# Memory Influences Subjective Experience: Noise Judgments

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The influence of memory on the subjective experience of later events was investigated in two experiments. In one experiment, previously heard sentences and new sentences were presented against a background of white noise that varied in intensity. In a second experiment, a cue set of words was presented either before or after a target set that was embedded in noise. The cue set was either the same as or different from the target set. In both experiments, one of the tasks was to judge the loudness of the noise. The data show that subjects were unable to discount the contribution of memory to perception when judging the noise level. Subjects appeared to base their noise judgments on case of interpretation of the message presented through noise, with differences in ease being misattributed to a difference in noise level. The advantages of subjective experience as a measure of memory, and the role of subjective experience and misattribution in confusions between cognitive and physical deficits are discussed.

Although memory has traditionally been assessed by recall or recognition tests, memory for a prior experience can also be revealed by its influence on the perception of later events. Several recent experiments have demonstrated that memory can serve to increase the accuracy of later perception, and that these effects on perception often are independent of performance on recall or recognition tests. For example, a prior presentation of a word in the experimental setting can have a large and long-lasting influence on its later identification in perceptually difficult situations, even when the word is not recognized as having been previously presented (e.g., Jacoby, 1983; Jacoby & Dallas, 1981). The experiments reported in this article describe another influence of memory on perception. Rather than examining effects of memory on accuracy of perception, we investigated the influence of memory on the subjective experience of later events.

Owing to the influence of behaviorism, perhaps, reporting accuracy has been the major focus of contemporary investigations of memory and perception. This contrasts with the focus on subjective experience and the use of introspection as a tool that marked earlier traditions. James (1890), for example, discussed the influence of attention and of expertise in terms of their effects on subjective experience. Attention and expertise were said to increase the intensity and the clarity of a sensation. Effects of the sort that James described are commonplace. Most of us have experienced the voice of the person with whom one is conversing at a cocktail party as

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Correspondence concerning this article should be addressed to Larry L. Jacoby or Lorraine G. Allan, Department of Psychology, McMaster University, Hamilton, Ontario, Canada L8S 4K1. appearing louder than that of another person who is equally nearby but involved in a different conversation. We have also noted that the words in the lyrics of a rock-and-roll song seem totally unintelligible prior to reading the lyrics but very clear after the lyrics have been read. Similarly, Osgood (1957) described the experience of listening to a male chorus in an operetta recording, and finding that reading the printed words resulted in the previously "unintelligible gibberish" becoming understood and sounding clear. In these examples, the subjective experience is one of a difference in loudness or clarity of the physical stimulus although the true difference is one of attention or prior experience. Subjective experience of a physical dimension not only mirrors true differences on that dimension but also reflects the influence of more cognitive factors.

There is a large body of literature documenting the influence of noncriterial variables on psychophysical judgments. For example, temporal judgments are influenced by such nontemporal variables as intensity, complexity and modality of the duration marker (see Allan, 1979; Doob, 1971; Ornstein, 1969). Any effect of memory or attention on subjective experience can easily be described as yet another example of an influence of a noncriterial variable on psychophysical judgments, and may be treated as totally unsurprising. Everyone knows that these effects exist.

Although we will describe effects of cognitive variables on psychophysical judgments, we treat those effects differently than others have. In psychophysical experiments, effects of cognitive variables are typically treated as a contamination of "true" judgments. In contrast, we use those effects as a measure of memory. That is, we treat effects of an earlier presentation of an item on later subjective experience in the same way we have previously treated effects on the accuracy of perceptual identification performance (e.g., Jacoby & Dallas, 1981). Memory for a prior event may influence subjective experience as well as the accuracy of perceptual identification of later events.

Could an effect of prior experience on psychophysical judgments be taken as evidence that the effects of memory can be perceptual? From the point of view of the perceiver, the effects

Experiment 1 is from a B. A. honors thesis by L. K. Larwill; Experiment 2 is from a B. S. honors thesis by J. C. Collins (née Garossino).

of memory may be perceptual. However, an experimenter armed with a model like signal detection theory (SDT) might reach a different conclusion. For an effect to be considered perceptual, some users of SDT have required a change in the sensitivity parameter (d'), rather than in the criterion or bias parameter ( $\beta$ ). In psychophysical experiments, SDT has been used to show that noncriterial parameters often have their effects on bias, and leave true perceptual differences (d')unchanged (e.g., Allan, 1968). Similarly, memory may have its effect on psychophysical judgments by influencing bias, so that it could be argued that the effects of memory are not perceptual.

However, early in the SDT literature (see Green & Swets, 1966) effects on bias were described as being perceptual in nature. For example, it has been shown that as the watch proceeds in a vigilance situation, the decrement in target detection is due to an increasing strictness in the response criterion, rather than to decreasing sensitivity to the target. Yet the subjective experience is that the target is harder and harder to detect over time. We are interested in the point of view of the perceiver: subjective experience. Effects in subjective experience can be used as a measure of memory, regardless of whether those effects are due to a change in bias or a change in sensitivity.

Our earlier experiments investigating the influence of a prior presentation of a word on the accuracy of its later perceptual identification (e.g., Jacoby & Dallas, 1981) provided evidence that the effects of memory are sometimes experienced as being due to a change in a physical dimension of the stimulus. In those experiments, words were flashed for a brief duration (e.g., 35 ms), followed by a visual mask, and subjects were asked to report the word that had been flashed. Words previously read in the experimental setting, "old" words, were much more likely to be correctly identified than were "new" words. Of interest for present purposes are subjects' accounts of this difference in ease of identification. Several subjects told us that some words were presented for a longer duration than were other words and, consequently, were easier to identify. The words thought to have been presented for a longer duration were words that had been previously read in the experimental setting. Witherspoon and Allan (1985) followed this lead by varying the duration of presentations and requiring subjects to make temporal judgments. They found that words that had been previously read were judged as staying on the screen longer than new words. A single prior presentation of a word was sufficient to produce a difference in the later subjective experience of duration.

The experiments reported here were designed to examine the influence of prior experience on judgments of the loudness of noise. Experiment 1 examined effects in a situation that is somewhat akin to the example of reading the lyrics of a rockand-roll song prior to hearing the song. Subjects heard a list of sentences that they were instructed to remember for a later test. Those old sentences were then mixed with new sentences and presented individually against a background of white noise that varied in intensity. The task was to judge the loudness of the noise. Others (e.g., Franks, Plybon, & Auble, 1982) have observed that a prior presentation of a sentence can increase the accuracy of identifying words from that sentence presented later in white noise. We expected to find a corresponding effect in subjective experience, the noise accompanying old sentences being judged as less loud than that accompanying new sentences.

This effect on subjective experience may depend on a person actively trying to identify the words presented in white noise. That is, if left free to ignore the words, by being instructed only to judge the loudness of noise, people may show no effect of having previously heard a sentence. To check this possibility, subjects in one condition were only required to judge the loudness of the noise accompanying a test sentence, whereas those in a second condition were required to identify the words in the sentence as well as to judge the loudness of the accompanying noise. The inclusion of the latter, dual-task condition also allowed us to examine the relation between the accuracy of identification performance and judgments of noise.

# **Experiment** 1

# Method

# Subjects

A total of 42 undergraduates at McMaster University were given course credit or were paid for participating in this experiment. Subjects were native English speakers and tested individually.

#### Materials

The verbal material was recorded by Linda K. Larwill on the left channel of a Sony TC-270 reel-to-reel tape recorder, and white noise was recorded on the right channel. The noise included a high density of low frequencies so as to produce maximal interference with interpretation of the speech signal, and varied over a narrow range in its intensity. We did not specify the precise physical parameters of the noise, but, rather, attempted to select three levels of noise that were discriminably different, and that also differed to the extent to which they interfered with interpretation of the sentences played through noise. The 51 six- and seven-word sentences used in this experiment are listed in Larwill (1985). (Examples of the sentences are The rising wind whipped the dusty road. and Very few animals braved the cold winter.) Nine of the sentences were used only during practice and had a word frequency (Thorndike & Lorge, 1944) sum ranging from 399 to 600 words per million. For the remaining 42 sentences, the mean word frequency sum was 343.5 words per million.

During the experiment, the subject sat at a desk in front of two speakers arranged vertically (left speaker on top of right) at a distance of 1.82 m. A blind was erected in front of the tape recorder such that the subject could not see the experimenter adjusting the volume control. The subject recorded noise-level judgments in a prepared booklet containing a separate sheet of paper for each response. A 5point rating scale, with 1 being the lowest noise level and 5 being the highest noise level, appeared on each sheet. The subject circled the appropriate number.

#### Procedure

There were two groups of subjects: dual task (24) and single task (18). All of the subjects in the dual-task group were tested before the

subjects in the single-task group. A session lasted about 35 min and consisted of three phases.

*Phase 1: Study.* Of the 42 sentences, 21 were presented at the rate of approximately 1 sentence every 3 s. The subject was instructed to listen to each sentence and to repeat it aloud. After a subject could report no more words from a sentence, the next sentence was presented.

Phase 2: Practice. The 9 practice sentences were used to familiarize the subject with listening to sentences embedded in noise and with making noise-level judgments. A trial began with the experimenter giving a verbal warning signal of "Ready," followed by a sentence embedded in white noise. Dual-task subjects were required to repeat the sentence and then to rate the background noise level, whereas single-task subjects only rated the noise level. Dual-task subjects were encouraged to repeat as much of the sentence as they could. The experimenter manually recorded the identification response and the subject recorded a noise-level judgment in the prepared booklet.

Three practice sentences were presented at each of the 3 noise volumes in a random order. Subjects were not informed about the number of noise volumes and there was no feedback regarding identifications or noise level judgments. Although only 3 noise volumes were presented, the 5-point scale was used in an attempt to produce a greater range of judgments.

*Phase 3: Test.* All 42 sentences were presented embedded in noise, the 21 old sentences from Phase 1 and 21 new sentences not used in Phase 1. There were 7 old and 7 new sentences at each of the 3 noise volumes used in Phase 2. For each group, the task was the same as during the practice phase. Subjects were informed that some of the sentences were the same as heard in the first phase of the experiment.

### Results

In analyzing the data, we used analyses of variance (ANO-VAS) with proportions and ratings because we had interactions to examine, and we know of no suitable nonparametric test. The criterion for significance was set at p < .05.

## **Identification**

To be coded as correct, all the words in the sentence had to be repeated in the presentation order. Table 1 presents the mean identification results for the dual-task subjects, in terms of the proportion of sentences correctly identified. A 2 (sentence type) by 3 (noise volume) within-subjects ANOVA indicated a significant main effect of noise volume, F(2, 46) =32.16,  $MS_e = .033$ , with fewer sentences being correctly identified as noise volume was increased. The main effect of sentence type was also significant, F(1, 23) = 230.29,  $MS_e =$ .018. Sentences presented once prior to the identification task (old) were more likely to be correctly identified than sentences not presented during study (new). The significant interaction

 Table 1

 Experiment 1: Mean Proportion of Correctly Identified

 Sentences in the Dual-Task Condition

Sentence-type	Noise volume		
	Low	Medium	High
Old	.89	.84	.74
New	.68	.52	.25

of sentence type with noise volume, F(2, 46) = 9.69,  $MS_e = .026$ , indicates that accuracy of identification decreased at a faster\_rate, as a function of noise volume, for new sentences than for old sentences.

# Noise Judgments

Mean noise judgment, as a function of noise volume, is plotted in Figure 1 for old and new sentences, separately for each task. The data were analyzed by using a 2 (task) by 2 (sentence type) by 3 (noise volume) ANOVA with task as a between-subjects variable, and sentence-type and noise volume as within-subject variables. The significant main effect of noise volume, F(2, 80) = 240.47,  $MS_e = .187$ , confirms that the volumes used were discriminable.

Of particular interest is the significant main effect of sentence type F(1, 40) = 65.34,  $MS_e = .149$ , which reveals that the noise in which old sentences were embedded was judged less loud than that of new sentences. The absence of a significant interaction of sentence type with noise volume is illustrated by the parallel rating functions in Figure 1. For both tasks, rated loudness is decreased an equivalent amount by prior experience at each noise volume.

Although the noise judgments were somewhat higher for the dual-task subjects, the main effect of task, F(1, 40) = 2.51,  $MS_e = 1.164$ , was not significant, nor were any interactions involving that factor.

Noise judgments in the dual task were conditionalized on whether the sentence was correctly or incorrectly identified. Conditionalizing on a dependent variable results in means based on varying sample sizes and, for our data, creates many empty cells. Given the large number of empty cells and the repeated-measure design, a statistical analysis of the conditionalized data would be inappropriate. However, the visual representation in Figure 2 is informative. Whether the sentence was correctly or incorrectly identified, the background of old sentences was judged less noisy at each noise level.



Figure 1. Rating of background noise level as a function of noise volume for each task/sentence type combination.



*Figure 2.* Rating of background noise level as a function of noise volume for each sentence type conditional on identification response.

### Discussion

Our results replicate those of prior experiments (e.g., Franks et al., 1982), which show that old sentences are more likely to be correctly identified than are new sentences. In addition, we have demonstrated that old sentences are judged as having a less noisy background than new sentences. Prior presentation influenced noise judgments even in the single-task condition, the condition that did not require subjects to identify the sentences. Our data follow the same pattern as those obtained by Witherspoon and Allan (1985) in their investigations of the influence of prior experience on the subjective experience of duration.

A common account of the effects of prior experience on accuracy of identification is to claim that memory serves as a basis for bias or guessing. Guessing is most easily thought of as being an active, conscious process. For example, subjects might actively use memory to "fill in the gaps" when asked to identify words presented through noise. This use of memory would increase accuracy of identification performance by adding words that were correctly guessed to those that were actually perceived. However, guessing as an active process implies that people can discriminate between words that were guessed and those that were actually perceived. Given this ability to discriminate perceptual experience and memorybased guesses, there would be no reason to expect the observed influence of a prior presentation of an item on later subjective experience.

Counter to the active guessing account, the results of the present experiment can be used to argue that people are sometimes unaware of or at least unable to discount the influence of memory on perception. The influence of memory revealed itself by making the noise that accompanied old sentences seem less loud, an apparent change in the physical stimulus. Rather than serving as a basis for active, conscious guessing, the use of memory to aid perception was passive, of the "unconsciouss inference" sort described by Helmholtz, and was experienced as a change in the physical stimulus. Subjects apparently based their noise judgments on some global factor such as ease of interpretation of the message presented through noise. That is, subjective experience was based on an inference that misidentified the background noise as being overly responsible for differences in ease of interpretation. This drawing of an inference, however, did not rely on a conscious process. The "perceptual" effect of memory was experienced as being immediate, rather than as being mediated by some conscious attribution process.

Although the effects of memory were experienced as being perceptual, it is likely that the application of SDT would show that prior experience had its effect on bias rather than the sensitivity (d') of noise judgments. In our experiment, variations in d' would be revealed by nonparallel rating functions in Figure 1. The absence of an interaction of sentence type with noise volume in the ANOVA is consistent with the interpretation of prior experience influencing  $\beta$  rather than d'. Similarly, using a receiver operating characteristic (ROC) presentation of their data, Witherspoon and Allan (1985) showed that the effects of memory on temporal judgments was best described as a  $\beta$  effect. However, finding that the effects of memory are on bias does not weigh against calling those effects "perceptual" (Green & Swets, 1964). Using SDT, the experimenter may be able to ascertain that the influence of memory has been on  $\beta$  and that the contribution of the physical stimulus is unchanged. The subject in the experiment, however, makes a less analytic judgment than does the experimenter. In subjective experience, the contributions of memory are not separated from those of the physical stimulus.

Effects in subjective experience were a more sensitive measure of memory than was the measure of accuracy of identification performance. Even when only sentences that were correctly identified were considered, the noise accompanying old sentences was judged as being less loud than was that accompanying new sentences. It is likely that prior experience influenced the ease of interpreting a sentence presented through noise even when all the words in that sentence could be correctly identified, and ease of interpretation was apparently used as a basis for noise judgments. Similar effects on subjective experience, when accuracy of report was at ceiling, were found in the next experiment.

### Experiment 2

One of the most extensively investigated phenomena in psychology is that of perceptual set, the influence of preparation or attention on a person's ability to deal with an event. Haber (1966) and Pachella (1975) provide reviews of the literature devoted to this problem.

An early investigation of perceptual set by Kulpe (1904; cited in Haber, 1966) used briefly presented multidimensional stimuli. Prior to presentation of a stimulus, subjects were instructed to attend to some subset of its dimensions. After the stimulus had been presented, subjects reported the values of the attended dimensions and were also sometimes interrogated about the dimensions to which they had not been instructed to attend. The results showed that dimensions that were designated prior to presentation of the stimulus were

more accurately reported than were those designated after the stimulus had been presented. Also, based on introspective reports, subjects experienced attended dimensions as being clearer than unattended dimensions. By Kulpe's account, the effects of set are perceptual: Attended dimensions are more clearly perceived than are unattended ones.

Most recent investigations of perceptual set have concentrated on accuracy of perception rather than subjective experience. Haber (1965) is one of the few exceptions. He found that prior presentations of an item produced an increase in the judged clarity of the item when it was later presented. This effect of prior presentation was found even when the prior presentations of the item were so brief as not to allow the item to be identified.

Our manipulation of set in the second experiment was similar to our manipulation of memory in the first experiment, except that a shorter delay intervened between presentation of items and their repetition against a background of noise when the effects of set were assessed. There is a close relation between memory and set. Investigations of set have examined the effects of having relevant information in mind when an item is presented (e.g., Pachella, 1975), so that a manipulation of set can correspond to a test of memory after a very short retention interval.

To investigate the influence of perceptual set on subjective experience, we used a precue versus postcue comparison that is, in some ways, similar to that used by Kulpe (1904). A target set of words, embedded in noise, was presented on each trial. In a precue condition, a set of words not accompanied by noise was presented immediately before the target set, whereas in a postcue condition, the clear set was presented immediately after the target set. The clearly presented set, cue set, was either the same as (match) or differed from (nonmatch) the target set. The subject's task was to rate the background noise level of the target set. After this judgment had been made, subjects were tested for their recognition memory for words in the target and cue sets. To satisfy the requirements of the recognition memory test, subjects had to identify words during their presentation in the target set.

We expected the relation between the words in the cue set and those in the target set to be more important in the precue than in the postcue condition. For the precue condition, background noise was expected to be judged less loud on match trials than on nonmatch trials. Having just heard the words in the clear should aid interpretation of the same words mixed with noise, and produce the subjective experience of a reduction in the volume of the noise as compared to that on nonmatch trials. That is, memory for the cue set should have effects on identifying those same words presented in the target set that are similar to those observed by Kulpe (1904) when subjects were precued to attend to particular dimensions of presented items. In both cases, information gained from the precue can serve to direct the processing of target items, and, thereby, produce effects in subjective experience. For the postcue condition, we did not expect the relation between the words in the cue set and those in the target set to influence judgments of noise. That is, judgments of noise were expected to be equivalent across all combinations of conditions other than precue/match.

Method

# Subjects .

A total of 12 subjects from the same pool as in Experiment 1 participated.

# Materials

The verbal material was recorded by Jane C. Collins. A word pool of 492 medium-frequency (average = 21.9 per million), five-letter nouns were selected from Thorndike and Lorge (1944). Of these nouns, 60 were used in practice and the remaining 432 in test. Sets of 3 nouns were recorded on the left channel, with a computer beep 500 ms prior to each set. This beep served as a signal during the experiment for the experimenter to turn on the background white noise on the right channel. The noise was comprised of a high density of low-frequency signals and varied in intensity over a narrow range. Five ranges of intensity levels were used during the practice phase: 68-69, 71-72, 73-74, 76-77, and 79-80 db. Only three levels were used during the test phase: 69-70, 73-74, and 77-78 db. The measured intensity of the words without background noise was 70-74 db. The intensity of the words remained constant across noise conditions. The background noise in the room was measured as 52 db. The use of a larger number of noise levels during the practice than the test phase was meant to produce a wider range of noise judgments during the test phase. For both phases, subjects used a 5-point scale to judge the loudness of the noise.

Subjects recorded their responses in prepared test-booklets with three sheets of paper for each trial. The first sheet contained the noise rating scale, the second was blank, and the third contained the list of words for the recognition test. The blank sheet was included to prevent the subject from simultaneously listening to the presented words and reading the list of test words.

#### Procedure

Subjects were tested individually. A session lasted about 50 min and consisted of two phases.

*Phase 1: Practice.* There were 20 trials. On each trial, a set of 3 nouns, embedded in one of 5 levels of white noise, was presented at a rate of 1 noun per half second. The task was to rate the volume of the noise on the same 5-point scale used in the previous experiment. There were 10 s between trials for subjects to make their rating.

*Phase 2: Test.* This phase consisted of 96 trials. On each trial, a set of 3 nouns was presented at the rate of 1 noun per half second, followed, after a 1-s silent interval, by a second set of 3 nouns, also presented at a rate of 1 per half second. There were 10 s between trials.

There were two cue conditions: precue and postcue. In the precue condition, the first set (cue set) was presented with no noise and the second set (target set) was embedded in one of three levels of noise. The order was reversed in the postcue condition. There were two types of trials: match and nonmatch. On match trials, the two sets of 3 words were identical (same words in the same order). On nonmatch trials, there was no overlap of words between the two sets. All variables were manipulated within subjects. Each of the four cue-type combinations occurred on 24 trials. The 96 trials were presented randomly, with the restriction that within every 24 trials each of the four cue-type combinations was presented twice at each of the three noise volumes.

On each trial, the subject judged the loudness of the noise and then performed the recognition memory task. Each recognition list had four words, two old words, one from the cue set and one from the target set, and two new words. (Note that for match trials, both old words would have been presented in the target set and in the cue set.) The task was to indicate the old words. Subjects were not informed that two of the four items on each recognition test were old.

#### Results

# **Recognition Judgments**

The mean proportion of correctly recognized words was analyzed with a 2 (cue) by 2 (trial type) by 3 (noise volume) ANOVA, with all variables within subjects. This analysis revealed a significant main effect of noise volume, F(2, 22) = 5.52,  $MS_e = .010$ , a significant main effect of trial type, F(1, 11) = 30.27,  $MS_e = .037$ , and a significant trial type by noise volume interaction, F(2, 22) = 6.20,  $MS_c = .011$ . The probability of correctly recognizing words on match trials was near perfect (.99) at all three noise volumes, whereas on nonmatch trials, the probability of correct recognition decreased as noise volume increased (.86, .85, and .73).

## Noise Judgments

Mean noise judgment, as a function of noise volume, is plotted in Figure 3. The data were analyzed with a 2 (cue) by 2 (trial type) by 3 (noise volume) ANOVA, with all variables within subjects. The main effects of cue, F(1, 11) = 5.47,  $MS_e = .476$ , noise volume, F(2, 22) = 173.25,  $MS_e = .385$ , and trial type, F(1, 11) = 14.81,  $MS_e = .204$ , were significant, as was the cue by trial type interaction, F(1, 11) = 28.57,  $MS_e = .042$ . As can be seen in Figure 3, subjects judged the noise level to be lower on precue/match trials than on any of the other trials.

The absence of significant interactions of cue or trial type with noise volume is illustrated by the parallel rating functions in Figure 3. The decrease in rated loudness on precue/match trials is constant across intensity levels.



Figure 3. Rating of background noise level as a function of noise volume for each cue/trial type combination.

# Discussion

The pattern of results is exactly as would be predicted if memory for the cue set in the precue/match condition served to aid interpretation of words presented in the target set, and those effects on interpretation were mistakenly attributed to a reduction in the loudness of the noise. To reduce the experienced level of noise, it was necessary for words in the sets to match and for presentation of the cue set to precede that of the target set. It was only on these precue/match trials that words in the cue set, words presented without noise, could be used to aid identification of the words accompanied by noise, words in the target set.

The results also show that some factors that might have been important did not influence noise judgments. On precue trials, subjects were allowed to make their noise judgment immediately after hearing the noise that accompanied the target set, whereas on postcue trials, presentation of the cue set produced a delay between hearing the noise and the judgment of its loudness. This delay of judgments on postcue/ match trials may have, for some reason, increased the apparent loudness of the noise. However, there was no difference in noise judgments on nonmatch trials. Because the difference between cue conditions in terms of the delay of noise judgments was the same on match and nonmatch trials, effects on judgments cannot be due to an influence of delay alone. The pattern of results also indicate that repetition alone was not sufficient to produce the effects since noise judgments on postcue/match trials did not differ from those on the postcue/nonmatch trials.

As in Experiment 1, variations in d' in our experiment would be revealed by nonparallel rating functions in Figure 3. The absence of interactions with noise volume in the ANOVA is consistent with the interpretation of set influencing  $\beta$  rather than d'.

#### General Discussion

In psychophysical experiments, an effect of noncriterial variables is typically treated as a contamination of "true" judgments. In contrast, we have used those effects as a measure of memory, and as a measure of the effects of perceptual set. Effects on subjective experience can be observed even when accuracy of identification is at ceiling. Also, effects on subjective experience are of interest in their own right, and may not always parallel those on accuracy of identification. The subjective experience underlying equally accurate reports may differ in clarity or loudness or both. A misperceived item may sometimes be experienced as being very loud or clear.

In both experiments, effects on noise judgments were large relative to the mean squared error, averaging over half of a scale value on a 5-point scale, and extremely consistent across subjects. The effects are even more impressive when one serves as a subject in the experiment. When sitting through the experiment, as a preliminary test of the procedures, the authors showed the effects as clearly as did subjects in the actual experiments. The subjective experience was not one of guessing or, in any way, actively using memory to aid identification. Rather, the background noise simply seemed less loud when either prior experience or perceptual set was consistent with the sentence or words that were presented.

Most prior investigations of memory have used recall or recognition tests. Such tests require subjects to reflect on prior experience, treating memory as an object that is inspected so as to allow discrimination between items that are represented in memory and those that are not. Although memory does not serve the function of allowing one to gain awareness of his or her personal past, it also serves other functions that do not rely on awareness of the past. Rather than serving as an object for reflection, memory can function as a tool to aid perception and interpretation of later events. Our subjects were unable to separate the contribution of memory from that of the physical stimulus when judging the loudness of noise. These effects on subjective experience may join those on accuracy of identification (e.g., Jacoby & Dallas, 1981) as evidence of functions of memory that do not necessarily rely on awareness of the past.

The effects of prior experience on noise judgments may amount to a perceptual hindsight effect. In his investigations of hindsight, Fischhoff (1975) has demonstrated that people are largely unaware of the effect that outcome knowledge has on their postdiction of the likelihood of an event. Consequently, they overestimate what they would have known without outcome knowledge. This hindsight effect is very difficult to eliminate either through instructions or relevant practice. Similarly, people are largely unaware of or at least unable to discount the effects of a prior experience when judging the loudness of background noise. If this effect parallels the hindsight effect, it should be very difficult to eliminate the influence of prior experience on noise judgments. Once informed by experience, it may be near impossible to disregard the influence of memory and, thereby, fully regain subjective experience that is the equivalent of that of the naive listener.

The influence of memory on subjective experience may not be tightly tied to any particular physical dimension. It seems likely that the influence of memory can be experienced as an increase in clarity, a reduction in background noise, an increase in intensity of the stimulus or any of a number of other changes in physical dimensions, depending on the details of the test situation. That is, situational factors such as instructions specifying the dimension that is to be judged are expected to influence subjective experience through their influence on an attribution process. The possibility that an attribution process is involved in judgments of memory, as well as those of physical dimensions, has been discussed elsewhere (Jacoby, in press; Jacoby & Brooks, 1984).

We have justified our interest in effects on subjective experience by claiming that those effects may hold some advantages over other measures of memory. Whereas previous experiments have concentrated on recognition memory or recall of particular prior events, we have shown effects on subjective experience that are specific to memory for a particular prior event. More important than effects on recognition or recall, perhaps, memory for the past can also influence subjective experience of the present. We conclude by describing two other lines of investigation that might make good use of effects on subjective experience as a measure. Effects on subjective experience could be used in an attempt to reveal that difficulties produced by cognitive factors are sometimes mistakenly attributed to the physical dimensions of a situation. For example, when a student complains that a professor mumbles and talks too rapidly, the problem may be due partially to the student's lack of understanding of the material, although the difficulty is experienced as totally due to physical characteristics of the message delivered by the professor. The student may be incorrect in attributing the difficulty to physical characteristics, but he or she may still act on that attribution. A deficit in the student's understanding, of course, points toward a different form of treatment than does a deficit in the professor's elocution.

Variations in perception have been used by others as an indirect measure of subjects' motivations and attitudes, as in Bruner's (1957) discussion of perceptual readiness and as in the work on perceptual defense (e.g., Eriksen, 1966). That work typically measured accuracy of perception, and so, for example, required subjects to report taboo words. The work was open to the interpretation that the effects operated at the level of reports of experience, rather than changes in experience per se. The noise judgment paradigm more indirectly measures the background noise of messages, and does not necessarily require subjects to report the actual message. Because the change in subjective experience involves subjects' misattribution of effects of cognitive and, perhaps, affective variables to changes in the physical noise, it is unlikely that subjects could strategically change their reports of noise so as to hide those effects.

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