do not understand why the syntactic-semantic system would not be rich and flexible enough to allow the encoding and the retrieval of spatial and temporal information. I cannot see any clear qualitative difference between the two following memories which "spontaneously" come to my mind: "I was born at the time of the Battle of Stalingrad" and "Victor Hugo was born a long time ago at the beginning of Napoleon's Empire." It is true that one of the two memories can be strictly biographical (episodic) and the other is factual knowledge (semantic), but in both cases the events are "temporally dated" and "spatially localizable"; in the two cases the memory indispensable to the production of language is involved, spatiotemporal relations are syntactically and semantically encoded and retrieved, and lastly, in both cases the discursive and pragmatic context is the essential determinant of the access to the memory.

A second problem touches on the access to memory information. Of course it is now hardly questionable that such access is the result of an interaction between the conditions of encoding and the conditions of retrieval. Just what is the exact nature of this interaction? Tulving discards the hypothesis that the individual, through simple association, activates a previously stored memory trace. According to him, this associative mechanism is characteristic only of semantic memory. Indeed, the associations that first attracted attention were the semantic associations (predominant, general ones) and only lately have we been concerned with episodic associations (not predominant, circumstantial, specific ones). But, for instance, the system of "horizontal" and "vertical" associations of Wickelgren (1979) conveys information of an episodic as well as a semantic nature. Moreover, we have been able to show that an association, normatively or semantically defined, between the context of recognition and the encoding context is an important determinant of recognition (Peris 1983; Peris & Tiberghien 1984; Tiberghien 1981). According to Tulving a memory does not exist prior to its retrieval but results from the "combination" between the retrieval cues and the momentarily available mnesic information. The hypothesis is of course a tempting one for it enables us to account for the extreme diversity of our subjective experiences of recollection with a remarkable economy of means. But now what metaphor can we choose to describe such a process: resonance, hologram, scanning? How can we define and operationalize the predictions derived from such a hypothesis? Personally I do not think that the associationist or neo-associationist solutions have been suffi-

ciently thoroughly investigated to be definitively discarded (Donaldson 1981; Hunt & Einstein 1981; Jones 1982; Mandler 1980; Murdock 1982; Ratcliff 1978).

If we want to take the explanation further, several conditions have to be satisfied. The first point is to specify what is implied by the concept of context of encoding or retrieval. Modalities of contextualization can be very different, and it is not certain that identical psychological mechanisms are involved in effects of context linked to the psychophysiological state of the individual ("state dependent learning"), in effects of context linked to general environment, in effects of "list context," or in effects of specific context. Likewise, there are undoubtedly different degrees of integration of the context and focal information ranging from simple context juxtaposed to the target to context that, together with the target, constitute a highly integrated mnesic representation (Baddeley 1982b; Godden & Baddeley 1980). It is not certain that the dynamics of these different effects of context are entirely reducible. Our personal preference for the moment is a mechanism of access to memory led by semantic associations ("horizontal" or "vertical," "intrinsic" or "extrinsic," "interactive" or "independent") between the context of retrieval and the context of encoding. Perhaps we should postulate a double mechanism of retrieval of memory information: a very rapid, not very conscious, almost automatic process of combination between contextual retrieval cues and memory trace; a much slower, conscious, and intentional process of associative search or reconstruction of memory representation (Mandler & Boeck 1974; Peris & Tiberghien 1984).

The second point is to improve noticeably our understanding of the concept of familiarity and more precisely to ask ourselves whether there might not be two different origins to the feeling of familiarity. Does perceptual information repeatedly encoded in the same context give rise to a feeling of familiarity equivalent to the one resulting from the encoding of perceptual information in multiple contexts (Lamon 1982)?

The final point is to find out whether or not the psychological mechanisms of identification of new information and of old information are strictly identical. If not, we would be faced with an important theoretical problem for, in fact, the peculiarity of new perceptual information is that it cannot be characterized by its former context of encoding. Besides, Tulving is perfectly aware of the problem since he raises a question about the mechanism capable of determining the acceptance or rejection of mentally evoked information. The puzzle is far from being solved since, for example, some researchers note, in human-face memory, effects of context of the same magnitude on correct recognitions and on false recognitions (Davies & Milne 1983a,b; Donaldson 1981; Thomson, Robertson & Vogt 1982, Exps. 2-7; Winograd & Rivers-Bulkeley 1977, Exp. 1), others note an effect of context only on correct recognitions (Bruce 1982, Exp. 2; Brutsche, Cisse, Deleglise, Finet, Sonnet & Tiberghien 1981; Thomson & al. 1982, Exp. 1; Winograd & Rivers-Bulkeley 1977, Exp. 2); and finally Bower & Karlin (1974) do not observe any effect of context, either on correct recognitions or on false recognitions. This lack of coherence is puzzling and one can rightfully wonder whether the psychological processes leading an individual to accept old information can be unreservedly assimilated to those that lead him to accept new information as being old.

Finally, another problem arises from the confrontation between Tulving's synergistic model and the theory of signal detection applied to memory. Taking up again a very old theory, a practice which is often fruitful, Tulving suggests that there are two different thresholds determining the conversion of the response: a threshold of denomination and a threshold of familiarity (McDougall 1904). If I have not misunderstood Tulving's line of reasoning, contextual variations should not modify these two thresholds but only the ephoric information resulting from the combination between contextual cues and mnesic traces.

Now this is far from being an absolute law since in 86 experiments we have examined (Lecocq & Tiberghien 1981) context affects the index of discriminability in 91% of the cases but equally affects the criterion of decision in 74% of them. How can Tulving's theory explain this sensitivity of the criterion of decision to the effects of context?

Despite the importance of theoretical questions which remain to be answered, Tulving's work is a necessary and long-awaited incentive for all the researchers interested in the study of human memory. Moreover, we hope that the necessarily technical nature of the theoretical debates will not prevent the reader from appreciating the personal remarks developed by Tulving in the expansion of his basic text. The context in which a theory originated and was developed is often as instructive as the theory itself (the context again!).

## Memory: Two systems or one system with many subsystems?

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There are many things in Tulving's *Elements* with which I agree, and some with which I tend to disagree. One of the points of disagreement concerns the interpretation of the episodic/semantic memory distinction. The distinction is undoubtedly an important one. Its heuristic value for distinguishing between tasks that involve differences in information, in operations, and in applications is unchallenged. The problem, however, is whether it is profitable to postulate two functionally different memory systems which can operate independently. I will argue that instead of a distinction between two memory systems a unitary memory system consisting of many interrelated subsystems may be preferable.

According to the currently prevailing view of information processing, the input resulting from a sensory stimulation undergoes a rapid automatic analysis at different stages or levels of abstraction (e.g., Craik & Lockhart 1972; Shiffrin 1976). Although much may be said about the order of activation of codes in these stages (e.g., Nelson 1979; Treisman 1979; Van der Heijden 1981) this need not concern us here. As a result of the analysis, a large number of memory codes, each connected in a systematic way to codes in previous or subsequent stages, is activated shortly after the onset of a sensory stimulation. Of these codes only those at the first encoding stage have a direct correspondence with the specific physical characteristics of the input. At all following stages codes are abstractions that represent the organized knowledge about the world.

It is this organized knowledge that makes up semantic memory. As Tulving (1983b, p. 69) notes, the common interpretation of the concept "semantic" as referring to word meanings is too restrictive. Semantic memory also includes knowledge about many other characteristics of verbal and nonverbal stimuli that are not necessarily verbalizable, such as natural sounds, voices, visual forms, textures of objects, melodies, mood states, tastes of food, and so on. With this extension of the concept "semantic" in mind, each of the encoding stages may be conceived of as one or more subsystems which are involved in processing different aspects of the same sensory stimulation.

The codes in the various subsystems remain activated for a short period of time and compete for the limited capacity for controlled processing (e.g., Posner & Warren 1972; Shiffrin & Schneider 1977). A subset of these activated codes is selected for controlled processing that consists of performing any of a number of elaborative operations. This set of selected codes, and probably some of the nonselected but simultaneously active