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Inhibitory Effect of Schematic Processing on Perceptual Encoding

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It was hypothesized that although schemata facilitate organized conceptual processing, and hence recall, they simultaneously inhibit perceptual encoding. This inhibitory effect should emerge because schemata allow perceivers to rely on prior knowledge in place of incoming information and because schemata facilitate selective attention. Experiments 1 and 2 demonstrated that Ss encode less relevant perceptual information when they are provided with or are able to induce a schema. Experiment 3 demonstrated that Ss encode less relevant perceptual information when they are self-schematic in a domain, even though they have better recall for that information. Experiment 4 demonstrated that Ss encode less irrelevant perceptual information when they are provided with a schema. Thus, results show that although schemata facilitate recall, they simultaneously inhibit perceptual encoding.

Schemata play a vital role in information processing; they shape what we see and hear, how we store that information, and how we access it for later use. Whether in the form of self-schemata, stereotypes, social categories, or expectancies, schemata allow us to parse the perceptually seamless flow of incoming information into meaningful units. Schemata then enable the chunking of these individual units into understandable behaviors and the subsequent organization of behaviors into coherent impressions of persons or groups. These various and valuable processes are generally spontaneous, continuous, and ubiquitous, and they play a vital role in both comprehension and memory. Indeed, the facilitating effects of schemata on memory are so robust that Markus and Zajonc (1985) were led to conclude "In regard to sheer amount of recall it is a fair generalization that relevant schemas always facilitate recall; that is, individuals always remember more with a relevant schema than without one" (p. 153).

These benefits associated with schematic processing do not come without cost. Because schemata allow perceivers to rely heavily on their prior conceptualizations, they increase the bias in perceivers' memories. To date, two types of biases have been associated with schematic processing—distortion and discrimination. Distortion typically emerges when perceivers rely on their schemata to interpret ambiguous or novel events. For example, in Bartlett's (1932) classic experiments, subjects relied on Western schemata when reading the Inuit story *The War of the Ghosts.* Consequently, they incorrectly interpreted and remembered the narrative in ways that were consistent with their Western schemata but inconsistent with the actual story line (see also, Duncan, 1976; Zadny & Gerard, 1974). Discrimination problems emerge when perceivers integrate the events they witness so thoroughly with their prior knowledge that they can no longer differentiate between what they presently know and what they previously knew (as in the "hindsight bias," Fischoff & Beyth, 1975; see also, Sulin & Dooling, 1974). Discrimination problems also emerge when perceivers rely on abstracted concepts to make judgments concerning specific instances and thus are unable to differentiate between conceptually equivalent events that did and did not occur (Arkes & Freedman, 1984; Bransford & Franks, 1971; Cantor & Mischel, 1977). Nevertheless, despite the fact that schemata occasionally handicap information processing by creating problems of distortion and discrimination, the predominant view is that "the quantity and accuracy of people's memory . . . is superior whenever people are given an appropriate organizing theme as compared to when they are not" (Fiske & Taylor, 1991, p. 105).

In this article we challenge this view by arguing that schemata actually inhibit the amount of information that is remembered by suppressing the perceptual encoding of both relevant and irrelevant information. That is, if we consider perceivers' encoding of the perceptual information they encounter rather than their memory for the gist of that information, we might find that schematic processing actually inhibits the amount of perceptual information that is encoded. Before addressing such a possibility, it seems worth a brief digression to discuss what is meant by *perceptual encoding,* how it differs from *conceptual encoding,* and how these processes can be assessed.

Although one could parse the encoding process along a variety of dimensions, at the most basic level information can be encoded in two ways, conceptually or perceptually (cf. Craik & Lockhart, 1972). *Perceptual encoding* is the process by which the five senses translate environmental stimulation into mental

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representation. So, for example, one's assessment of the color of someone's skin or the loudness of someone's voice is a result of perceptual encoding. Were this perceptual encoding to be inhibited, one would not notice the color of the skin or the loudness of the voice and as a consequence would have no memory for this information. *Conceptual* (or gist) *encoding*, by contrast, is the process by which one interprets meaning from the information gathered by the five senses. So, for example, the realization that one is looking at an African-American person or listening to a heated debate is a result of conceptual encoding (if this realization occurs at the time of encoding). Were this conceptual encoding to be inhibited, one would not understand that the color of skin is associated with the person's racial background or that the loudness of voices is evidence of a disagreement, and, once again, one would consequently have no memory for this knowledge.

There is a long tradition in social psychology of relying on attentional measures and recall and recognition to assess conceptual encoding. Unfortunately, these measures are inadequate to assess perceptual encoding. Attentional measures are insufficient to assess perceptual encoding because it is impossible to know the type of features (i.e., perceptual or conceptual) to which the perceiver is devoting attentional resources. Although measurement of eye movements can provide an indication of perceptual encoding (e.g., McConkie & Zola, 1981), measurement of looking time does not necessarily provide evidence of perceptual encoding (e.g., Kintsch & Keenan, 1973).

Recall and recognition are also unsuited to the task of measuring perceptual encoding. Because of the importance of the conceptual comparison and retrieval processes inherent in these measures, recall and recognition are more sensitive to organizational and conceptual processing than they are to perceptual encoding (for a review of the conceptual vs. perceptual nature of memory measures, see Roediger, 1990). Consider, for example, the conceptual measure of recall. When you are trying to recall what you ate for lunch, you can rely on cues such as what you were doing at the time, where you were, or what you typically eat more easily than you can rely on your more difficult-to-access, visual memories of what was sitting on your plate. Even if you paid very little attention to the way your lunch looked or tasted, you might easily recall what you ate if you successfully find an appropriate recall cue, such as where you were, what you were doing, whom you were with, or how you felt later. Thus, because of their conceptual nature, recall and recognition are not appropriate measures of perceptual encoding.

A variety of measures have been developed that are well suited to the task of assessing perceptual encoding and storage of information. In general, these measures tend to differ from recall and recognition in that they do not require intentional recollection of an episode to demonstrate memory. As a consequence, these measures are referred to as *implicit*, because demonstration of memory is inherent to the procedure (for reviews, see Richardson-Klavehn & Bjork, 1988; Roediger, 1990; Schacter, 1987; Tulving & Schacter, 1990). Implicit measures typically rely on some facilitation in performance or processing time after presentation of a stimulus to demonstrate encoding and storage of that stimulus. To the extent that a perceiver can more quickly or accurately recognize an object on the second presentation than on the first, this facilitation is considered evidence of memory for that object. Although the implicit versus explicit nature of the memory measure is theoretically orthogonal to the perceptual versus conceptual nature of the measure, perceptual memory measures tend to be implicit rather than explicit, because explicit measures such as recall and recognition generally contain strategic retrieval processes (for an exception, see Blaxton, 1989).

Consider three of the most prominent implicit perceptual memory measures: perceptual identification, word-stem completion, and word-fragment completion. Perceptual identification is a task in which subjects are presented with a brief exposure of a word (on the order of 30 ms) and are asked to identify it. Encoding is indicated in this task by the extent to which subjects are able to identify words that they have encountered in the experiment. Word-stem completion is a task in which subjects are presented with the first three letters of a previously encountered word and are asked to add letters to form the first word that comes to mind. The three letter string, *ban*____, for example, could be completed as *banter*, *bannister*, or any other word that occurs to subjects. Word-fragment completion is similar to word-stem completion, but rather than removing all of the letters after the first three, select letters are removed throughout the word. Encoding is indicated in these tasks by the extent to which subjects complete the word stems or fragments with words that they have previously encountered in the experiment. These types of measures are thought to tap perceptual rather than conceptual encoding because they are sensitive to the match in modality of presentation between study and test but insensitive to semantic processing (e.g., see Blaxton, 1989; Graf & Mandler, 1984; Graf, Shimamura, & Squire, 1985; Jacoby, 1983; Roediger & Blaxton, 1987). So, neither thinking about a word nor hearing it spoken would lead to much facilitation on these visually oriented perceptual memory measures, whereas both thinking about a word and hearing it spoken would facilitate recall or recognition.

Because schemata promote organized conceptual processing, extensive reliance on recall and recognition might have led previous investigators to overestimate the facilitating effects that schemata have on memory for relevant material. Through their ability to lend meaning and structure to individual instances, schemata may well facilitate recall and recognition even though they inhibit encoding and storage of perceptual information. That is, schemata may not facilitate the quantity of information that is remembered, they may simply facilitate the quantity of information that is retrieved. Because perceptual memories tend to be difficult to access consciously, subjects without a schema may appear to have less information in memory than subjects with a schema, when in fact they actually have more information in memory but simply cannot retrieve much of it. Thus, the multitude of demonstrations across a variety of domains that schemata facilitate memory for relevant information might be more a function of the memory measures used than of the contents of memory. Perceivers without a schema might encode more perceptual information than perceivers with a schema but simply lack a theme with which to interpret, organize, and retrieve that information. Perceptual measures such as word-stem completion, word-fragment completion, and perceptual identification, which are less sensitive to organization and which minimize the retrieval component in memory, might paint a different picture from previous research.

The possibility that schematic processing could inhibit perceptual encoding, even as it facilitates conceptual encoding, follows naturally from the conclusion that schemata guide interpretation and selective attention (see Figure 1). Schemata facilitate interpretation of incoming information by allowing perceivers to rely on their prior conceptualizations to understand specific instances. In many circumstances, they also provide perceivers with expectancies about the type of information that will be encountered next. As a consequence, perceivers who have a schema do not need to pay much attention to either relevant or irrelevant information, because they can rely on previously stored information and expectancies. Perceivers without a relevant schema, on the other hand, must rely on more effortful, piecemeal integration (Fiske & Neuberg, 1990) of available information.

Consistent with this viewpoint, perceivers spend less time encoding behavioral information when they can apply an appropriate schema than when they cannot (Fiske, Neuberg, Beattie, & Milberg, 1987; Stern, Marrs, Millar, & Cole, 1984; see also Bargh & Thein, 1985; Belmore, 1987; Markus, 1977). The implications of this finding, however, are not completely clear. On the one hand, it is possible that schematic perceivers are simply more adept and efficient at processing schema-relevant information, and thus the speed with which they process incoming information is unrelated to the amount of information they actually encode. This viewpoint is common to most conceptions of schemata (for reviews, see Hastie, 1981; Markus & Zajonc, 1985). On the other hand, and according to the current hypothesis, the decreased time spent in information

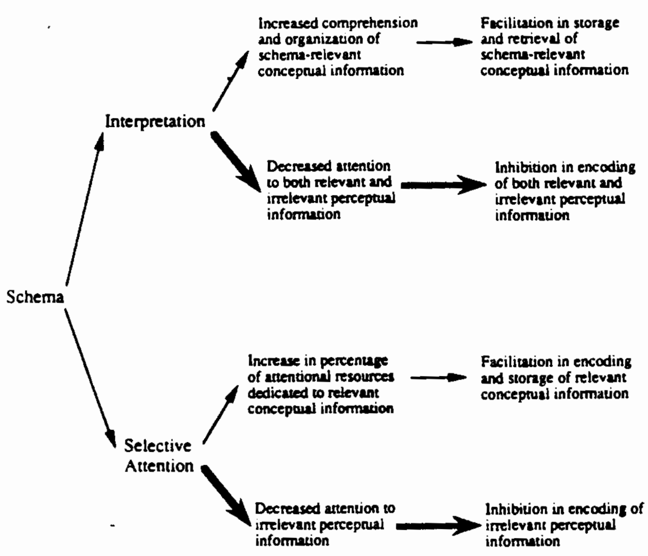

Figure 1. A representation of the effect of schematic processing on conceptual memory and perceptual encoding. (Heavy arrows indicate the effects of schematic processing that are proposed by our model. Light arrows indicate the effects of schematic processing that are proposed by previous theory.)

processing by perceivers with a schema may lead them to encode less perceptual information.

As can be seen in Figure 1, selective attention also has the potential to play an important role in the inhibition of perceptual encoding, albeit only in the case of irrelevant information. By facilitating selective attention, schemata enable perceivers to ignore irrelevant information and devote their attention only to relevant information (see Stern et al., 1984; White & Carlston, 1983). Such attentional strategies can lead to a further inhibition in encoding of perceptual information that is irrelevant to the currently activated schema. Thus, the effects of interpretation and selective attention should be to decrease the amount of processing that perceivers devote to relevant and irrelevant information, thereby decreasing the perceptual encoding of this information.

To date there is suggestive evidence from experiments in cognitive psychology that schemata might inhibit perceptual encoding. These experiments examined the perceptual encoding of words that were read in a meaningful context or outside of such context and generally found evidence of decreased perceptual encoding when words were read in a meaningful context. To the extent that schemata provide a meaningful context, these experiments suggest that schemata might inhibit perceptual encoding. Because these experiments were not intended to examine the effect of schematic processing, however, none of them provide a test of the current hypothesis.

For example, Jacoby (1983) has demonstrated decreased perceptual encoding of words preceded by a semantically related word compared with words preceded only by a series of *x*s or compared with words that subjects expected to be preceded by their antonyms but were preceded by an unrelated word. Jacoby did not include a condition, however, in which words were followed by other words that did not violate subjects' expectancies but were semantically unrelated. Such a condition would have allowed a direct comparison of encoding of word pairs in a meaningful context to encoding of word pairs in a meaningless context, while eliminating the confounding variation in expectancies. Without such a condition, interpreting his experiments with regard to the current hypothesis requires an inappropriate comparison between text-reading conditions and list-learning conditions, or between expected and unexpected events.

MacLeod (1989) has also demonstrated decreased perceptual encoding of words read in a meaningful context compared with words read in a nonsensical context. In MacLeod's experiments, however, subjects were instructed to interrupt their reading to cross out words that did not fit in their context. By causing subjects to disrupt their reading and attend to words presented out of context, this task could have induced sufficient additional processing to produce the facilitation in encoding that he found for these words. Finally, Levy and Kirsner (1989) and Oliphant (1983) have shown decreased perceptual encoding of words that are read in sentences compared with words that are read in lists. Once again, however, words read in sentences are not only read in a meaningful context but they also receive substantially less visual processing than words read in lists, as the eye does not even fixate on all of the words read in sentences but focuses directly, for a substantial period of time, on words read in lists (e.g., see Rayner, 1978). Nevertheless, these experiments provide suggestive evidence using implicit memory procedures that people do not perceptually encode words as thoroughly when the words are read in a meaningful context as when they are read outside of such context.

If schemata do inhibit perceptual encoding as the current hypothesis suggests, such an inhibition would have important consequences for later memory-based processes, because perceptual information is often crucial to a perceiver's processing goals. Consider, for example, a perceiver who has a stereotype that African-Americans are more hostile than Caucasians. If that perceiver were to witness an African-American shoving a Caucasian, the perceptual features of the shove would be relevant to the stereotype (whereas the perceptual features concerning the person's shirt or socks probably would not be relevant). According to our hypothesis, the perceiver's schema (or stereotype) would cause an inhibition in attention to and encoding of all perceptual features of the incident, including those concerning the actual shove. As a consequence, the perceiver would simply encode the gist of the behavior—that the African-American shoved the Caucasian—in a stereotype-consistent manner. Thus, the shove would likely be perceived and remembered as evidence of hostility, whereas the perceptual details of the shove would never be encoded. So, for example, the perceiver would not remember where or how the hands of the African-American were placed on the body of the Caucasian, how much tension was evident in the arms of the African-American, how rapidly and how far back the Caucasian was moved, and so forth.[1]

A perceiver who did not have a stereotype concerning the hostility of African-Americans would attend to and encode the relevant and irrelevant perceptual features of the incident. Such a perceiver would thereby have the perceptual information in memory with which to build a coherent picture but would not have the knowledge structures available that allow for interpretation of that information. So although perceivers with a schema might well have better "gist" encoding than perceivers without a schema (i.e., better comprehension at the time of encoding), the encoding process of schematic perceivers would leave them with little or no information that is unsullied by their schematic filter. Aschematic perceivers, on the other hand, would have a great deal of perceptual information in memory that would be available for later interpretation and consideration (i.e., they would have available the type of perceptual information discussed earlier). Thus, the shove might later be interpreted as evidence of either playfulness or hostility, and the perceiver could vacillate over time in her or his interpretation.

The studies reported herein were designed to test the possibility that schemata inhibit perceptual encoding. In the first experiment, subjects were presented with an ambiguous sequence of behaviors. Some subjects were provided with an appropriate schema with which to interpret the behaviors, and some were not. We then assessed whether schemata inhibit perceptual encoding. The second experiment was a conceptual replication of the first experiment, in that subjects either induced or did not induce an appropriate schema, and we assessed whether schemata inhibit perceptual encoding. The third experiment was an extension of the first two experiments in that we assessed whether self-schemata inhibit perceptual encoding while simultaneously facilitating conceptual memory. Finally, the fourth experiment addressed the role of selective attention in the inhibitory effect of schematic processing on perceptual encoding of irrelevant information.

Experiment 1: The Effect of Schematic Processing on Perceptual Encoding

To determine whether subjects encode less perceptual information when they rely on a schema than when they do not, in Experiment 1 we presented subjects with a series of behaviors that were difficult to interpret without an appropriate schema. Subjects who did not have a schema were expected to pay a great deal of attention to the individual behaviors in an attempt to comprehend them. Subjects who had a schema were expected to pay only minimal attention to the behaviors, as the behaviors would be expected and easy to interpret. In this way, schematic processing should lead to a reduction in perceptual encoding. To measure perceptual encoding, a word-stem completion task was devised as an implicit, perceptual measure.

Method

Subjects. Twenty-four introductory psychology students participated in this experiment in partial fulfillment of their course requirements.

Procedure. Subjects were run in groups of up to 6 people. Subjects were presented with a paragraph developed by Bransford and Johnson (1973) that is sufficiently ambiguous so that it cannot be interpreted without an appropriate title. The paragraph describes the procedures one engages in while doing laundry (see Bransford & Johnson, 1973, for this paragraph and similar others). Half of the subjects were randomly assigned to read no title before reading the paragraph, and half read the title, "Washing Clothes." The paragraph was typed on a single sheet of paper that remained facedown until the experimenter read the paragraph aloud, while subjects read it silently to themselves. The page was then returned to the experimenter.

A booklet containing two presentations of 46 word stems from the paragraph was then distributed. These word stems were created by randomly choosing 50 words that contained more than three letters from the paragraph and removing all the letters after the first three. The first three letters of 4 of these words were identical to other word stems, so these 4 word stems were removed from the list. The final list of 46 word stems was alphabetized, and to increase the sensitivity of the measure, two iterations of each word stem were created. This use of two iterations rather than one presentation of each stem was adopted because second completions to word stems have been found to be sensitive to the same factors (e.g., word frequency and potential number of completions), and to the same degree, as first completions (Graf & Williams, 1987). The word stems were presented in two columns so that the two iterations of each word stem were presented next to each other on the page. Subjects were told to complete these word stems by adding letters to form the first English words that come to mind. Subjects were told not to choose the same completion to the two iterations

[1] By inhibiting perceptual encoding in this way, schemata might facilitate the type of attributional biases documented by Trope (1986; Trope, Cohen, & Alfieri, 1991) in the identification and inference processes. As Trope noted, expectancies and stereotypes can influence the identification stage. To the extent that perceptual information is not encoded, later inferences about the meaning of the behaviors have the potential to be more extreme and schema consistent.

of a single word stem. When subjects had completed the booklet of word stems, they were debriefed, thanked, and dismissed.

Results and Discussion

The two iterations of the 46 word stems were scored as a function of whether the completed words were present in the paragraph. Each stem had a possible score of 1, if subjects chose a word from the paragraph as the solution to either the first or second presentation of the word stem, or 0. As predicted, subjects who read the paragraph without the aid of a title chose more words from the paragraph as solutions to the word stems ($M = 21.6$) than subjects who read the paragraph with the aid of a title ($M = 18.9$), $t(22) = 2.63$, $p < .02$.[2] Thus, subjects in the current experiment showed evidence of decreased, rather than increased, perceptual encoding in the presence of a schema.

These results stand in sharp contrast with those of Bransford and Johnson (1973), who found that subjects who received a title to this paragraph recalled significantly more information from the paragraph than subjects who did not receive a title. There have been countless replications of Bransford and Johnson's findings, and it has been demonstrated that the presence of a thematic title facilitates recall of specific words as well as general ideas (for a review, see Markus & Zajonc, 1985). The clear distinction between the results of the current experiment and those of previous research, however, lies in the type of memory that was assessed. Bransford and Johnson demonstrated that people have better conceptual memory in the presence of a schema, whereas the results from Experiment 1 demonstrate that people have better perceptual memory in the absence of a schema.

Experiment 2: The Effect of Schematic Processing on Perceptual Encoding—A Conceptual Replication

The results from Experiment 1 provide initial support for the possibility that schematic processing leads to an inhibition in perceptual encoding. The goal of the next experiment was to extend Experiment 1 using a different manipulation of schemata and an additional measure of perceptual encoding. In the second experiment, subjects in the schema condition were presented with a series of behaviors that were performed by two individuals. We expected these subjects to search for themes underlying the behavior of the two individuals and use these themes to aid in the processing of the later behaviors. In other words, these subjects would induce a schema that would facilitate information processing concerning the two individuals. For this reason, we expected to observe decreased perceptual encoding among these subjects.

Subjects in the no-schema condition were not provided with an opportunity to induce schemata, as the behaviors were associated with two loosely knit groups (whose members would not be expected to be uniform on any important psychological dimensions). Because the group membership in this condition was not psychologically meaningful, subjects were not expected to attend to group-level information to facilitate their processing of the individual behaviors (cf. Srull, 1981). Thus, we did not expect subjects to search for themes underlying the behaviors of group members, and consequently subjects should not notice that such themes were present. As a result of this failure to associate group-level information with specific behaviors, subjects would not have schemata available to facilitate information processing concerning the behaviors of group members. For this reason, they would have to pay close attention to the specific behaviors and should engage in a great deal of perceptual encoding.

Because important processing differences exist between perceptual measures, just as they exist between the conceptual measures of recall and recognition, it was necessary to demonstrate that the inhibitory effect of schemata on perceptual memory would emerge with a variety of perceptual memory measures. Such a replication across memory measures would demonstrate that the results of Experiment 1 were not unique to word-stem completion but rather would emerge with any memory measure that is primarily perceptual in nature. For this reason, perceptual encoding in Experiment 2 was measured using the procedure of word-fragment completion.

Method

Subjects. Sixty introductory psychology students participated in this experiment in partial fulfillment of their course requirements.

Procedure. Subjects were run in groups of up to 10 individuals. They were given a booklet containing 96 frequency-similar words that were selected from a larger stimulus list (developed by Tulving, Schacter, & Stark, 1982) on the basis of pretesting that identified words whose fragments have baseline completion rates between 30% and 60%. Each word was associated with a correct or incorrect definition, and each page of the booklet contained a definition, located in the center of the page. The subjects' task was to evaluate the intelligence reflected in each word definition on a 9-point scale. Subjects were told they would be asked about their impressions of the persons who or groups that provided the definitions once they had finished this task.

Half of the subjects were randomly assigned to evaluate word definitions that were allegedly produced by two individuals, and half of the subjects were randomly assigned to evaluate word definitions that were allegedly produced by different members of two loosely knit groups. These groups were ostensibly composed of people who had been randomly selected from the phone book and then grouped according to the first letter of their last name (from the first half of the alphabet or the second half of the alphabet). The source of each definition was labeled at the top left-hand corner of each page. In the individual condition, the definition was associated with either the name Steve or Rick, whereas in the group condition the definition was associated with a male individual and his group status (e.g., Bob J. in the first alphabet group or Herb S. in the second alphabet group). Each name in the group condition appeared only once, although the group membership was mentioned with each occurrence of a definition.

The definitions were organized such that one source always defined the words correctly, and the other source always defined the words incorrectly. The correct definitions were simplifications of those pro-

[2] When first and second completions to the word stems were examined independently, the identical pattern of results emerged across the two completions. On the first iteration of the word stems, 14.9 words from the paragraph were chosen as completions in the no-title condition, and 13.4 words from the paragraph were chosen as completions in the title condition. On the second iteration of the word stems, 6.7 words from the paragraph were chosen as completions in the no-title condition, and 5.5 words from the paragraph were chosen as completions in the title condition.

vided by *Webster's New Collegiate Dictionary* of a sort that an intelligent person might reasonably be expected to provide on a vocabulary test (e.g., *horizon*—The line where the sky and earth meet). The incorrect definitions were slight variations on these simplifications, designed to be subtly incorrect so that they would not be inherently more memorable or easily evaluated than the correctly defined words (e.g., *sheriff*—The mayor of a small town).

During the test phase, subjects were given a word-fragment completion task for half of the words randomly selected from the induction phase. Although these word fragments were designed by Tulving et al. (1982) to have only one correct solution, pretesting indicated that subjects occasionally arrive at an alternative solution. Because these alternative solutions represented less than 2% of the overall solutions, however, they were coded as incorrect. As in Tulving et al., subjects were given 20 min to solve the various word fragments. Once they had completed this task, they were debriefed, thanked, and dismissed.

Results and Discussion

Subjects' word-fragment completion scores were summed to form a variable with a potential range from 0 (no correct completions) to 48 (all correct completions). Because the word fragments tended to have only one possible solution, a greater number of correct solutions was interpreted as evidence of increased perceptual encoding. As predicted, subjects in the individual condition showed decreased perceptual encoding, completing fewer word fragments correctly ($M = 26.2$) than subjects in the group condition ($M = 30.1$), $t(58) = 2.02$, $p < .05$.

Thus, once again, subjects showed evidence of decreased, rather than increased, perceptual encoding in the presence of a schema, and once again, these results stand in contrast with previous research, as Srull (1981) has demonstrated that subjects have better recall when behaviors are associated with an individual than when they are associated with a loosely knit group. The dissociation between Srull's results and those of the current experiment is explained, however, by the fact that Srull was concerned with conceptual memory, whereas we were assessing perceptual encoding.

The results from Experiment 2 provide further support for the hypothesis that schematic processing inhibits perceptual encoding. There are two related mechanisms that could explain this effect. As noted earlier, schematic perceivers may engage in less perceptual encoding because they are relying on their prior knowledge structures in place of incoming information (interpretation) or because those prior knowledge structures provide them with expectancies concerning the nature of incoming information. Either mechanism would cause them to devote fewer attentional resources to the encoding process. Because of the nature of the first two experiments, there is no way to determine whether the inhibition in perceptual encoding emerged as a consequence of interpretation or expectancy generation, because schemata provided expectancies in both of these studies. In Experiment 1, schematic subjects were invariably aware of the procedures involved in doing the laundry and thus knew what to expect, and in Experiment 2, schematic subjects would have quickly learned to expect the intelligent source to be correct and the unintelligent source to be incorrect.

Experiment 3 was designed to demonstrate that schemata can inhibit perceptual encoding even when they do not provide expectancies about the nature of the information that will be encountered next. In Experiment 3, subjects could rely on prior knowledge to facilitate rapid interpretation of the material but not to predict what the sequence of information would be. So, to the extent that schemata inhibit perceptual encoding in Experiment 3, this inhibition could not be a function of expectancy generation but instead must be a function of interpretation.

Experiment 3 was also designed to demonstrate in the context of a single study that schemata inhibit perceptual encoding while simultaneously facilitating conceptual memory. Furthermore, Experiment 3 was intended to increase the generalizability of the previous findings by relying on multiple measures of perceptual and conceptual memory and by relying on another important manipulation of social schemata—self-schemata.

Experiment 3: The Effect of Self-Schemata on Perceptual Encoding and Conceptual Memory

Markus (1977) has demonstrated that people can make judgments about the self-descriptiveness of trait adjectives more rapidly when they are relevant to self-schemata than when they are not. This finding is consistent with the results of other schema research (e.g., Belmore, 1987; Fiske et al., 1987; Stern et al., 1984) demonstrating that subjects spend less time processing schematic information than processing aschematic information. Although Markus (1977) did not examine subjects' recall for the trait words they encountered, Carpenter (1988) has found that people show better recall for behaviors that are relevant to their self-schemata than for behaviors not relevant to their self-schemata (for similar results in the chronic accessibility literature see also Higgins, King, & Mavin, 1982). This finding suggests that subjects might have better conceptual memory for trait words when they are relevant to their self-schemata than when they are not. The goal of the current experiment was to demonstrate that self-schemata facilitate conceptual memory and simultaneously inhibit perceptual encoding. To measure conceptual memory, subjects were given either a recall or a recognition task. To measure perceptual encoding, subjects were given either a word-fragment completion or a perceptual identification task.

Method

Subjects. One hundred two introductory psychology students participated in this experiment in partial fulfillment of their course requirements.

Procedure. Subjects were run individually using a computer to display the instructions and experimental materials. In the first stage of the experiment, subjects were asked to rate themselves on 10 trait dimensions. Each trait dimension was represented by two polar opposite trait-adjective pairs (e.g., *intelligent–unintelligent* and *smart–dumb*), so subjects made 20 self-ratings. The trait adjectives were presented as anchors on 9-point scales, with 1 trait adjective on one end of the scale and its opposite on the other end of the scale. The subjects' task was to type in the number that represented where they stood on each continuum. The 20 trait pairs were presented in random order.

Once subjects had finished these self-ratings, they made 60 speeded me–not me judgments, in which they indicated whether a word described them by pushing a key labeled *me* or a key labeled *not me*. Subjects were instructed to rest their index fingers on these two keys and to push the appropriate key as quickly as possible once a trait adjective was shown. The trait adjectives remained on the screen until subjects pushed a key, and the screen was then cleared. Five hundred ms later, the next trait adjective was presented. The 60 words about which they made these judgments were trait adjectives relevant to the 10 trait dimensions on which they had earlier rated themselves. Three words were positively associated with each trait dimension, and 3 words were negatively associated with each trait dimension (e.g., *lively, outgoing, social,* and *quiet* and *withdrawn* and *timid*). Two lists of 60 words were created from a larger list of 120 trait words, and subjects were randomly assigned to one of the two lists.

When subjects had finished making me–not me judgments, they were randomly assigned to one of four memory tasks: perceptual identification, word-fragment completion, recall, or recognition. In the recall task, subjects were simply asked to type in all the words they could remember from the me–not me phase of the experiment. In the three other memory conditions, the 60 words that subjects had previously seen (targets) and the 60 words they had not seen (foils) were presented in random order, one at a time, in the center of the computer screen. After each judgment that subjects made concerning these words, the screen was cleared, and the next word was presented 500 ms later.

In the recognition condition, the target and foil words were presented intact, and subjects were asked whether they had previously seen each of these words in the me–not me phase of the experiment. Their answers were recorded as a simple yes or no judgment. In the word-fragment completion condition, fragments of the target and foil words were presented, and subjects were asked to type in English words that fit the individual patterns of letters and spaces. These word fragments were selected through pretesting to have a baseline completion rate between 20% and 60% for their associated trait words (see the Appendix for the 120 trait words and their word fragments). In the perceptual identification condition, subjects were first given 24 practice trials, in which words were exposed at decreasing durations, from 133 ms to 33 ms, with each word followed immediately by a perceptual mask: @#$%&@#$%&. After this practice stage, they were shown the target and foil words at 33-ms durations, with each word followed immediately by the perceptual mask.[3] The subjects' task was to guess the identity of the presented words, and they typed their guesses into the computer. Once subjects had completed the memory task, they were debriefed, thanked, and dismissed.

Results and Discussion

Our first goal was to determine whether we would replicate Markus's (1977) finding that subjects make faster judgments concerning the trait words for which they are self-schematic than concerning the words for which they are aschematic. In service of this goal, subjects who chose responses below 3 or above 7 on both trait scales underlying each dimension were considered to be schematic on that trait dimension. In this way, schematicity was idiosyncratically determined, and subjects were found to be self-schematic on an average of 3 of the 10 trait dimensions.

Subjects' average response times to the me–not me judgment task were then analyzed in a two-way, mixed-model analysis of variance (ANOVA), with type of memory measure as a between-subjects factor and schematicity as a within-subjects factor. As predicted, the ANOVA revealed a significant effect for schematicity, such that subjects made faster judgments concerning the traits for which they were self-schematic ($M = 1{,}103$ ms) than for the traits for which they were aschematic ($M = 1{,}215$ ms), $F(1, 98) = 23.69$, $p < .001$. No effect emerged for the type of memory measure ($F < 1$, *ns*), nor was there an interaction between memory measure and schematicity, $F(1, 98) = 1.58$, *ns*.

Our next goal was to determine whether schemata were inhibiting perceptual encoding while simultaneously facilitating conceptual memory. In service of this goal, a difference score was calculated for each subject in the word-fragment completion and perceptual identification conditions. This task was accomplished by subtracting the number of correct responses to the foil words from the number of correct responses to the target words. In a similar manner, in the recognition condition, subjects' total number of positive identifications of foil words was subtracted from their total number of positive identifications of target words. Finally, in the recall condition, subjects' total number of correctly recalled target words was computed.

Because these four memory measures relied on different procedures, subjects' memory scores were transformed to z scores separately for each condition before being subjected to an ANOVA. As predicted, the ANOVA revealed a significant interaction between schematicity and type of memory, with subjects showing better conceptual memory for the schematic words and better perceptual memory for the aschematic words, $F(3, 98) = 2.73$, $p < .05$ (see Figure 2 for the nontransformed scores). No main effect emerged for schematicity ($F < 1$, *ns*).

To examine the effect of schematic processing across the replications of the perceptual and conceptual measures, the z scores from the word-fragment completion and the perceptual identification conditions were collapsed into an index of perceptual memory, and the z scores from the recognition and recall conditions were collapsed into an index of conceptual memory. An ANOVA on the resultant z scores again revealed the predicted interaction between schematicity and nature of the memory measure, $F(1, 100) = 8.19$, $p < .01$. Simple effects analyses revealed that subjects had better perceptual memory for the aschematic trait words, $F(1, 44) = 4.86$, $p < .05$, and better conceptual memory for the schematic trait words, $F(1, 56) = 2.94$, $p < .10$.[4]

The results from this experiment provide further support for the hypothesis that schematic processing inhibits perceptual encoding. Because subjects in this experiment could not generate expectancies about the nature of upcoming events, these results cannot be accounted for by the role that schemata play

[3] Software control of a cathode-ray tube (CRT) screen presentation is a complex problem, but one that can be accomplished without additional hardware connections (see Bargh, Bond, Lombardi, & Tota, 1986, for a discussion of CRT screen variability issues). To set the presentation durations for the perceptual identification tasks in Experiments 3 and 4, an oscilloscope attached to a light diode was used to determine that the software was presenting the stimuli for 33.3-ms durations and was then following that presentation immediately with the perceptual mask. The oscilloscope revealed that the software produced the intended exposure durations on more than 98% of the presentations. The rare inaccuracies resulted in screen presentations of 50 ms, followed immediately by the perceptual mask.

[4] All of the response time and memory analyses were also conducted, with the two counterbalanced 60-word lists included as a between-subjects factor. No interactions or main effects for trait list emerged from these analyses, so this factor is not reported in any of the analyses.

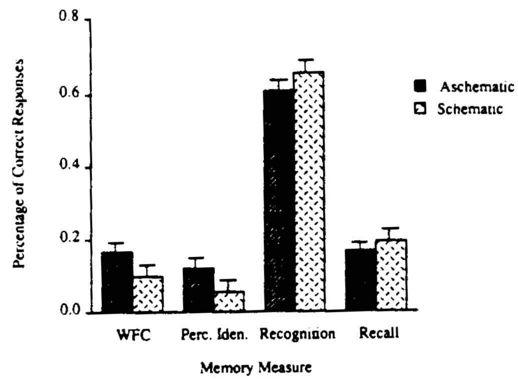

Figure 2. Perceptual and conceptual memory for schematic and aschematic trait words. (Bars represent one standard error. WFC = word-fragment completion; Perc. Iden. = perceptual identification.)

in generating expectancies. Rather, as depicted in Figure 1, interpretation seems to be more directly implicated in these findings. The recall and recognition results also provide supportive evidence that schematic processing facilitates conceptual memory even as it inhibits perceptual processing.

Experiment 4: A Test of Selective Encoding

Overall, the results from the first three experiments suggest that schemata inhibit perceptual encoding in a variety of contexts. This inhibitory effect presumably emerged because schemata facilitate interpretation, and sometimes allow for the generation of expectancies, so schematic subjects need not pay as much attention to incoming information. The goal of Experiment 4 was to examine the role that selective attention plays in the inhibition in perceptual encoding of irrelevant information. To address this process, it is necessary to reconsider the schematic function of selective attention (see Figure 1).

An important feature of schemata is that they direct attention toward relevant instances and away from irrelevant instances. Moreover, because people behave like "cognitive misers" (Fiske & Taylor, 1991), schematic perceivers should not devote any more attention to relevant information than is necessary, even though they are preserving attentional resources by ignoring irrelevant information. Aschematic perceivers, on the other hand, cannot differentiate between relevant and irrelevant material, so they should attend equally to both types of information. Consequently, schematic perceivers should pay less attention to irrelevant information than should aschematic perceivers, thereby encoding less irrelevant perceptual information.[5] In addition, because schematic perceivers should avoid devoting more attentional resources to the encoding task than are necessary, they are likely to encode no more relevant perceptual information than aschematic perceivers.

Because schemata facilitate interpretation, they lead to decreased attention to both relevant and irrelevant information (e.g., Stern et al., 1984). With the ambiguous paragraph from Bransford and Johnson (1973), the size of this effect is rather large, as pretesting revealed that subjects without a schema require almost 50% more time to read the paragraph than do subjects with a schema. For this reason, any inhibitory effect that selective attention might have on the perceptual encoding of irrelevant information can be masked by the overall attentional differences that emerge. So, when perceivers are processing information at their own pace, selective attention might have an inhibitory effect on the perceptual encoding of irrelevant information, but this effect might be undetectable because of the overall decrease in encoding brought about by interpretation. Therefore, to examine the independent effect of selective attention, it is important to eliminate the attentional effects brought about by interpretation. One way to accomplish this goal is to control subjects' looking time, thereby eliminating the overall decrease in attention that is brought about by interpretation.

Although attention and looking time tend to be highly correlated, selective attention could inhibit encoding independent of looking time by causing perceivers to ignore irrelevant instances even when they continue to remain perceptually available (e.g., see Jacoby, 1983). According to such an attentional strategy, perceivers with a schema would quickly classify irrelevant information and then ignore it as they attend only to relevant information. Perceivers without a schema, on the other hand, would have to attend equally to relevant and irrelevant information because they would be unable to differentiate between the two. Consequently, when looking time is held constant, schematic perceivers should show a high degree of perceptual encoding only of relevant information, whereas aschematic perceivers should show an equally high degree of perceptual encoding of both relevant and irrelevant information.

To examine the impact of selective attention on perceptual encoding, subjects were again presented with the ambiguous behavioral sequence used in Experiment 1, this time with looking time held constant. To measure perceptual encoding, subjects were given a perceptual identification task.

Method

Subjects. Fifty-three introductory psychology students participated in this experiment in partial fulfillment of their course requirements.

Pretest. Subjects were run individually using a computer to display the instructions and experimental materials. Subjects were told that they were participating in an experiment on near-subliminal perception and that they would see a series of words flashed at very high speeds. Their task was to guess the identity of the words that were displayed, and they were to indicate their choices by typing them on the computer keyboard. Before being presented with the ambiguous behavioral sequence, subjects were first given 30 practice trials, in which words were exposed at decreasing durations, from 133 ms to 33

[5] In support of this possibility, Srull, Lichtenstein, and Rothbart (1985) have found that as an expectancy or schema develops, people begin to show poorer recall for schema-irrelevant behaviors. Similarly, Fiske, Kinder, and Larter (1983) have demonstrated that political experts are more able than political novices to discriminate between congruent and incongruent information and are more likely to devote attention to incongruent information. The implications of these data are not completely clear with regard to the current hypothesis, however, as both Srull et al. and Fiske et al. used a conceptual memory measure, and development of the schema in Srull et al. was equated with serial position of the information.

ms, with each word followed immediately by a perceptual mask: @#$%&@#$%&. Once subjects had completed 30 practice trials, they were exposed to 50 more trials at 33 ms per word, with each word followed by the perceptual mask. To reduce the variance in performance on the upcoming perceptual identification task, 28 of the 53 subjects were chosen for participation in the perceptual identification phase of the experiment because they correctly identified more than 30% but less than 70% of the pretest words in these 50 trials.[6]

Procedure. Once subjects had finished identifying the pretest words, they were presented with the "Washing Clothes" paragraph. Half of the subjects were randomly assigned to read the title before reading the paragraph, and half did not read the title. To control reading time, the paragraph was presented one word at a time for a presentation duration of 750 ms per word, with all punctuation removed (see Dooling & Lachman, 1971). Each word was presented in the middle of the computer screen, which was then cleared after 750 ms. Two hundred ms later, the next word appeared.

After reading the paragraph, subjects were given another 12 practice trials at the perceptual identification task, in which words were exposed at ever-decreasing durations from 67 ms to 33 ms. They were then presented with 33-ms exposures of 15 relevant words from the paragraph, 15 irrelevant words from the paragraph, and 30 frequency-similar foil words, all in random order. The relevance of the target words to the theme of the paragraph was determined by a naive rater who was instructed to divide 30 frequency-similar words from the paragraph into lists of 15 relevant words and 15 irrelevant words. Each word in the perceptual identification task was followed directly by the perceptual mask, and the subjects' task was to guess the identity of the word and type their guess into the computer. Once subjects had completed the perceptual identification task, they were debriefed, thanked, and dismissed.

Results and Discussion

If selective attention causes an inhibition in perceptual encoding of irrelevant information, subjects should show worse perceptual identification of irrelevant words in the presence of a title than in the absence of a title. Because the attentional effects of interpretation have been removed by presenting all words for a fixed duration, however, subjects in this experiment should show equivalent perceptual identification of relevant words in the presence and absence of a title. Consistent with this prediction, an ANOVA revealed a marginal two-way interaction between presence of a title and type of word, $F(2, 25) = 3.1$, $p < .07$ (see Figure 3). Simple effects analyses revealed that the presence of a title inhibited identification of irrelevant words, $F(1, 26) = 4.5$, $p < .05$, but did not influence identification of relevant words, $F(1, 26) < 1$, *ns*, or foil words, $F(1, 26) < 1$, *ns*. A main effect also emerged for type of word, $F(2, 25) = 4.0$, $p < .05$, such that relevant words were identified with the greatest frequency, followed by irrelevant words and then foil words. However, this main effect was qualified by the presence of the predicted interaction. No main effect emerged for presence of a title, $F(1, 26) < 1$, *ns*.[7]

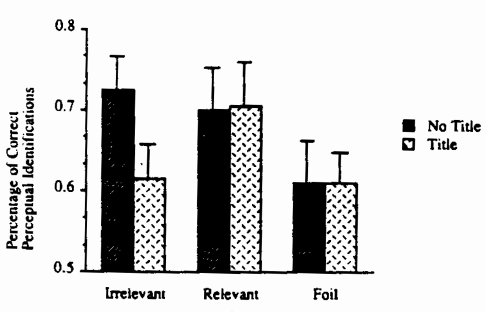

Figure 3. Percentage of correct identifications of relevant and irrelevant words in the presence and absence of a title. (Bars represent one standard error.)

As can be seen in Figure 3, when the attentional effects of interpretation are controlled, subjects with a schema show decreased perceptual encoding of irrelevant information, compared with subjects without a schema, but equivalent perceptual encoding of relevant information. These results suggest that the schematic function of selective attention can lead to inhibition in perceptual encoding of irrelevant information above and beyond that brought about by interpretation.

General Discussion

Taken together, these experiments provide support for the hypothesis that schemata inhibit perceptual encoding. Experiment 1 demonstrated decreased perceptual encoding among subjects who were provided with a schema. Experiment 2 demonstrated decreased perceptual encoding among subjects who were able to induce a schema. Experiment 3 demonstrated decreased perceptual encoding of schema-relevant information but increased conceptual memory for this information. Finally,

[6] One might imagine an alternative procedure for matching subjects' perceptual thresholds to exposure durations in which subjects are exposed to words for decreasing durations until they can only identify, for example, 50% of the words. However, because presentation durations on the CRT are limited to increments of 16.66 ms, it is not possible to set each subject's presentation duration so that performance is at or near some preset criterion. Thirty-three-ms exposures are appropriate for about 50% of a college-age sample, but 16.7 ms is far too fast for all but a small percentage of subjects, and 50 ms is too slow for all but a small percentage of subjects. Consequently, we simply eliminated subjects if their perceptual thresholds did not match our criteria. Because there are no apparent reasons why schemata should selectively inhibit the perceptual encoding of irrelevant material only among people whose perceptual threshold is at or near 33 ms, this selection procedure was adopted.

[7] The 25 subjects who did not perform between 30% and 70% on the perceptual identification pretest were presented with the Bransford and Johnson (1973) paragraph but were given a recall task in place of the perceptual identification task. Although this assignment to the recall condition was not random, it was made before subjects encountered the experimental materials and was orthogonal to their assignment to the title–no-title conditions. As predicted, an ANOVA revealed a marginal two-way interaction between presence of a title and type of word recalled, $F(1, 23) = 4.1$, $p < .06$. Simple effects analyses revealed that the presence of a title facilitated recall of relevant words, $F(1, 23) = 6.2$, $p < .03$, but did not influence recall of irrelevant words, $F(1, 23) < 1$, *ns*. The main effect for type of word was not significant, $F(1, 23) = 2.6$, $p > .10$. A marginal effect for presence of a title emerged, with subjects recalling more words in the presence of a title (12.0) than in the absence of a title (9.2), $F(1, 23) = 3.7$, $p < .07$. These findings are entirely consistent with previous research in which schemata have been reliably found to facilitate recall for relevant information (e.g., see Dooling & Lachman, 1971).

Experiment 4 demonstrated that when information is presented for a fixed duration, subjects provided with a schema showed evidence of decreased perceptual encoding of irrelevant information. Thus, these experiments used three manipulations of schemata, three measures of perceptual encoding, and two measures of conceptual memory to demonstrate that schemata reliably inhibit perceptual encoding even as they facilitate conceptual memory.

Because our findings indicate that schemata inhibit rather than facilitate perceptual encoding, they seem incongruent with a large body of research in the schema literature. However, they are consistent with the labor-saving functions served by the schematic processes of interpretation and selective attention. To the extent that perceivers rely on their schemata to facilitate the interpretation of all instances, and the selective encoding of relevant instances, they will pay less attention to perceptual information. Consequently, although schemata facilitate the recall of information, they simultaneously inhibit perceptual encoding. This dissociation suggests that as a result of schematic processing, perceivers may have less perceptual information in memory but better access to and understanding of the information that they do have. This facilitation in access and comprehension has led researchers to posit that schemata facilitate memory, when in fact the current results suggest that schemata merely facilitate the organization and strategic retrieval of information in memory, but inhibit the amount of perceptual information that is actually encoded.

In contrast with these findings, research by Bargh and his colleagues (Bargh & Pratto, 1986; Bargh & Thein, 1985) in the chronic accessibility literature provides results that seem to suggest that schematic subjects are more, not less, perceptually selective. For example, Bargh and Thein (1985) have demonstrated that when people are presented with more information than they can easily attend to, only people who are chronically accessible for honesty differentiate in their impressions between mainly honest and mainly dishonest people. Subjects who were not chronically accessible for honesty showed patterns of memory and impressions that suggested that they did not notice that the target persons differed in their honesty. Furthermore, Bargh and Pratto (1986) have demonstrated that subjects show greater interference in a Stroop task when adjectives to be color named are relevant to their chronically accessible constructs than when they are irrelevant to these constructs. In combination, these studies seem to suggest that subjects who are chronically accessible in a domain are more attentive and sensitive to the perceptual features in that domain than in others. By virtue of the fact that chronic accessibility is conceptually related to schematicity, their results seem to contradict those reported here.

The results of Bargh and Pratto (1986) and Bargh and Thein (1985) are probably not evidence, however, that people who are chronically accessible in a domain are more perceptually selective, or engage in greater perceptual encoding, than people who are not chronically accessible in that domain. Rather, they are more likely to be evidence of the increased ability of chronically accessible subjects to comprehend and semantically process difficult material. In a manner similar to self-schemata, chronic accessibility seems to facilitate conceptual or gist encoding even as it inhibits perceptual encoding.

For example, in the impression-formation task of Bargh and Thein (1985), subjects who were chronically accessible for honesty were better able to interpret honest behaviors under conditions of cognitive load than subjects who were not chronically accessible for honesty. Thus, these findings are evidence for the role of chronic accessibility in conceptual interpretation and not evidence for their role in perceptual encoding. Furthermore, in the Stroop task of Bargh and Pratto (1986), subjects who were chronically accessible in a particular domain demonstrated greater conceptual, not perceptual, interference from exposure to words in that domain. As Bargh and Pratto noted, the Stroop effect is not a perceptual phenomenon but rather is a consequence of semantic activation and conceptual interference leading to a slowed reaction time (e.g., see Logan, 1980; Warren, 1972). Therefore, Bargh and Pratto's data are more relevant to the automaticity and semantic depth to which chronically accessible information is processed than they are to issues of perceptual selectivity and encoding. Without collecting perceptual memory measures (which was not the goal of these experiments), it is impossible to determine whether these experiments would have revealed facilitation or inhibition in perceptual encoding as a consequence of chronic accessibility. We would predict, however, that experiments that exposed subjects to traits or behaviors for which they were or were not chronically accessible, and that required them to make judgments concerning themselves or others on these dimensions, would reveal an inhibition in perceptual encoding of chronically accessible trait constructs.

If schemata inhibit the encoding of perceptual information, as the current experiments suggest, this inhibition is likely to have important implications for social judgment processes. Inhibition in perceptual encoding represents an important limitation in our memory for schematically or stereotypically interpreted events, which might in turn contribute to the resilience of stereotypes, expectancies, and social categories. For example, imagine a woman who has stereotypes that engineers are cold and heartless and psychologists are warm and compassionate. One day she observes someone whom she has been told is an engineer intently staring at another person from mere inches away, while that other person is slumped down in his chair looking distraught. She might say to herself, "That heartless jerk, look at him intimidating that poor guy in the chair." On the other hand, had she been told that he was a psychologist, she might have thought, "What a nice guy, there he is trying to comfort that poor unhappy person in the chair." Because of the inherent ambiguity of the behavior, such a category-based expectation would have an important influence on its identification, in a manner probably outside of awareness (Trope, 1986).

Under either expectancy, if schemata inhibit the encoding (and thus later memory for) perceptual information, the woman will remember only the fact that the person was intimidating someone (for example) and will not remember the detailed perceptual information about how he leaned over the occupied chair. As a consequence of this failure to encode into memory the original perceptual information, she would be in a poor position to recategorize the behavior if she later learned that her expectancy was incorrect. Rather than being able to reinterpret the instance of leaning over the chair as indicating comforting instead of intimidation, she would be confronted with the impossibility that he could be a psychologist. After all, she had personally witnessed him intimidating someone, and this conceptualization of intimidation would be the only memory that schematic processing had left her with. In such a fashion, the schematic inhibition of perceptual encoding could make processes such as recategorization and stereotype revision highly unlikely to occur.

Although it may seem surprising that perceptual information can facilitate or inhibit stereotype revision, a clever experiment by Massad, Hubbard, and Newtson (1979) suggests that it can. In Massad et al.'s experiment, subjects were presented with Heider and Simmel's (1944) classic film of moving shapes. Massad et al. replicated Heider and Simmel's finding that subjects easily construct a coherent, causal, anthropomorphic story to explain the actions of the moving shapes. Massad et al. also demonstrated that by providing an alternative interpretive schema to the one that subjects typically arrive at, subjects could be induced to perceive and unitize the film in a completely different manner. More germane to the argument presented here, subjects in Massad et al.'s experiment were unable to change their interpretation of the moving shapes when they were provided with a new alternative schema after they had already viewed the shapes. It seemed that subjects could no longer remember the specific actions that had taken place in the film and could only remember their interpretations of the actions. When subjects were allowed to go back and view the film again with their new interpretive schema in mind, they were able to reunitize the film in a way appropriate to the new schema and were able to discern how that new schema might explain the behaviors they witnessed. Importantly, however, they were not able to do this in a memory-based fashion, a finding that is consistent with the arguments presented in this article.

In a related vein, experiments by Lewicki (1985) also provide compelling evidence that memory for perceptual information can have a strong impact on social judgment. In the first phase of his third experiment, half of the subjects had a very brief, unpleasant experience with a short-haired female experimenter wearing tortoise-shell glasses. In the second, ostensibly unrelated phase of this experiment, subjects were allowed to choose between two experimenters, one of whom wore similar glasses and a hairstyle similar to the earlier experimenter. Lewicki found that subjects were far more likely to avoid the short-haired experimenter with glasses when they had previously been mistreated by the other short-haired experimenter with glasses. When subjects were asked why they made their choice between experimenters, they invariably stated that it was entirely random. Thus, it seems that the perceptual memory of glasses and short hair, which was associated with unpleasantness, influenced subjects' later interactions in a different context.

Similarly, Henderson (1990) has demonstrated that once Caucasian subjects encounter a rude African-American student, they are more likely to avoid the next African American whom they encounter. When they have just encountered a rude Caucasian student, however, they do not avoid the next Caucasian whom they encounter. In this case, the perceptual information of being African-American is a salient basis of categorization for subjects, whereas the perceptual information of being Caucasian is not. This sort of perceptual memory that Lewicki (1985) and Henderson document might play a far more important role in stereotyping than has generally been considered (see also, Berkowitz & Knurek, 1969).

One might wonder whether the type of memory that is studied in this research (i.e., implicit memory) has any important consequences, given that it is often nonconscious or difficult to retrieve. It might seem at first that if people cannot consciously retrieve certain memories, then it does not matter if schemata inhibit them. To the contrary, research on the effects of a variety of types of nonconscious information on judgment and behavior (e.g., Bargh & Pietromonaco, 1982; Kunst-Wilson & Zajonc, 1980; Lewicki, 1986) suggests that nonconscious memories can be potentially important determinants of behavior and judgment. Furthermore, as Smith and Branscombe (1988) have demonstrated, experiments on priming effects in impression formation (e.g., Higgins, Rholes, & Jones, 1977) can themselves be considered evidence of the importance of implicit memory. Not only do priming effects often emerge without awareness, but also their very nature can be altered from assimilation to contrast if people become aware of the previous priming episode (Lombardi, Higgins, & Bargh, 1987; for related findings, see also, Jacoby, Kelley, Brown, & Jasechko, 1989; Smith, Stewart, & Buttram, 1992).

Moreover, Breuer and Freud (1895/1955) believed that it is in part the unconscious nature of repressed desires that make them so difficult to counteract and contend with. To the extent that this is true, the often unconscious nature of perceptual memories might make them quite influential in shaping behavior. When perceivers are not aware of them, or at least not aware of their influence, they cannot temper their conclusions, nor can they argue against them. This inability to counter argue the implications of perceptual memories might, in part, account for the power they have in shaping behavior in studies like those of Lewicki (1985) and Henderson (1990). Had subjects in Lewicki's experiment been aware that their bias against the second experimenter was caused by her haircut and eyeglasses, they probably would have dismissed those feelings outright and not allowed them to influence their later behavior and judgment. Because they were not aware of the source of this bias, however, the specific and seemingly minor instance of glasses and short hair became a basis of categorization.

In conjunction with Lewicki (1985), Henderson (1990), and Smith and Branscombe (1988), the results from the current experiments suggest that implicit memories, both perceptual and conceptual, might play an important role in social processes. Implicit memories not only have the strong potential to influence social judgment (as in Higgins et al., 1977; Smith et al., 1992), but they also have been shown to be highly specific and extremely robust over long periods of time, sometimes surviving long after conscious recollection of events has faded away (e.g., Kolers, 1976; Smith et al., 1992; Tulving et al., 1982). Furthermore, many implicit memories have been shown at normal levels among amnesics who have virtually no explicit memory capabilities whatsoever (e.g., Graf et al., 1985; Warrington & Weiskrantz, 1970). For these reasons, it seems that the study of social processes could benefit from the use of implicit memory procedures in a variety of settings.

Finally, the studies reported here suggest that it is time to reconsider the usefulness of schemata. Schemata clearly serve an important conceptual and organizational role in information processing, and they provide insight into what is likely to occur and what has probably occurred. For these reasons, they seem to allow perceivers to process more information with less effort. Yet herein lies their fault. The studies reported here suggest that schemata do not really allow more information processing with less effort. Rather, schemata simply allow the perceiver to quickly encode the gist of an event, thereby causing the perceiver not to attend to the available perceptual information. So the gist is stored, but the original perceptual event is lost. In such a fashion, the momentary facilitation in understanding that schemata bring about can be outweighed by the long-term loss to memory of the complex, perceptual world.

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(Appendix follows on next page)

Appendix

Trait Words and Their Word Fragments

Independent		**Dependent**	
independent	__de_e__en_	cooperative	c_op__t__e
ambitious	am__t__us	tactful	t__tf_l
confident	co_fi_e_t	tolerant	_ol_r__t
aloof	a__of	dependent	d_p__d_n_
arrogant	_rr__a_t	vulnerable	vu__r__le
aggressive	a__r__s_v_	helpless	h__p_e_s
Artistic		**Unartistic**	
creative	cr__t__e	patient	p_ti__t
artistic	a_t_sti_	rational	_a_ion_l
imaginative	im__n_t_ve	stable	s__ble
impulsive	i_pu_s__e	consistent	c_n__s__nt
sensitive	_e_ns__iv_	conservative	c__s__v__ive
spontaneous	sp__t_n__s	methodical	m_th_d__l
Honest		**Dishonest**	
sincere	s__c__e	phony	ph__y
blunt	b_u_t	deceitful	de__i_fu_
loyal	l_y_l	liar	_i_r
ethical	e_h_c_l	fake	_ak_
frank	f__nk	false	f__se
honest	h_ne_t	sneaky	s__ky
Intelligent		**Unintelligent**	
intelligent	in__l_g__t	dumb	d__b
sharp	sh__p	stupid	s_u__d
smart	_ma_t	naive	_ai_e
bright	br_g_t	slow	_l_w
curious	c_ri_us	foolish	f__li_h
clever	c__v_r	dense	d_ns_
Athletic		**Unathletic**	
active	_ct_v_	lethargic	l__h__gic
energetic	e__r__ic	soft	_of_
intense	_nt_nse	feeble	fe_b_e
athletic	_th_et_c	flabby	fl__by
strong	st_o_g	frail	_r_il
healthy	he_l__y	weak	w__k
Decisive		**Indecisive**	
prompt	pr_m_t	fickle	fi_k__
emphatic	em_h_t_c	whimsical	wh_m__al
certain	c_rt_in	tentative	t_nt_t__e
decisive	dec_s__e	sluggish	s__g__sh
definite	d_f_n_t_	reluctant	rel__t_nt
precise	p__c_se	vague	v_g_e
Outgoing		**Shy**	
extrovert	ex__ov_rt	quiet	q_i__
lively	_iv__y	withdrawn	w__d__wn
bold	_ol_	hesitant	h_s__nt
outgoing	_utg__ng	formal	f_rm_l
friendly	fr__n_ly	timid	_im_d
social	s_ci_l	modest	__d_st

Appendix (*Continued*)

Adventurous		Unadventurous	
reckless	r_ck__s	cautious	cau__us
rash	r_s_	moderate	m_d__te
courageous	c__r_g__s	afraid	_f_a_d
daring	da__ng	nervous	__rv_us
adventurous	ad__t_r_us	careful	__re_ul
brave	b__ve	prudent	p_ud__t
Feminine		**Masculine**	
tender	t__der	assertive	a__rt_ve
docile	d_c_l_	dominant	d__n_nt
jealous	_ealo__	powerful	__w_rf_l
submissive	s_bm_s__e	rugged	r__g_d
domestic	d_m__t_c	forceful	f__ce__l
gentle	ge__le	virile	v_r_le
Religious		**Atheistic**	
religious	r_l_g__s	atheist	_th__st
spiritual	sp__it__l	agnostic	_gn_st_c
devout	d_v_ut	faithless	fa_th_e_s
holy	h__y	immoral	__m_r_l
pious	p__us	skeptic	_k_p__c
reverent	r_v__nt	corrupt	c_r__pt

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