

Elaboration, Organization, and Hypermnesia for Words

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It has long been known that under certain circumstances memory can improve rather than decline over time, even though the person has had no further opportunity to study the target items. This phenomenon, first noted by Ebbinghaus, was formally documented in Ballard's classic studies of oblivescence and reminiscence in children's memory for verse. Nevertheless, for approximately 60 years a number of investigators sought vainly to reproduce Ballard's effect reliably and establish the conditions under which it could be observed. For this reason, Buxton described reminiscence 40 years ago as a "now you see it, now you don't" phenomenon. More recently, however, Erdelyi (1984) and his associates have succeeded in producing reliable reminiscence effects in the laboratory, at least for pictorial items, and a considerable literature has developed concerned with the mechanisms responsible for what is now known as the hypermnesia effect.

Our initial interest in hypermnesia came from the claim, common among psychotherapists and police investigators, that hypnosis could be used to refresh memory (a claim that is substantially incorrect; for a review, see Register & Kihlstrom, 1987). In the course of designing a series of studies on hypnotic hypermnesia, we conducted a systematic inquiry into hypermnesia effects in the normal waking state, both to perfect our experimental procedures and to understand the mechanisms underlying the effect (Klein & Kihlstrom, 1986; Mross & Kihlstrom, 1986).

Our first study, performed by Ernie Mross, was a replication of an earlier study by Shapiro and Erdelyi. Subjects were given a single visual presentation of a set of either 60 line-drawings of common objects, or the typewritten names of these objects, with 30 subjects in each group. The items were shown on separate 35mm slides at a rate of 5 seconds per slide. Following an initial recall trial lasting 7 minutes, the subjects were asked to relax and think about the items for an additional 5 minutes. This was followed by two more recall trials, separated by a 5-minute think interval. In order to reduce spurious effects arising from spontaneous changes in response criterion, the subjects were asked to recall 60 different items on each trial, guessing if necessary.

Slide 1 shows the average number of items recalled on each of the three recall trials. Analysis of variance revealed a significant main effect of trials, indicating that net recall increased significantly across the three tests of memory. However, while Shapiro and Erdelyi obtained significant hypermnesia only for pictures, Mross found hypermnesia in both conditions -- although admittedly the effect is greater for pictures than for words.

This finding led us to be interested in the factors affecting hypermnesia for words. Erdelyi has argued that imagistic memory has a privileged status with respect to hypermnesia. However, we suspected that hypermnesia has less to do with the structure of the memory trace than with how that trace is encoded -- that is, that well encoded memories, whether propositional or imagistic in nature, are more likely to be subject to hypermnesia. For that reason, we turned our attention away from hypermnesia for pictures to hypermnesia for words.

Our next experiments employed the "depth of processing" paradigm to control the encoding of verbal items. Subjects were presented with 64 personality trait adjectives, randomly assigned to four orienting tasks: orthographic, phonemic, semantic, and self-referent. The self-referent orienting task has been subject of much inquiry among personality and social psychologists: subjects are asked to decide whether a particular trait adjective described themselves. Research by Rogers and his colleagues has shown that self-referent processing is a very powerful encoding task, producing memory for that is far superior even to that of items subject to standard semantic processing.

Slide 2 presents the results of a study by Ernie Mross, based on earlier procedures developed by Stan Klein (Klein & Kihlstrom, 1986). There were 20 subjects in the experiment, which employed a within-subjects design and incidental learning. Analysis of variance yielded a significant interaction of trials with orienting task. Hypermnesia was obtained only for those words subject to self-referent processing. This finding is consistent with our hypothesis about encoding and is particularly interesting given the nature of the stimulus materials: they are highly abstract words, and thus it would seem difficult to argue that imagistic processing was responsible for the effect.

Nevertheless, Stan Klein repeated the experiment with another 20 subjects, dropping the phonemic condition and adding an imagistic one. He also dropped the third recall trial, as Mross' experiment indicated that most hypermnesia was accomplished on the second recall trial. Slide 3 shows that recall was inert in the imagery condition; replicating Mross's findings, significant hypermnesia was obtained only for the self-referent condition. So, we can conclude that the self-reference effect on hypermnesia is reliable and is not an artifact of imaginal processing.

But what precisely is it about self-referent encoding that enables hypermnesia to occur? In a series of papers, Roediger (1982) and his colleagues have argued that the growth of memory over repeated retrieval attempts is correlated with the level of retention displayed on the initial trial of the test series, rather than the amount of encoding initially received by the items (but see Payne, 1986). Encoding is of interest only because it happens to produce good initial retrieval. Supporting this argument, they analyzed cumulative recall curves and showed that there is a negative correlation between asymptotic recall and the rate at which that asymptote is approached. So, the smaller the difference between initial and asymptotic levels, the more recall will grow on each trial. According to this argument, pictures and self-

referenced words show hypermnesia simply because their initial recall levels are closer to asymptote.

Nevertheless, the level of recall argument is based on analyses of cumulative recall, and cumulative recall is not the same as hypermnesia. Cumulative recall curves reflect only the number of initially forgotten items recovered over succeeding trials and ignore initially remembered items that are subsequently forgotten; by contrast, hypermnesia refers to net increments in recall produced when intertrial recovery exceeds intertrial forgetting.

A third experiment by Ernie Mross clearly shows the difference between the two. A total of 18 subjects were run in a within-subjects design with two encoding conditions, phonemic and self-referent. Phonemic encodings typically produce extremely low levels of incidental recall, so Mross assigned four times as many items to that condition as to self-reference, yielding a total of 80 target items (64 plus 16). Slide 4 shows cumulative recall over three 7-minute recall trials separated by 7-minute think intervals. Items in both conditions showed significant cumulative recall. Although initial levels of recall are equivalent in the two conditions, the phonemic condition has a higher asymptote, and thus a lower rate of approach. Both curves fit the cumulative exponential function described by Roediger. However -- and this is the point of the demonstration -- only the self-referenced items showed hypermnesia. Slide 5 shows net recall -- intertrial recovery minus intertrial forgetting -- over the three trials: planned comparisons showed that there is a significant increase only in the self-referent condition. The moral of the story is that cumulative recall is indeed determined by the level of initial recall (relative to asymptote), but that cumulative recall is not to be confused with hypermnesia.

So, we're back to considering the effects of processing received by the items at the time of initial encoding -- and specifically to the nature of the self-reference effect. Rogers, taking his cue from standard analyses of the depth-of-processing effect, has argued that self-reference produces highly elaborate encodings. That is, items subject to self-referent processing are linked to the large fund of knowledge subsumed under the subject's self-concept -- thereby producing an extremely rich and distinctive memory trace. However, Stan Klein noted that self-referent processing also provides the subject with the opportunity to organize the target items into two categories -- those that are self-descriptive and those that are not. The standard semantic processing task, however, does not encourage organizational activity. Accordingly, the self-reference effect may reflect organizational rather than elaborative processing at the time of encoding.

To test this hypothesis, Klein conducted a total of five experiments to compare self-referent and semantic processing under conditions that either encouraged or prevented organizational activity (Klein & Kihlstrom, 1986). To make a long story short, self-referent processing was superior to semantic processing only when the self-referent condition encouraged organizational activity and the semantic task did not; when these conditions were reversed, recall was superior in the semantic condition. Although these studies focused on the results of a single recall trial, they

suggested that hypermnesia might be a function of organizational (interitem) rather than elaborative (single item) processing at the time of encoding.

Klein has now examined this hypothesis in a new series of studies, of which I will discuss just two. In the first, he asked independent groups of 28 subjects to make semantic or self-referent decisions concerning a list of occupation terms. Half the subjects received orienting tasks that subtly encouraged to organize the items into two categories, while the remaining subjects did not. Slide 6 shows the results for two five-minute recall tests separated by a five-minute think interval. There was a significant main effect of recall trial, qualified by a significant interaction between trials and orienting task. Hypermnesia was obtained only in the two organized conditions. Incidentally, it should be noted that the apparent interaction of orienting task and organizational activity is not significant. So, we can conclude that the hypermnesia obtained with the standard self-referent orienting task reflects organizational rather than elaborative processing activity.

Klein's second experiment employed more naturalistic behavior descriptions and eliminated self-referent processing. The 74 subjects were presented with 20 behavior descriptions (e.g., "avoided looking at the answers to the test") relevant to five personality trait categories. Half the subjects studied the list in anticipation of a memory test; the other half were asked to form an impression of the individual who engaged in the behaviors described. All subjects then received two 5-minute recall tests separated by a 5-minute think interval. Slide 7 shows the basic results. One of the interesting things about this procedure is that the memory set obviously involves intentional learning while the impression set involves incidental learning, yet a number of experiments on social cognition show that the impression set yields higher recall. This must be one of the few instances in which incidental is better than intentional memory. More relevant to present purposes, however, is the significant interaction between set and trials: hypermnesia is observed only in the impression set condition. We chose the impression set precisely because it makes salient the organization of the list in terms of personality traits -- in fact, clustering of the behavior by traits (indicated by the broken lines) is significantly higher under the impression set than under the memory set -- so the fact that hypermnesia occurs only in that condition is good for our hypothesis.

We have now produced significant hypermnesia for words presented under three different encoding conditions, but only when those encoding conditions encouraged organizational activity on the part of the subject, but not when organization is discouraged or impossible. However, we do not think that elaborative activity is unrelated to hypermnesia. In one of our studies, for example, we have observed significant hypermnesia in both elaborative and organizational conditions (Klein & Kihlstrom, 1986, Experiment 2). However, we do believe that our findings call attention to a neglected aspect of cognitive processing during learning. There appear to be two somewhat different sorts of activities: elaborative processing, which we consider to represent the linking of individual list items to pre-existing knowledge structures already available in memory; and organizational processing, by which we mean the linking of individual list items to each other.

Perhaps organizational activity is so important in hypermnesia for words because it allows initially recalled items to serve as retrieval cues for other items initially forgotten. We haven't yet worked out the details of this organization-based facilitation of recall, but our results clearly indicate that elaboration accounts of memory functioning will have to be supplemented by an appeal to organizational principles. Retention is maximal only when some degree of interitem organization takes place in addition to the elaboration of individual items. Organizational principles were once of central importance in theories of memory, but their importance has been overshadowed by the current emphasis on elaborative processing. Without detracting from this line of research at all, we wish to suggest that our theories and paradigms should once again consider the organizational activity of the learner.

Author Notes

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