Temporal Judgments about Natural Events

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The information one remembers about the time of an event is rarely as precise as one would like. For a few consequential events, exact dates can sometimes be recalled; for example, one might remember that John Kennedy's assassination took place on November 22, 1963 or that Pearl Harbor was attacked on December 7, 1941. But aside from these blockbuster events and from recurrent events like birthdays and holidays, exact and explicit dates are usually unavailable. Even fairly important events, such as Spiro Agnew's resignation or the DC-10 crash in Chicago, which could hardly have escaped our notice at the time of their occurrence, now are difficult to date accurately. Things could be otherwise. Events could be logged in memory in the way they are recorded in almanacs, and in this case determining when an event occurred would amount to simple table lookup. But since access to specific remembered dates is uncommon for ordinary events, it is of interest to examine the more indirect means that people use in reckoning how long ago such events happened.

With a few brave exceptions (e.g., Linton, 1975), previous research on temporal memory has been limited to the study of short intervals (on the order of minutes or hours) and to brief events (usually words or syllables) presented to the subject in the laboratory. Examples are the "time perception" experiments of Fraisse (1963) and Ornstein (1969), and the literature on recency judgments in list learning (e.g., Hacker, 1980). Our investigation focuses on people's accuracy in dating natural events over longer intervals. Like the earlier research, however, we employ experimental methods to test individuals' memory for such facts. In this respect, our studies parallel many current investigations of spatial knowledge and cognitive maps.

The Accessibility Principle

Consider an event such as the Chicago DC-10 crash, for which no exact date is retrievable. How could one go about estimating its relative time of occurrence? One possibility is based on the obvious fact that, generally speaking, the longer an event is retained in memory, the less one can remember about it. Thus, given events that are equivalent in other respects, the event about which one remembers most is likely to be the one that happened most recently. We call this rule the "Accessibility Principle," since it asserts that the more accessible the information about an event, the more recent that event will seem. Of course, this principle is hardly foolproof. Factors like the initial salience of an event or its similarity to other events can influence the amount of information retained about it, beyond any effect of sheer passage of time. There is even evidence that, under certain conditions, recallable information can actually increase with delay (Erdelyi & Kleinbard, 1978). Nevertheless, the Accessibility Principle may still be useful as a rough guide to the time of an event, even though subject to error from variables like salience (as we demonstrate below).

We view the Accessibility Principle as a close kin to the Lack of Knowledge Inferences described by Collins (1978) and to the Availability Heuristic of Tversky and Kahneman (1973). The difference is that while Lack of Knowledge and Availability are used to draw conclusions about frequency or probability, the Accessibility Principle yields conclusions about the age of unique events. In the former case, one reasons that since one can't remember the event well, it probably happened infrequently or not at all. In the latter case, one reasons that since one can't remember the event well, it probably happened long ago.

Subjective Age of Paired Events of the 1970's

A straightforward prediction of the Accessibility Principle is that events that are retrospectively vivid and memorable should seem more recent than events that are not (other things being equal). Consider, for example, the DC-10 crash in Chicago and the DC-10 crash in Antarctica of about the same period. Since the DC-10 crash in Chicago is comparatively more memorable than the one in Antarctica, the Chicago crash should be judged more recent, even though, in point of fact, it happened six months earlier (May 25, 1979 vs. November 28, 1979).

We tested this prediction in an experiment using 19 pairs of events like the two DC-10 crashes that were matched as closely as possible for actual time of occurrence and for the content of the events themselves. The pairs included sports and cultural events (e.g., Saul Bellow wins the Nobel Prize vs. Burton Richter wins the Noble Prize) as well as standard news stories, all of which occurred between 1973 and 1980. Within each pair, one of the events was designated as more memorable than the other on the basis of ratings collected from two judges, neither of whom were aware of the hypothesis under investigation. A complete list of the pairs, together with their true dates and memorability status, is given in Table 1. In the experiment proper, the 38 individual events were read to subjects in random order, and the subjects were asked to respond to each with a number that best represented how recently the event happened. The numbers were chosen from a 0-to-9 scale, with high values corresponding to recent events and low values to old ones. We informed subjects before the start of the experiment that all of the events took place after 1970. Since the 15 subjects were of college- or graduate-student age, all of them had lived through the time of the target incidents.

Mean recency ratings from these subjects are also displayed in Table 1. Although on average the true date of the memorable events is slightly earlier than that of the less memorable ones (a difference of .05 years), subjects' ratings place the memorable events later. The overall mean rating for the memorable events is 5.7, whereas the mean for the less memorable events is 5.1. These ratings differed significantly when either subjects or event pairs are considered a random effect [for subjects, $F(1,14) = 20.43$, $p < .01$; for events, $F(1,18) = 4.58$, $p < .05$; however, quasi-$F(1,25) = 4.01$, $.05 < p < .10$]. As an example of this

Accessibility outcome, 80% of the subjects rated the Chicago DC-10 crash as occurring after the Antarctica crash, despite the fact that the opposite order is the correct one. Table 1 also reveals a number of exceptions to the Accessibility predictions, although in most cases these are from pairs in which the difference in memorability is small. As one would expect, the correlation between memorability and recency ratings is significant for these stimulus items [$r(36) = .38$, $p < .05$].

Recall and Perceived Age of Events in 1982

Although our prediction was confirmed that more accessible events seem more recent, measurement of accessibility (the memorability ratings) was fairly indirect for the events of the first study. In a second experiment, we have evaluated accessibility more directly by measuring subjects' recall of events, rather than relying on ratings. We predict that the larger the number of propositions about an incident that a subject can recall, the more recent that incident will seem. In this new experiment, the basic recency judgments and recall protocols were obtained from separate subject groups. Notice, however, that the act of recall may itself make the associated events more accessible. For this reason, it is of interest to compare recency ratings from subjects who have just completed recalling the events and recency ratings from subjects who have not engaged in recall. If recall increases accessibility, then ratings of recency-after-recall should be systematically greater than ratings of recency-without-recall.

The target events in this study were 40 headline-type incidents that were culled from the front pages of the Chicago Tribune and the New York Times between January 4 and January 11, 1982. This collection of events included items such as: Richard Allen resigns as National Security Advisor, the first U.S. test-tube baby leaves the hospital, and the U.S. drops its anti-trust suit against IBM. Since we were interested in tracking the relationship between recency and recall at different intervals after the events took place, we tested several independent groups of subjects: one Recall and one Recency group during the week immediately following the last target event, a second pair of Recall and Recency groups during the week beginning 15 days after the last event, and a third pair 60 days after the last event. To assess our hypothesis that recall increases apparent recency, we also asked subjects in the 60-day Recall group for recency ratings after they had completed their recall protocols. Recency ratings were elicited in a way similar to that of the first experiment (except that the subjects were told that the events happened in the 1980's rather than the 1970's). Recall subjects were given the same event names (e.g., Richard Allen resigns) and were asked to write down all of the facts they could remember directly related to the named events. The recall score for each incident was calculated as the average number of true atomic propositions recalled about it (see Kintsch, 1974). Stricter scoring methods (e.g., counting only directly relevant true propositions) yielded the same pattern of results. Fifteen subjects participated in each of the Recall and Recency groups.

The main results from this second study are given in Table 2 in the form of Spearman correlations between recency ratings and recall scores. Also shown in Table 2 are the correlations between recency and the events' true dates. Two facts about these data stand out. First, as the Accessibility Principle predicts, recall and recency are significantly correlated at each of the three intervals. Data from the first interval are especially interesting since they are least likely to be influenced by media retellings and follow-up reports. Second, and somewhat surprisingly, the number of propositions recalled is a better predictor of recency than the actual date of occurrence at all three intervals. In addition, a trend in the rating data followed the prediction that subjective recency would increase following recall. The average recency rating after recall was 5.7 for subjects in the 60-day Recall group; however, the average rating from the 60-day Recency group was 5.3. But although this trend was significant when tested over events [$F(1,39) = 13.07$, $p < .01$], it was nonsignificant when tested against subjects [$F(1,28) = 1.28$, $p > .10$].

Implications

According to the Accessibility Principle, the apparent age of an event depends upon the amount of information about it that one can bring to mind. This principle gained credence from the results of our first study, in which more memorable events were rated as taking place more recently than similar events of approximately equal objective age. The second experiment strengthened the case for Accessibility by demonstrating that the number of facts recalled about an event is a powerful predictor of its subjective time of occurrence. We have little doubt that other cognitive processes can also affect temporal judgments for natural events like these. As we have acknowledged, certain influential or recurrent events may be tagged with dates; the time of lesser events may be estimated through their causal connections to these influential ones. Still, a glance at the items in Table 1 suggests that causal links to datable events may not always be present, and in these circumstances, the Accessiblity Principle may be the dominant method for temporal judgments.

The Accessibility hypothesis bears an analogy to classical strength theories of time perception, which predict that the strength of the memory trace at the time of test determines the apparent age of the associated event (see the references cited by James, 1890, Pp. 632-633, and more recently, Hinrichs, 1970, and Morton, 1968). Pure strength theories, however, have not fared especially well in tests involving multiple list learning (Hintzman & Block, 1971; Flexser & Bower, 1974). By implication, these earlier results suggest that the mechanism responsible for our accessibility effects is not as simple as a unidimensional quantity connected to one's memory for an event. Our experiments leave the exact nature of the underlying mechanism as an open question. Nevertheless, the similarity mentioned above between the Accessibility Principle, the Availability Heuristic, and Lack of Knowledge Inferences may indicate that we are tapping part of a very general and complex inductive procedure.

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TABLE 1
Stimulus Events, True Dates, and Mean Recency Ratings, Experiment 1

Event Pairs	Date	Recency Rating
1. Reagan and Bush nominated by the Republican convention.	7/80	8.2
Carter and Mondale nominated for a second term by the Democratic convention.	8/80	7.5
2. Dustin Hoffman won an Academy Award for Kramer vs. Kramer.	4/80	7.8
Sally Field won an Academy Award for Norma Rae.	4/80	7.2
3. A DC-10 crashed in Chicago.	5/79	7.1
A DC-10 crashed in Antarctica.	11/79	5.5
4. Lord Mountbatten assassinated in Ireland.	8/79	5.9
U.S. Ambassador Adolph Dubs assassinated in Afghanistan.	2/79	6.7
5. The Supreme Court affirmed a lower court decision ordering California Medical School to admit Allan Bakke.	6/78	6.5
The Supreme Court ruled that labor unions could distribute material of a political nature at an employment site.	6/78	5.1
6. David Berkowitz was arrested on a murder charge.	8/77	6.7
Gene Leroy Hunt was arrested on a murder charge.	4/78	5.3
7. West German terrorists hijacked a Lufthansa airliner.	10/77	6.0
An alleged bank robber, Thomas Hannan, hijacked an airplane in Nebraska.	10/77	4.1
8. Roots won an Emmy Award.	9/77	6.5
Eleanor and Franklin won an Emmy Award.	9/77	6.1
9. Annie opened on Broadway.	4/77	6.1
The Gin Game opened on Broadway.	10/77	3.5
10. Saul Bellow won a Nobel Prize in literature.	10/76	5.4
Burton Richter won a Nobel Prize in physics.	10/76	4.3

TABLE 1 (cont.)

11. Bruce Jenner won an Olympic Gold Medal in the decathlon.	7/76	5.1
Evelin Schlaak won an Olympic Gold Medal in the discus throw.	7/76	3.9
12. Mao Tse-tung died.	9/76	4.8
Chou En-lai died.	1/76	5.4
13. Muhammad Ali KOs Joe Frazier.	10/75	4.3
Muhammad Ali KOs Jean-Pierre Coopman.	2/76	4.6
14. E. L. Doctorow's Ragtime published.	7/75	4.7
Irving Stone's The Greek Treasure published.	9/75	5.0
15. Linda Ronstadt's Heart Like a Wheel won a Gold Record.	1/75	6.3
John Denver's An Evening with John Denver won a Gold Record.	2/75	4.6
16. Aristotle Onassis died.	3/75	4.8
H. L. Hunt died.	11/74	5.1
17. Steve Garvey wins baseball's Most Valuable Player award.	11/74	5.3
Jeff Burroughs wins baseball's Most Valuable Player award.	11/74	4.1
18. Patty Hearst kidnapped.	2/74	4.1
J. Reginald Murphy, editor of the Atlanta Constitution, kidnapped.	2/74	5.1
19. Spiro Agnew resigned as Vice Pres.	10/73	3.0
Nelson Rockefeller resigned as Governor of New York.	12/73	4.5

Note. The first member of each of the pairs was rated as the more memorable. The standard error of the above means is .46.

TABLE 2

Spearman Correlations between Recency Estimates, True Dates, and Number of Recalled Propositions, Experiment 2

	Number of Propositions Recalled	True Date
Recency Rating		
+0 Days	.80***	.18
+15 Days	.69***	.41**
+60 Days	.68***	.34*

*p < .05
**p < .01
***p < .001