

# Effect of Temporal Focus on the Recall of Expectancy-Consistent and Expectancy-Inconsistent Information

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This research examined the impact of temporal focus on the recall of information that is consistent or inconsistent with an expectation. A consistent pattern of results across 4 experiments indicates that when Ss' expectations are temporally unfocused, better memory for consistent information is observed. In contrast, when expectations are focused in time—that is, Ss know when the relevant events are likely to occur—recall for consistent and inconsistent information is more balanced. Experiment 4 tied these recall findings to the amount of processing devoted to consistent and inconsistent events. When expectations were temporally unfocused, processing time and recall was greater for the confirmatory information. When expectations were temporally focused, more equivalent processing time and recall of consistent and inconsistent information was observed. Discussion centers on the role of temporal focus as a determinant of whether an event is one-sided or two-sided.

All superstition is much the same, whether it be that of astrology, dreams, omens, retributive judgment or the like, in all of which the deluded believers observe events which are fulfilled, but neglect or pass over their failure, though it be much more common.

—Francis Bacon (1620/1899, p. 321)

Conventional wisdom, captured with characteristic eloquence by Francis Bacon (1620/1899), posits an asymmetry in the type of evidence that people bring to bear on their beliefs and expectations. Evidence that confirms a person's expectations is thought to be readily noticed and eagerly accepted; disconfirmatory evidence, in contrast, is passed over or vigorously refuted. The existence of various folk beliefs such as "it always rains after you wash the car," "the subway always seems headed in the wrong direction," or "people act strangely during a full moon," appear to support this particular aspect of conventional wisdom. In each case, it seems that the confirmatory events stand out and are better remembered. Such beliefs can thus appear to be irresistible "facts" of a person's everyday experience.

People's intuitions about the kind of information they are inclined to remember has received considerable support from psychological research. Numerous studies have shown that people's expectations guide their interpretation of new material and facilitate the pick-up and retention of information consistent with their beliefs and suppositions (Barlett, 1932; Bodenhausen, 1988; Cohen, 1981; Rothbart, Evans, & Fulero, 1979;

Snyder & Uranowitz, 1978; Stangor & Ruble, 1989; Taylor & Crocker, 1981; Zadny & Gerard, 1974).

As is the case with much conventional wisdom, however, the actual state of affairs is more complicated than it initially appears. There is also a body of evidence indicating that it is often the information that is *inconsistent* with a person's expectations that stands out and is better remembered (Bargh & Thein, 1985; Gilovich, 1983; Hastie & Kumar, 1979; Srull, 1981; Srull & Wyer, 1989; Stern, Marrs, Millar, & Cole, 1984). Greater recall of inconsistent information tends to be observed when the discrepancy is particularly jarring or vivid, or when it triggers attributional processing (Gilovich, 1983, 1991; Hastie, 1984).

Thus, with respect to how people process information that is consistent or inconsistent with an expectation, the predictions of folk wisdom have met with mixed success in the laboratory. Sometimes people do indeed recall consistent information better than information that contradicts their expectations, but sometimes the opposite is the case. The goal, then, is to devise a satisfactory explanation for this divergent pattern of results. The most widely accepted attempt at integration emphasizes the degree to which new information violates an initial expectation (Hastie, 1981; Hastie & Kumar, 1979; Hastie & Mazur, 1978; Wyer & Gordon, 1982; see Fiske & Taylor, 1991; Higgins & Bargh, 1987; Stangor & McMillan, 1992, for reviews). According to this account, information that fits our initial expectations is better remembered than irrelevant or moderately discrepant information, but not as well as information that is truly discrepant. Although this account has much to commend it, the supporting evidence is not as strong as is often claimed (cf. Higgins & Bargh, 1987). Apparent demonstrations of superior recall of inconsistent information are sometimes little more than set-size effects (i.e., small subsets of the target items being more memorable by virtue of their rarity). Studies that have unconfounded set size and the consistency-inconsistency of information typically have not found superior recall of information that violates an expectation (Belmore & Hubbard, 1987; Hastie & Mazur, 1978; Hemsley & Marmurek, 1982). Further-

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more, critics have claimed that the expectations induced in these experiments are too weak to have much bearing on the degree to which strongly held beliefs influence people's recall of new information (cf. Higgins & Bargh, 1987). Finally, nearly all of the relevant evidence comes from the domain of person memory (i.e., whether behavioral information consistent or inconsistent with a personal impression is better remembered). Although this domain is certainly an important topic of study for social psychologists, the results from this area may not allow us to generalize to the effect of more general beliefs—such as those described by Francis Bacon (1620/1899)—on the recall of consistent and inconsistent information.

To come to grips with the memorial effects of more general beliefs and expectations, we have introduced a distinction between one-sided and two-sided events (Gilovich, 1991). *Two-sided* events are those that stand out and register as events regardless of how they turn out. For instance, when a person bets on a sporting event, both outcomes (i.e., a win or a loss) are likely to be significant, and therefore both are likely to be noticed and remembered. Thus, the outcome of a sporting event can be considered a two-sided event. The same could be said of, say, buying stock, going on a date, or taking a vacation: Whether favorable or unfavorable, both outcomes command attention and register as events. We predict that folk wisdom is not particularly applicable to such two-sided events because both outcomes tend to stand out in one's experience, and information that fits one's expectation does not enjoy much of an advantage in recall.

*One-sided* events, in contrast, are those that stand out and are mentally represented as events only when they turn out one way. Consider the belief that "the phone always rings when I'm in the shower." If the phone rings while an individual is showering, it becomes eventful because of the set of behaviors involved in attempting to answer it (e.g., deciding whether to answer, running dripping wet to the phone, and experiencing the frustration when no one is on the other end). In contrast, if the phone does not ring while a person is showering, it is unlikely to register as an event. Nothing happened. Logically, such a nonoccurrence is just as much of an event as an occurrence, but phenomenologically it is not (cf. Agostinelli, Sherman, Fazio, & Hearst, 1986; Fazio, Sherman, & Herr, 1982; Newman, Wolff, & Hearst, 1980). We believe it is these one-sided events to which folk wisdom best applies, and information consistent with an expectation is likely to be noticed and subsequently recalled.

Of course, for this distinction between one-sided and two-sided events to be useful, it is essential to be able to specify the determinants of whether an event is likely to be one- or two-sided. One potential determinant examined in this article is whether a person's expectations are temporally focused or unfocused. *Temporally focused* expectations are those for which the relevant outcome occurs at a particular point in time known in *advance*. For example, an expectation that a particular team will win a given sporting event focuses one's attention on what occurs at the relevant moment (the end of the game) and, as a consequence, either outcome (a win or a loss) is likely to be noticed and remembered. Thus, the expectation is temporally focused, and the outcome is two-sided. In contrast, if a psychic predicts an upturn in a person's fortune, the resulting expectation is not anchored at any particular point in time, and it is

thus *temporally unfocused*. As with most unfocused expectations, the relevant events are inherently one-sided: Information consistent with the expectation is likely to stand out as more of an event than information at variance with the expectation. Thus, we predict that when expectations are temporally unfocused, greater recall will be observed for consistent than inconsistent events. However, when expectations are temporally focused, people's recall of the two types of information will be more balanced.

Stated differently, what temporal focus does is regulate attention. When one knows when a critical event will occur, one looks for the relevant information at that moment, and so either outcome—success or failure, confirmation or disconfirmation—stands out from the stream of ongoing experience. Because one's attention is focused equally on either outcome, neither enjoys much of a recall advantage. In contrast, when one's expectations are not temporally focused, one does not know where or when to look for the relevant information, and one's attentional focus is determined by the quality of the events themselves (cf. Agostinelli et al., 1986; Fazio et al., 1982; Newman et al., 1980; Treisman & Souther, 1985). More often than not, we believe, it is the information that confirms people's expectations that more readily commands their attention. Temporal focus, then, has the greatest impact on the recall of information that is inconsistent with an expectation. Events that confirm a precisely articulated expectation tend to attract people's attention whether they know the timing of their likely occurrence or not, and so they benefit little from the attentional "spotlight" created by a temporally focused expectation. On the other hand, events that are at variance with an expectation tend to be less salient, and therefore they profit a great deal from more directed attention.

This article presents four experiments that examined the impact of temporal focus on the recall of consistent and inconsistent information. Experiment 1 simulated the essential psychological processes underlying differences in temporal focus by permitting some subjects to know at what point the relevant events would occur, whereas other subjects had to extract the relevant events from the background of "filler" information. Experiments 2 and 3 investigated temporal focus more directly by varying the temporal specificity of the prediction. Finally, Experiment 4 examined differences in processing time for consistent and inconsistent information as a function of temporal focus.

## Experiment 1

### Method

*Subjects.* The subjects were 56 Cornell undergraduates who received course credit for their participation. Eleven subjects (3 in the temporally focused condition and 8 in the temporally unfocused condition) failed to recall any events at all, and thus their data were deleted from the analyses. All reported analyses are thus based on the data from the remaining 45 subjects.<sup>1</sup>

<sup>1</sup> The significant effects in all experiments reported here remain unchanged when the subjects who failed to recall any events at all are included in the analyses.

*Procedure.* Expectancies were induced in all subjects by having them read a diary purportedly written by a fellow student. The subjects were instructed to read the diary carefully to form an impression of its author. In the first day's entry, the student mentioned her interest in psychic phenomena and dream prophecy. After discussing different scientific viewpoints on the topic to make the phenomenon of psychic prediction seem plausible to our more skeptical subjects, the author of the diary indicated that she intended to conduct her own informal test of dream prophecy by writing down each night's dream and the events that occurred the following day and then determining if there was any relation between the two. There were 10 entries in the diary. In the first entry, the writer discussed her interest in the paranormal. On Day 6, the writer reported not having a dream the night before. Thus, dream prophecies were made on 8 days. The diary entries for the different days contained an average of 11.2 sentences that reported an average of 5.4 events typical of undergraduate life (e.g., discussions of school assignments, meals, social life, and extracurricular activities).

Each dream was paired with an event that was either consistent or inconsistent with the dream content. Of the eight dream prophecies (e.g., "I dreamt of people being happy"), four were paired with consistent events (e.g., "Our class shouted with joy when our teacher canceled the final") and four with inconsistent events (e.g., "Our class moaned with disappointment when our teacher assigned a paper due after spring break"). The order of presentation of the dream prophecies was random. Two versions of the diary were constructed, with the pairing of consistent and inconsistent events with each prophecy counterbalanced across versions.

Subjects were randomly assigned to either the focused or unfocused condition. In the focused condition, the dream was placed at the beginning of each day's entry, and the most significant event relevant to the dream was placed at the end, set off from the rest of the text by a bold label: "The most significant event of the day." Thus, subjects' attention was focused on a particular point in the diary where information that was consistent or inconsistent with the dream was provided. It was expected that in this focused condition both consistent and inconsistent information would be equally noticed and remembered.<sup>2</sup>

In contrast, in the unfocused condition, the dream was presented at the beginning of each entry, but the consistent or inconsistent target events were embedded somewhere in the text for that day. Thus, subjects could not expect this information to be presented to them at a particular location, and their attention was not automatically drawn to both consistent and inconsistent information. It was predicted that under these conditions the target events that confirmed the expectation would be more likely to "pop out" and attract the subjects' attention (Treisman & Souther, 1985).

Subjects read the diary at their own pace. Following a 1-min distractor task in which subjects converted fractions to percentages, they were asked to recall as many of the dream-event pairs as possible. Subjects were then asked to estimate the proportion of dreams that were followed by confirmatory, disconfirmatory, or irrelevant events in the following day's diary entry.

*Stimuli.* To ensure that the consistent and inconsistent events were equally memorable, two steps were taken. First, 24 subjects, none of whom participated in the experiment itself, were presented with a list of the 16 events (8 dream-consistent events and 8 dream-inconsistent events) presented out of context (i.e., without the corresponding dreams). After a brief filler task, they were asked to recall as many of the 16 events as they could. The results revealed that the subjects did not recall any more of the dream-consistent events ( $M = 3.75$ ) than of the dream-inconsistent events ( $M = 3.54$ ),  $t(23) < 1.0$ .

This same group of 24 subjects also rated the vividness of each of the 16 events on a 19-point scale, with 1 labeled *not vivid at all* and 19 labeled *extremely vivid*. There was no difference in subjects' ratings of dream-consistent ( $M = 12.7$ ) and dream-inconsistent events ( $M = 13.5$ ),  $t(23) = 1.58$ , *ns*.

*Scoring criteria.* We counted as correctly recalled only those prophecies for which both the dream and the target event were reported. However, it was not necessary for the subject to recall either portion verbatim: Dreams and target events were scored for gist. The scoring was done by a judge who was unaware of the hypothesis. A second judge, unaware of subjects' condition, scored the responses of 20 randomly chosen subjects. The two judges were in perfect agreement with respect to the inconsistent events ( $r = 1.0$ ) and in near-perfect agreement on the consistent events ( $r = .96$ ).

## Results

*Recall.* The recall data are presented in Table 1. An inspection of these data indicate that the results conformed to our predictions. When subjects' attention was focused on the expectancy-relevant information, they recalled roughly equal proportions of consistent and inconsistent events. In contrast, when subjects' attention was unfocused, they recalled almost three times as many consistent events as inconsistent events.

To assess the statistical significance of these results, we performed a 2(condition: focused vs. unfocused)  $\times$  2(event type: consistent vs. inconsistent) mixed analysis of variance (ANCOVA), with the last factor a within-subjects variable. The ANOVA uncovered two main effects. First, subjects in the focused condition recalled more information overall than those in the unfocused condition ( $M_s = 56.8$  and  $41.3$ , respectively),  $F(1, 43) = 6.63$ ,  $p < .05$ . Second, subjects recalled a larger proportion of consistent dream-event pairs ( $M = 61.1$ ) than inconsistent dream-event pairs ( $M = 36.7$ ),  $F(1, 43) = 36.46$ ,  $p < .0001$ . However, these main effects were qualified by the predicted interaction between condition and event type,  $F(1, 43) = 13.76$ ,  $p < .001$ . Analyses of the simple main effects for each condition showed no difference in the recall of consistent and inconsistent dream-event pairs among subjects in the focused condition,  $F(1, 43) = 2.47$ ,  $p = .12$ , but a substantial difference in the recall of consistent and inconsistent dream-event pairs on the part of those in the unfocused condition,  $F(1, 43) = 47.75$ ,  $p < .0001$ . Stated differently, subjects in the two conditions recalled equal proportions of consistent dream-event pairs ( $F < 1$ ), but those in the unfocused condition recalled significantly fewer inconsistent dream-event pairs than their counterparts in the focused condition,  $F(1, 43) = 16.99$ ,  $p < .0001$ .

*Subjective estimates.* Recall that subjects were asked to estimate the proportion of the target person's dreams that were followed by events that were consistent, inconsistent, or irrelevant with respect to the prediction. These data are also presented in Table 1, and they reveal a pattern that largely reinforces the recall data. Subjects who read the diary under conditions in which their attention was unfocused estimated that the dream prophecies were confirmed twice as often as they were disconfirmed. Those who read the diary with their attention focused on the expectancy-relevant information, in contrast, estimated that the number of prophecies that were confirmed

<sup>2</sup> Of course, by highlighting the dream-relevant events in this way, we might increase subject's recall of *all* dream-relevant events. Such an overall increase, however, cannot produce our predicted pattern of results, which is that temporal focus will interact with event type and lead to improved recall of inconsistent events only.

Table 1  
*Mean Percentage Recall and Subjective Estimates as a Function of Event Type and Attentional Focus*

Event type	Condition	
	Focused ( <i>n</i> = 22)	Unfocused ( <i>n</i> = 23)
	Recall	
Consistent		
<i>M</i>	61.4	60.8
<i>SD</i>	22.8	24.8
Inconsistent		
<i>M</i>	52.3	21.7
<i>SD</i>	26.6	22.9
	Subjective estimates	
Confirmatory		
<i>M</i>	46.7	52.4
<i>SD</i>	15.8	23.7
Disconfirmatory		
<i>M</i>	36.7	26.0
<i>SD</i>	13.4	15.9
Irrelevant		
<i>M</i>	16.5	21.6
<i>SD</i>	13.9	28.4

or disconfirmed were more nearly equal. Stated differently, subjects in the two conditions did not differ much in their estimates of the prevalence of confirmations, but they did differ more substantially in their estimates of the prevalence of disconfirmations. Because subjects' estimates were obviously not independent (i.e., each subject's estimates of the percentage of confirmed, disconfirmed, and irrelevant events must sum to 100), we tested the significance of the observed pattern of results with a single, between-groups comparison. In particular, we chose to examine the category of information (disconfirmatory events) that seemed to discriminate the most between the two focus conditions on both the recall and subjective estimate data. This test revealed a significant difference between the two conditions,  $F(1, 43) = 5.86, p < .05$ .

*Correlational analyses.* As one would expect, subjects' estimates were correlated with the content of what they recalled. In particular, the correlation between the percentage of inconsistent events recalled and subjects' estimates of the percentage of dreams that were followed by disconfirmatory events was .38 ( $p < .01$ ). For the consistent events, the corresponding correlation was less strong ( $r = .23, p < .15$ ).

## Discussion

When subjects' attention was focused on the expectancy-relevant information, they recalled nearly equal proportions of the consistent and inconsistent events. In contrast, when their attention was not focused, and the relevant events had to be extracted from a backdrop of mostly irrelevant information, they tended to recall more of the information that was consistent with the original hypothesis or expectation.<sup>3</sup>

In this experiment, we manipulated the focus of subjects' attention by varying the location and format of the critical ex-

pectancy-relevant information. This is obviously a step removed from our real interest in the effect of temporal focus on recall. Nevertheless, we chose to manipulate the focus of subjects' attention in this first experiment to simulate what we believe are the essential psychological processes engaged by differences in temporal focus. In the focused condition, subjects could anticipate the appearance of the expectancy-relevant information, and therefore their attention was focused equally on both consistent and inconsistent events. In the unfocused condition, in contrast, the appearance of the expectancy-relevant information could not be anticipated, and so it had to be extracted from the backdrop of extraneous events. As anticipated, the events that confirmed subjects' expectations stood out more clearly from this background and were better recalled.

What happens when temporal focus is examined more directly? Can the same effects be obtained through a manipulation of temporal focus itself? It is to these questions that the next experiment is addressed.

## Experiment 2

This study was modeled after the real-world tendency for predictions to vary in their temporal specificity. Some predictions carry no indication of when they are likely to occur (e.g., "You will meet a tall, dark stranger"). Others are more specific (e.g., "The Republicans will regain the White House in 1996"). According to our analysis, the more temporally specific the prediction, the more one's expectations are temporally focused, and the more nearly equivalent will be one's recall of confirmatory and disconfirmatory events. Temporally specified predictions serve to direct one's attention to the precise point in time when the critical event is deemed likely to occur. Because one's attention is so sharply focused on the critical moment, any event—whether it confirms or disconfirms one's expectation—is likely to be noticed and remembered.

## Method

*Subjects.* The subjects were 81 Cornell undergraduates who received course credit for their participation. The data from 3 subjects (2

<sup>3</sup> A few words are in order about the nature of the expectations induced in our subjects. The stimulus materials in all four experiments reported here describe an individual who decides to test whether dreams or premonitions can prophesize future events. Thus, the "expectation" on the part of our subjects was a rather detached, vicarious one, and we do not claim that all of our subjects were firmly convinced that the dream prophecy hypothesis would be confirmed. Nevertheless, we expected even this mild expectation (or hypothesis really) to guide subjects' processing and recall of the stimulus information in the predicted fashion. It should be noted that we attempted to ascertain the strength of subjects' expectations by administering two scales that assessed subjects' beliefs in extrasensory perception and the prophetic nature of dreams. Unfortunately, subjects' responses on these two scales showed minimal variability, with only 15% of our subjects checking a value beyond the neutral, or "agnostic," midpoint of either scale. As a consequence, the relationship between belief in the paranormal and memory for consistent versus inconsistent events was quite variable and uninformative across the four studies reported here.

in the temporally specified condition and 1 in the temporally unspecified condition) were deleted from the analyses because of their failure to recall any events at all. All analyses were based on the data for the remaining 78 subjects.

*Procedure.* As in Experiment 1, expectancies were induced by having subjects read a diary purportedly written by a fellow student. The nature of the expectancies and the structure of the student's diary were somewhat different, however, and so the subjects first read the following instructions:

The following is an excerpt taken from the diary of an undergraduate student. This student had participated in a study on extrasensory perception (ESP) conducted by the psychology department at Cornell. The student was one of many who expressed a belief in ESP and who thought that she might have it herself. The student was placed in a Ganzfeld experiment. In this experiment, the student sits in a comfortable chair and is allowed to relax. To ensure that the student is not distracted by extraneous stimuli, earplugs are worn and the eyes are covered with special goggles. Once the student is completely relaxed, he or she free associates about wishes, dreams, events, and so forth, after which a prediction is made or some sort of premonitory experience is reported. The student came every Sunday night and made predictions for the following week. The diary you will read chronicles this particular student's predictions, premonitions, or feelings as well as some events that happened to her throughout the weeks. Be sure to read all the information carefully because we are interested in the impression you form of this student. You will be asked about your impressions near the end of the experiment. Also, we would like you to consider the predictions and any events that might be relevant to the theme of the prediction to see if there is any correlation.

As before, the diary was a fictitious text developed specifically for this experiment. The diary began with one Sunday night's prediction, followed by daily entries for the remainder of the week. The next Sunday's entry contained another prediction, and so on. In the temporally specified condition, the prediction identified a specific day of the week on which the predicted event should occur (e.g., "I have a feeling that I will get into an argument with my psychology research group on Friday"). In the temporally unspecified condition, the prediction was not tied to a particular day of the week (e.g., "I have a feeling that I will get into an argument with my psychology research group"). The events relevant to each prediction—consistent or inconsistent—were included in the entry for the specific day prophesied in the temporally specified condition. In other words, if in the temporally specified condition the prediction indicated that the relevant outcome would happen on Friday, that event (consistent: "Our professor assigned us to research groups, and we immediately disagreed over our topic"; inconsistent: "Our professor assigned us to research groups, and we immediately came to a unanimous decision on our topic") was embedded somewhere in the entry for Friday. In the temporally unspecified condition, the relevant event was also embedded in Friday's entry, but the prediction made no mention of the day the relevant event should occur.

After reading the hypothetical student's diary, subjects were given a 10-min distractor task in which they rated the target person on numerous scales. Subjects were then asked to recall as many of the predictions and relevant events as they could and to estimate the percentage of time the student's predictions were followed by consistent, inconsistent, and irrelevant events.

*Scoring criteria.* As before, all scoring was done by a judge who was unaware of the hypothesis. Subjects were given credit for a correct recollection when they remembered both a given dream and its associated event. A second judge, unaware of subjects' condition, scored the dream–event recall data for 31 subjects chosen at random. Interjudge reliability was satisfactory ( $r = .90$  for consistent events, and  $r = .80$  for inconsistent events).

Table 2  
*Mean Percentage Recall and Subjective Estimates as a Function of Event Type and Temporal Specificity*

Event type	Condition	
	Temporally specified	Temporally unspecified
Recall		
Consistent		
<i>M</i>	63.5	62.8
<i>SD</i>	24.2	23.5
Inconsistent		
<i>M</i>	46.8	28.2
<i>SD</i>	24.4	24.4
Subjective estimates		
Confirmatory		
<i>M</i>	48.4	45.0
<i>SD</i>	17.4	18.9
Disconfirmatory		
<i>M</i>	35.5	29.3
<i>SD</i>	14.2	15.7
Irrelevant		
<i>M</i>	16.0	25.5
<i>SD</i>	17.2	17.5

*Note.*  $n = 39$  for both the temporally specified and unspecified conditions.

## Results

*Recall.* An inspection of the recall data presented in Table 2 indicates that the results are consistent with our hypotheses. When the predictions were temporally unspecified, subjects recalled more than twice as many confirmatory prophecy–event pairs as disconfirmatory pairs. When the predictions were temporally specified, in contrast, this discrepancy was substantially narrowed.

To assess the significance of these data, a 2(condition: specified vs. unspecified)  $\times$  2(event type: consistent vs. inconsistent) mixed ANOVA was performed, with the last factor a within-subjects variable. The ANOVA uncovered two main effects. Subjects in the temporally specified condition recalled more information ( $M = 55.1$ ) overall than those in the temporally unspecified condition ( $M = 45.5$ ),  $F(1, 76) = 4.81$ ,  $p < .05$ . Also, subjects recalled more consistent prophecy–event pairs ( $M = 63.1$ ) than inconsistent prophecy–event pairs ( $M = 37.5$ ),  $F(1, 76) = 61.19$ ,  $p < .0001$ .

Once again, however, these main effects were qualified by a significant Condition  $\times$  Event Type interaction,  $F(1, 76) = 7.50$ ,  $p < .01$ . Analysis of the simple main effects for each condition showed that subjects in the temporally unspecified condition recalled significantly fewer inconsistent prediction–event pairs than consistent prediction–event pairs,  $F(1, 76) = 55.77$ ,  $p < .0001$ . For subjects in the temporally specified condition, this discrepancy, although significant, was substantially narrowed,  $F(1, 76) = 12.93$ ,  $p < .01$ . Stated differently, subjects in the two conditions did not differ in their recall of consistent prediction–event pairs ( $F < 1$ ), but those in the temporally unspecified condition recalled significantly fewer inconsistent predic-

tion–event pairs than their counterparts in the temporally specified condition,  $F(1, 76) = 11.27, p < .001$ .

*Subjective estimates.* Table 2 shows subjects' estimates of the percentage of prophecies that were followed by consistent, inconsistent, and irrelevant events. The findings are similar to those of Experiment 1. Subjects in the two conditions did not differ in their estimates of the percentage of confirmed expectations. As before, however, subjects in the unspecified condition estimated seeing fewer inconsistent events than did subjects in the specified condition, although in this case the difference was only marginally significant,  $F(1, 76) = 3.28, p < .10$ .

*Correlational analyses.* As in Experiment 1, subjects' estimates were correlated with the content of what they could recall. In particular, the correlation between the percentage of inconsistent events recalled and subjects' estimates of the percentage of dreams that were followed by disconfirmatory events was .45 ( $p < .0001$ ). For the consistent events, the corresponding correlation was .39 ( $p < .001$ ).

### Discussion

This experiment replicates and extends the findings of Experiment 1. When subjects' expectations were temporally unfocused because of the unspecified time at which the predicted events were likely to occur, they could recall more than twice as many consistent prophecy–event pairs as inconsistent prophecy–event pairs. In contrast, those subjects who were exposed to more temporally specified predictions recalled a more evenly balanced mix of consistent and inconsistent information.

In this experiment we manipulated temporal focus in an ecologically valid manner—through the temporal specificity of the various predictions. Nevertheless, the context in which subjects' recall was assessed was not any more or less reflective of the real world than the typical laboratory memory experiment. Subjects read the relevant material and fed back what they could recall only because it was asked of them as part of an experiment. Under such circumstances, there is always the worry that some seemingly trivial aspect of the procedure may have artifactually generated the obtained results.

In this case, one possible alternative interpretation may stand out (as it did to a reviewer of this article). In particular, subjects in the temporally specified condition, knowing that a prophecy called for an event to occur on a specified day, may have chosen to read only the information contained in the entry for that day. All other information may have been ignored. If so, the processing demands on these subjects may have been reduced so substantially that one might expect them to recall the prophecy–event pairs more accurately.

We do not believe that this constitutes a plausible alternative interpretation of our results for several reasons. First, it was readily apparent while watching subjects perform the experiment that they were doing what subjects typically do in such experiments—they conscientiously read the material they were asked to read. There was no evidence whatsoever that subjects skipped over any section of the diaries. Second, we specifically guarded against this possibility by telling the subjects to read the material with an eye toward forming an impression of the author of the diary. To form an accurate impression, the subjects would need to process *all* of the material.<sup>4</sup>

Nevertheless, to rule out this alternative interpretation even more definitively, we conducted a replication of this experiment in which the presentation of the stimulus material was not under the subjects' control and so they could not simply flip from one section of the text to another.

### Experiment 3

#### Method

This experiment was an exact replication of Experiment 2 except that the stimulus materials were presented to subjects by way of a Macintosh computer in cartoon format. Each event described in the diary was depicted graphically, with the same text in the previous experiment listed either as a caption on the bottom of the screen or as a thought bubble emanating from the protagonist. Once the program was begun, the material was presented at a set rate without intervention on the part of the subject. Each cartoon frame was on screen for 5 s. The entire presentation took 15 min. The subjects were 36 Cornell undergraduates who received course credit for their participation.

#### Results

*Recall.* The results were quite similar to those obtained in the previous experiment. When the predictions were temporally unspecified, subjects recalled nearly three times as many confirmatory prophecy–event pairs ( $M = 81.9\%$ ) as disconfirmatory pairs ( $M = 29.2\%$ ). In contrast, when the predictions were temporally specified, this discrepancy was reduced substantially ( $M_s = 79.2\%$  and  $55.5\%$ , respectively).

As before, the significance of these results was assessed by a 2(condition: specified vs. unspecified)  $\times$  2(event type: consistent vs. inconsistent) mixed ANOVA, with the last factor a within-subjects variable. This analysis yielded a marginally significant main effect for condition,  $F(1, 34) = 3.30, p < .10$ , and a highly significant main effect for event type,  $F(1, 34) = 70.16, p < .0001$ . More important, a significant interaction was observed,  $F(1, 34) = 10.23, p < .01$ . Analysis of the simple main effects for each condition showed that subjects in the temporally unspecified condition recalled significantly fewer inconsistent prediction–event pairs than consistent prediction–event pairs,  $F(1, 34) = 66.90, p < .0001$ . In contrast, when the expectations were temporally specified, this difference, although still significant, was substantially reduced,  $F(1, 34) = 13.41, p < .01$ . Stated differently, subjects in the two conditions did not differ in their recall of consistent prediction–event pairs ( $F < 1$ ), but subjects in the temporally unspecified condition recalled significantly fewer inconsistent prediction–event pairs than their counterparts in the temporally specified condition,  $F(1, 34) = 8.19, p < .01$ .

*Subjective estimates.* Subjects' estimates of the percentage

<sup>4</sup> It is important to note that a "weak" version of this alternative interpretation is not only nonproblematic, it *is* the account we are offering. When people know when an expectancy-relevant event will occur, they tend to pay particularly close attention at that moment and exert less cognitive effort at other times. Consequently, the claim that our subjects may have been unusually attentive at the temporally specified periods cannot be construed as an alternative interpretation of the present findings.

of prophecies that were followed by consistent, inconsistent, and irrelevant events conformed to the same pattern (but to a greater degree) as that obtained in the previous experiment. In particular, subjects in the temporally specified condition estimated seeing significantly more inconsistent events ( $M = 42.5\%$ ) than did subjects in the temporally unspecified condition ( $M = 25.9\%$ ),  $F(1, 34) = 13.18$ ,  $p < .001$ .

*Correlational analyses.* Subjects' estimates were correlated with the content of what they could recall, but only with respect to the inconsistent events. The correlation between the percentage of inconsistent events recalled and subjects' estimates of the percentage of dreams that were followed by disconfirmatory events was .45 ( $p < .01$ ). There was no correlation between estimates and recall for confirmatory events ( $r = .04$ ).

### Discussion

As before, when subjects' expectations were unfocused because of the temporally unspecified nature of the expectations, they had difficulty picking out the events that violated the expectation. Subjects in the temporally unspecified condition recalled nearly three times as many consistent prophecy-event pairs as inconsistent prophecy-event pairs. In contrast, when subjects' expectations were focused by the temporally specified nature of the expectations, the disconfirmatory events were more salient. Subjects in the temporally specified condition recalled a mix of consistent and inconsistent prediction-event pairs that was more balanced. However, it is important to point out that even when the predictions were temporally specified, subjects still exhibited superior recall for the consistent prediction-event pairs.

### Experiment 4

Our contention throughout has been that when people's expectations are temporally unfocused, the outcomes that conform to expectations will tend to be more salient, receive more processing, and, as a result, be easier to recall. In contrast, when people's expectations are temporally focused, the confirmatory and disconfirmatory events are likely to receive more equal attention and therefore be more equally memorable. To provide more direct evidence for this analysis, we measured the amount of time subjects spent scrutinizing consistent and inconsistent information in a replication of Experiment 1. We anticipated that subjects in the focused condition would spend equal time reading about confirmatory and disconfirmatory events. In contrast, we expected those in the unfocused condition to fail to notice the relevance of the inconsistent events and thus to devote more processing time to the events that were consistent with their expectations. Furthermore, we expected these differences in processing time to mirror any observed differences in recall (cf. Craik & Lockhart, 1972).

### Method

*Subjects.* Subjects were 71 Cornell undergraduates who received course credit for their participation. The data for 7 subjects (4 in the focused condition and 3 in the unfocused condition) were deleted from the analyses because of their failure to recall any events. All analyses were thus based on the data from the remaining 64 subjects.

*Stimulus materials and manipulation.* Most elements of the experiment were identical to those of Experiment 1, including the focus manipulation, the general thrust of the text of the student diary, and the specific dreams and target events reported in the diary. In this study, however, the diary was shortened somewhat and presented one sentence at a time on an Apple IIe computer. Subjects controlled the rate of presentation of each sentence by pressing the return key. As in Experiment 1, the presentation of the eight target events was counter-balanced, creating two versions of the diary (each prediction that was paired with a confirmatory event in one version was paired with a disconfirmatory event in the other, and vice versa). The consistent and inconsistent target events for each prediction were made nearly equivalent to each other in word length and number of syllables. This resulted in a set of consistent and inconsistent events that were balanced, on average, in terms of number of words ( $M_s = 17.1$  and  $17.2$ , respectively) and number of syllables ( $M_s = 23.1$  and  $21.7$ , respectively).

*Procedure.* Subjects were randomly assigned to either the focused or unfocused condition. Subjects were instructed to read the diary of an undergraduate student in order to form an impression of this individual, and they were given instructions on how to advance to the next sentence by pressing the return key. To decrease extraneous variability in response times, subjects were asked to place their right index finger on the return key and to leave it there throughout the experiment. After subjects received instructions and had their questions answered, the experimenter left the room for the duration of the reading phase.

Subjects did not receive a warm-up trial. It was felt that the "cover story" presented on the screen before the presentation of stimuli allowed sufficient time for subjects to become proficient in advancing to the next sentence. After reading the diary, the subjects were immediately asked to recall as many dreams and related events as they could. They were also asked to estimate the percentage of dreams that were followed by consistent, inconsistent, and irrelevant events.

*Scoring criteria.* As before, all scoring was done by a judge who was unaware of the hypothesis. Subjects were given credit for a correct recollection if they remembered both a given dream and its associated event. A second judge, unaware of subjects' condition, scored the data for 30 subjects chosen at random. The interjudge reliability was satisfactory ( $r = .84$  for consistent events, and  $r = .92$  for inconsistent events).

### Results

*Recall.* As can be seen in Table 3, the pattern of results closely matches that obtained in Experiment 1, although the overall rate of recall was lower. When subjects' expectations were focused, they tended to recall consistent and inconsistent events equally well. When their expectations were unfocused, in contrast, they recalled more consistent than inconsistent events.

The significance of these results was tested in a 2(condition: focused vs. unfocused)  $\times$  2(event type: consistent vs. inconsistent) ANOVA, with the last factor a within-subjects variable. One main effect was observed: Subjects in the focused condition ( $M = 46.9$ ) recalled more information overall than those in the unfocused condition ( $M = 33.6$ ),  $F(1, 62) = 9.26$ ,  $p < .01$ . However, this main effect was qualified by a significant Condition  $\times$  Event Type interaction,  $F(1, 62) = 4.14$ ,  $p < .05$ . Analyses of the simple main effects showed no difference in the recall of consistent and inconsistent dream-event pairs among subjects in the focused condition, ( $F < 1$ ). Subjects in the unfocused condition, in contrast, recalled significantly more consistent events than inconsistent events,  $F(1, 62) = 5.30$ ,  $p < .05$ . Stated differently, subjects in the two conditions did not differ in their

Table 3  
Mean Percentage Recall and Subjective Estimates as a Function of Event Type and Attentional Focus

Event type	Condition	
	Focused	Unfocused
Recall		
Consistent		
<i>M</i>	45.3	39.8
<i>SD</i>	24.1	22.8
Inconsistent		
<i>M</i>	48.4	27.3
<i>SD</i>	24.5	21.4
Subjective estimates		
Confirmatory		
<i>M</i>	43.6	41.8
<i>SD</i>	20.4	19.1
Disconfirmatory		
<i>M</i>	45.6	27.8
<i>SD</i>	19.4	14.9
Irrelevant		
<i>M</i>	10.7	30.4
<i>SD</i>	10.7	22.1

Note.  $n = 32$  for both the focused and unfocused conditions.

recall of the consistent dream–event pairs ( $F < 1.0$ ). However, subjects in the unfocused condition recalled significantly fewer inconsistent dream–event pairs than did subjects in the focused condition,  $F(1, 62) = 13.43, p < .01$ .

*Subjective estimates.* As can be seen in Table 3, subjects' estimates of the percentage of dreams that were followed by consistent, inconsistent, and irrelevant events closely followed those obtained in the previous three experiments. No differences were observed in subjects' estimates of consistent events. However, subjects in the unfocused condition estimated seeing significantly fewer inconsistent events than those in the focused condition,  $t(62) = 4.11, p < .001$ .

As in the previous experiments, subjects' estimates were correlated with the content of what they could recall. The correlation between the percentage of inconsistent events recalled and subjects' estimates of the percentage of dreams that were followed by disconfirmatory events was  $.34 (p < .01)$ . The corresponding correlation for consistent events was  $.26 (p < .05)$ .

*Reading time.* As can be seen in Table 4, the amount of time subjects took to read each sentence corresponds closely to the pattern of recall results obtained. A  $2 \times 2$  ANOVA revealed only a significant Condition  $\times$  Event Type interaction,  $F(1, 62) = 7.84, p < .01$ . As expected, subjects in the focused condition devoted equal time to reading both consistent and inconsistent events,  $F(1, 62) = 1.42$ . Subjects in the unfocused condition, in contrast, spent significantly more time reading the consistent events than the inconsistent events,  $F(1, 62) = 7.64, p < .01$ . Stated differently, subjects in the unfocused condition spent significantly less time reading inconsistent events than subjects in the focused condition,  $F(1, 62) = 6.45, p < .05$ . On the other

hand, no differences were observed between the two groups in their reading times for consistent events ( $F < 1$ ).

Although the consistent and inconsistent events for each of the eight pairs were nearly equal in terms of number of words, we decided to further control for word length by dividing subjects' reading latencies by the relevant number of words for each event. These results are presented in Table 4. Again, the two-way ANOVA revealed a significant interaction between condition and event type,  $F(1, 62) = 9.89, p < .01$ . As expected, subjects in the focused condition devoted equal time to reading consistent and inconsistent events,  $F(1, 62) = 2.06, p < .16$ . Subjects in the unfocused condition, in contrast, spent more time reading the consistent than the inconsistent events,  $F(1, 62) = 9.06, p < .01$ . Stated differently, subjects in the unfocused condition spent less time reading the inconsistent events than subjects in the focused condition,  $F(1, 62) = 7.42, p < .01$ . In contrast, subjects in the two conditions spent roughly equal time processing the consistent events ( $F < 1$ ).

*Correlational analysis.* To examine the postulated relationship between depth of processing and recall, we computed the point-biserial correlation between reading time and whether or not an event was recalled, after controlling for word length and serial position. Thus, for each subject, we computed the partial correlation between the per-word reading time for each event and whether that event was recalled, controlling for the position of the event in the diary. The mean partial correlation was  $.18$ , which was reliably greater than zero,  $t(62) = 3.82, p < .001$ .<sup>5</sup>

We also examined the relationship between processing and recall separately for the two conditions. The mean partial correlation was marginally greater than zero for the focused condition,  $t(30) = 1.93, p = .06$ , and was significantly greater than zero for the unfocused condition,  $t(31) = 3.60, p < .01$ . However, a one-factor ANOVA revealed no difference between the mean partial correlations for the two conditions ( $M_s = 0.14$  and  $0.22$ , respectively;  $F < 1$ ).

Overall, these results suggest that information that received more processing was better recalled. Rather equivalent processing time and recall was observed for both consistent and inconsistent events when expectations were focused; in contrast, more processing time was devoted to the consistent information when expectations were unfocused, and, as a result, this information was better recalled.

## General Discussion

The present research supports the conceptual framework we have introduced to account for people's recall for information that is consistent or inconsistent with an expectation (Gilovich, 1991; Madey & Gilovich, 1990). This framework attempts to reconcile conventional wisdom—which holds that information that confirms people's expectations is particularly memorable—with the mixed findings reported in the psychological literature. We argued that the recall of expectancy-relevant information can be better understood by distinguishing between one-

<sup>5</sup> The degrees of freedom reflect that one subject recalled all of the consistent and inconsistent dream–event pairs and thus was excluded from the subsequent correlational analyses.

Table 4  
*Mean Per-Sentence and Per-Word Reading Times (in Milliseconds) as a Function of Event Type and Attentional Focus*

Event type	Condition	
	Focused	Unfocused
Per-sentence reading time		
Consistent		
<i>M</i>	5,350	5,514
<i>SD</i>	1,621	1,726
Inconsistent		
<i>M</i>	5,714	4,674
<i>SD</i>	1,654	1,544
Per-word reading time		
Consistent		
<i>M</i>	308	320
<i>SD</i>	91	98
Inconsistent		
<i>M</i>	332	269
<i>SD</i>	98	88

Note.  $n = 32$  for both the focused and unfocused conditions.

and two-sided events. One-sided events are those for which only one outcome tends to stand out; two-sided events are those for which both types of events—consistent and inconsistent—tend to be noticed and remembered.

To explore this distinction between one- and two-sided events, we examined in this article a variable that we believe to be an important determinant of whether an event is likely to be one- or two-sided—whether an expectation is focused or unfocused in time. Our findings indicate that when expectations are temporally unfocused, people tend to exhibit differential recall of expectancy-relevant information, and it is primarily the information that supports the expectation that is recalled. In contrast, when people's expectations are focused in time (i.e., the person knows when the relevant outcomes are likely to occur) recall tends to be more nearly equal for consistent and inconsistent information.

The data from subjects' estimates of the percentage of consistent, inconsistent, and irrelevant events they thought they had seen further support our analyses of when inconsistencies are likely to be passed over and forgotten: Subjects in the temporally unfocused condition estimated seeing significantly fewer inconsistent events than subjects in the temporally focused condition.

There is one particularly noteworthy aspect of the two experiments that manipulated temporal focus most directly (i.e., Experiments 2 and 3): Although subjects in the temporally specified conditions recalled significantly more of the inconsistent events than their counterparts in the temporally unspecified conditions, they nonetheless were still able to recall the consistent events better than the inconsistent events. Why might that be? Recall that by our analysis, when a person's expectation is temporally focused, any relevant event—confirmatory or disconfirmatory—is likely to be noticed. Furthermore, because of this equivalence in encoding, the person's memory for the two kinds of outcomes should be similar as well. Perhaps the failure

to find equal recall for consistent and inconsistent events in these two experiments is due to an advantage enjoyed by the consistent events at the time of retrieval. Note, for example, that any recollection of the gist of a given prophecy is more likely to trigger the recall of an event that confirmed the prophecy than an event that refuted it. Prophecies are no doubt linked more tightly to confirmatory than disconfirmatory events because there are typically more constraints on the former than the latter: Prophecies can only be confirmed by a limited number of events, but there are relatively many ways they can be disconfirmed. To test this explanation, we went back to the raw data from Experiments 2 and 3 and computed, for each subject, the correlations between the recall of the various prophecies and their corresponding consistent and inconsistent events. In support of this contention, these correlations were reliably higher for the consistent events (mean  $r = .89$ ) than the inconsistent events (mean  $r = .71$ ),  $t(43) = 3.89$ ,  $p < .001$ .<sup>6</sup>

Along similar lines, it is also noteworthy that even in Experiments 1 and 4, in which recall of the inconsistencies was so greatly enhanced among subjects in the temporally focused conditions, there was no evidence that the inconsistent events were *better* recalled than the consistent events. In our framework, we would only expect such an asymmetry when subjects' expectations are temporally focused *and* the events that violate their expectations generate additional processing. This additional processing most often involves an attributional analysis that seeks to make sense of the violation (Hastie, 1984) or a counterfactual rumination of "what might have been" (Kahneman & Miller, 1986; Miller, Turnbull, & McFarland, 1990). In the present research, the events that were inconsistent with the target person's dreams were not the type to generate such thoughts. After all, there is no shortage of reasons why a given prophecy might not be fulfilled, and so a search for a specific cause would no doubt seem fruitless. Thoughts about what might have been were similarly uncommon, doubtless in part because the prophecies were not the subjects' own.

Although, by our analysis, it is typically the case that for one-sided events it is the information that supports a person's expectations that registers and is remembered, are there any types of one-sided events for which the opposite pattern might be found? We believe there are. For example, Erving Goffman (1963) long ago presented a provocative analysis of what he called "negatively eventful actions," or those activities that are so normative and so common that people are typically unaware of their existence until they are *not* performed (e.g., maintaining an appropriate "personal space" in social interaction or appearing to be inattentive to the private conversations of others in public places). These events are clearly one-sided in our terms, but it is the expectancy *violations* that stand out. The expectancies in this case are so overlearned that they often cannot be consciously articulated, and this may be part of the reason that the asymmetry in attention they yield is opposite to the pattern documented in the present studies.

<sup>6</sup> Because the correlation coefficient requires variability in both variables, this analysis was based on the data from 44 of the original 114 subjects who recalled some, but not all, of the dreams and relevant events for both the confirmed and disconfirmed prophecies.

With the juxtaposition of Goffman's (1963) analysis and the current findings in mind, we are currently investigating other variables that determine whether events are one- or two-sided and whether the attentional and memorial asymmetries favor the information that is consistent or inconsistent with a person's expectations (cf. Gilovich, 1991). One such factor may be the instrumental or hedonic consequences of different actions. If the potential outcomes of an action induce the same level of emotion or require the same amount of follow-up activity, the outcomes are likely to be phenomenologically two-sided. However, any marked asymmetry in hedonic or instrumental significance will make the outcomes one-sided. Consider the subway effect, or the belief held by numerous commuters that the subway is "always" headed in the wrong direction. It is easy to see how an asymmetry in hedonic consequences makes occasions when the subway is going the other direction more memorable than the times when it is going one's own way. A subway car headed in one's intended direction leads to mindless boarding and continued pursuit of the day's agenda. The "event" in question (the subway's arrival) hardly registers. A car headed in the opposite direction, in contrast, produces frustration, anxiety, and repeated glances at one's watch. It leaves an impression.

Various asymmetries in numerical, temporal, or spatial pattern also render some events one-sided. For instance, many people report that they have an uncanny tendency to awaken when their digital clock is showing a "meaningful" pattern, such as 2:22 or 1:23. Beliefs like these no doubt arise because such patterns stand out in a way that 3:17 or 4:29 do not. Indeed, the occult "science" of numerology thrives on such asymmetries: Various coincidences are imbued with special significance because their salience and memorability make them appear more common than they actually are. Similarly, the widespread beliefs that gamblers often get "on a roll" and that basketball players shoot in streaks (Gilovich, Vallone, & Tversky, 1985) are no doubt partly due to similar processes: A run of consecutive successes or failures is so much more noteworthy and memorable than a mixture of good and bad. Every streak is thus brought to bear on the streakiness hypothesis in a way that periods of alternating performance are not.

Perhaps the most common type of one-sided event stems from the distinction between confirmed and nonconfirmed expectations. Many expectancies are violated not because events transpire that directly disconfirm them, but simply because nothing happens to confirm them. A psychic's prediction that there will be a cataclysmic earthquake is not disconfirmed by any single event, but by its accumulated failure to take place. As a result, there is a tremendous asymmetry in the salience of the relevant outcomes (or, in our terms, the relevant outcomes are inherently one-sided). Such prophecies are confirmed by discrete events that stand out in one's experience, but they are disconfirmed by nonevents that are less likely to draw one's attention (Agostinelli et al., 1986; Fazio et al., 1982; Newman, et al. 1980; Nisbett & Ross, 1980).

It is hoped that a closer examination of various classes of one-sided and two-sided events, like the present investigation of temporally focused and unfocused expectations, will expand researchers' understanding of people's recall of expectancy-consistent and -inconsistent information beyond what is known about person memory. The kind of expectations that

form the basis of various folk beliefs, for example, may be very different from the kind of expectations that represent people's impressions of others, and such differences may have significant attentional and memorial consequences. By examining more directly people's ability to recall information relevant to various folk beliefs, researchers may be better able to understand some of the conflicting results reported in the memory literature, and, equally important, may shed some light on how various superstitions survive the challenge of everyday empirical contradiction.

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