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CHAPTER 3 . . . . . .

Lectures for a Layperson: Methods for Revealing Unconscious Processes

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A layperson might ask, "Is there any reason to fear the possibility of subliminal perception; that is, can subliminal perception techniques be used to control my behavior so as to make me act in ways that are counter to my own purposes?" If our layperson were to approach a psychologist with this question, he or she would likely receive a rather lengthy lecture on the importance of terminology (what is meant by "subliminal?"). This would likely be followed by an even longer lecture on the controversial nature of claims about subliminal perception. The substance of the latter lecture would depend on whether the questioned psychologist was an advocate or a critic of such claims. An advocate would provide historical examples of unconscious influence, discussed in the context of ideas advanced by prominent psychologists such as Freud, Janet, and Jastrow, and would garner further support for the existence of unconscious processes by pointing to neuropsychological syndromes such as "blindsight" (Weiskrantz, 1986). John Kihlstrom (Chapter 1, this volume) provides an excellent discussion of that sort, as

do other contributors to this volume. Elsewhere we too have commented on the neuropsychology literature related to consciousness and have described experiments showing unconscious influences of memory and of perception (e.g., Jacoby & Kelley, 1987, 1991; Kelley & Jacoby, 1990; Toth, Lindsay, & Jacoby, in press).

A critic of unconscious influences would likely respond to our layperson's question by discussing experimental design and methodology. Merikle and Reingold (Chapter 2, this volume) provide a critique of attempts to measure unconscious processes and examine the assumptions underlying those attempts. Merikle began as a critic of unconscious processes (Merikle, 1982), casting doubt on supposed demonstrations of such processes, but has become a cautious advocate. In this chapter we too are concerned with the problem of measuring unconscious processes. We describe procedures that reveal unconscious influences on subjective experience and that allow one to separate aware and unaware influences of memory and perception.

Long lectures about definitions and methodology are likely to test the patience of the layperson. We agree with the layperson that the question of unconscious influences is a question of control, a question of whether techniques can be used to produce behavior that is counter to one's current purposes. Of course, unconscious influences are not always counter to one's purposes—far from it—but such effects are most starkly apparent when they are in opposition to our intentions. Indeed, we treat demonstrations of such effects as the cornerstone for our investigation of unconscious processes. Our conclusion, perhaps discomforting for the layperson, is that unconscious influences are ubiquitous. It is clear that people sometimes consciously plan and then act. More often than not, however, behavior is influenced by unconscious processes; that is, we act and then, if questioned, make our excuses.

A resurgence of interest in unconscious processes has been produced by findings of dissociations between performance on direct and indirect tests of memory and of perception. On an indirect test, people are not instructed to report on a past or present event but, rather, engage in some task that can indirectly reflect the influence of that event. In "blindsight," patients can make visual discriminative responses without the subjective experience of seeing (Weiskrantz, 1986). In prosopagnosia, patients can show discriminative galvanic skin responses to familiar faces without the subjective experience of recognizing those faces (for a review, see Young & De Haan, 1990), and in Korsakoff amnesia, patients can give correct memory responses without the subjective experience of remembering (e.g., Warrington & Weiskrantz, 1974). Normal subjects also show dissociations between their performance on indirect versus direct tests of memory (for reviews, see Richardson-Klavehn & Bjork, 1988, and Hintzman, 1990). In unconscious perception (e.g., Marcel, 1983a), a briefly presented pattern-masked word can facilitate responding on a subsequent lexical decision task, although subjects are unable to report that a word has been flashed when given a direct test of perception.

One reason for excitement about the finding of dissociations is their relation to unconscious influences. For example, effects of memory on an indirect test may reflect unconscious processes because a person need not be aware of using memory for such effects to occur. In that regard, an indirect measure has the same status as a projective test, such as the Rorschach (1921/1981). The rationale for using projective tests is that they are said to reveal unconscious concerns that would not be revealed in response to direct questions. Thus, dissociations between direct and indirect measures of memory or perception are analogous to dissociations between self-report measures and projective tests of personality. As we argue later, the interpretation of cognitive task dissociations also shares problems with the interpretation of other results that have been taken as evidence of unconscious influences. To anticipate, many people who feel quite comfortable interpreting the results of indirect tests would not feel so comfortable if they thought of those tests as akin to a Rorschach. The major problem for interpreting dissociations is that of relating processes to tasks. Most of us are not tempted to treat a Rorschach test as being factor- or process-pure, but measures of memory and perception are often treated as such. For example, implicit tests of memory have been said to measure implicit memory (Schacter, 1987). In contrast, we view all task performance as a joint product of unconscious (automatic) and intentional (controlled) processes and describe a technique, termed the "process dissociation procedure," designed to separate these two contributions to performance. This procedure allows us to escape many of the problems that have plagued earlier investigations of unconscious processes.

A central problem in investigating unconscious influences is that of defining awareness. As a starting point, we follow Bowers (1984) in treating determinants of thought and action that are not noticed or appreciated as constituting unconscious influences. This broad definition has the advantage of allowing one to treat subliminal perception in the same general framework as other unconscious effects, such as unconscious influences of memory. Perhaps there is nothing special about the effects of presenting items for such a brief duration that people are unaware of their presentation. As described later, we have obtained effects similar to those credited to subliminal perception by dividing subjects' attention during the presentation of items that are clearly supraliminal. For unconscious influences of memory as well as unconscious influences of perception, our interest is in the discrepancy between

effects on performance and subjects' awareness of the source of those effects.

How should awareness be measured? Here we return to the concerns of the layperson. The layperson considers awareness important because one can sometimes avoid influences from a source of which one is aware. That is, the layperson's fear of unconscious processes may be explained by the belief "What I cannot see or know about can hurt me." Some psychologists have expressed concern that relying on subjects to define awareness leads to as many definitions as subjects, thus precluding detection of the "true" threshold (Eriksen, 1960; Merikle, 1984). In contrast, we believe it is entirely appropriate (and, indeed, essential) for awareness and conscious control to be defined by the subject. We argue that awareness is a prerequisite for conscious control, and we assess awareness and control in terms of a person's ability to avoid a source of influence. For example, if a briefly flashed item produces responding that is counter to a person's current purposes, there is good reason to suspect the involvement of unconscious processes. Of course, awareness does not necessarily imply control, as shown, for example, by the Stroop effect (Stroop, 1935). Indeed, unconscious perception might actually involve a fleeting awareness. Regardless, it is the lack of *intentional control* that defines our interest in unconscious processes. Emphasizing factors that affect the conscious control of behavior highlights the relation between unconscious processes and the notion of automaticity (Jacoby, 1991; Jacoby & Kelley, 1991). The unconscious influences that we describe bear more relation to automaticity as described in the attention literature (e.g., Logan, 1990; Shiffrin & Schneider, 1977) and to habit as described by James (1890/1962) than to the psychoanalytic unconscious. (For discussions of differences between the cognitive and the psychoanalytic unconscious, see Eagle, 1987, and Kihlstrom, 1987.)

This chapter is divided into several major sections. We begin by discussing the importance of subjective experience. We present evidence to show that subjective experience is constructed and reflects an unconscious inference or attribution process. Next, we argue that awareness is a prerequisite for conscious control and that an important function of conscious control is to oppose unconscious influences. We describe the methodological advantages of arranging a situation such that consciously controlled and unconscious processes act in opposition to one another. Such opposition paradigms can provide unambiguous evidence for unconscious influences of memory and perception. More extensive discussions of the topics considered in these first two sections appear elsewhere (Jacoby & Kelley, 1990; Jacoby, Kelley, & Dywan, 1989; Kelley & Jacoby, 1990).

After discussing the advantages of opposition, we describe the process dissociation procedure and show how it can be used to derive

separate quantitative estimates of consciously controlled and unconscious processes. We discuss the advantages of separating the contributions of conscious and unconscious processes *within* a task as compared to focusing on dissociations *between* tasks and identifying tasks with particular types of processes. We argue that a problem for interpreting dissociations between tasks is that tasks are almost never process-pure. We end by identifying unconscious influences with automaticity and by emphasizing parallels between unconscious perception and effects produced by dividing attention. Throughout, we orient the chapter to answering the layperson's question about influences that are counter to intention.

SUBJECTIVE EXPERIENCE

The layperson is likely to take the existence of a single, shared "real world" as a given. By that naive realist view, the present is truly as it presents itself and memory for the past can be trusted. The naive realist view has been attacked both by philosophers and by psychologists. Those attacks have been so successful that the layperson, when pressed, is likely to admit: "There are two sides to every story" and "You can't really understand until you've been in my shoes." Aphorisms of that sort reflect the general belief that a person's needs and desires can influence his or her interpretation of a complex situation. That general belief is formalized in (and may, in part, have originated from) psychoanalytic theory (see Erdelyi, 1985) and other theories, such as the New Look theory of perception (Bruner & Postman, 1949). By a constructivist view of the sort that we advocate, perception of the present and of the past is rife with unconscious influences. Producing effects on subjective experience provides a means of revealing unconscious influences, particularly if those effects cannot be avoided. Our research focuses on questions such as the following: What is the origin of unconscious influences on subjective experience? How pervasive are "distortions" or "illusions" of subjective experience? Granted that the interpretation of a complex situation can be unconsciously influenced by higher order needs, do these influences extend to the perception of fundamental physical dimensions such as the loudness of a noise?

Our answer to the question about the origin of unconscious influences differs from that of psychoanalytic theory. Whereas psychoanalytic theory postulates pervasive influences of important conflicts and general needs, we have emphasized the role of the mundane (e.g., Jacoby & Kelley, 1987; Kelley & Jacoby, 1990). We hold that a current situation acts as a complex retrieval cue for the memory of particular prior episodes that are very similar to the present one. Memory for prior episodes can

influence the interpretation of a current situation without one's being aware of the role that memory is playing. Thus, an important difference between our episodic view and the psychoanalytic view is in the specificity of predicted effects. Recent research has shown that even Freudian slips are much more reliant on the specific details of a situation than would have been predicted by the psychoanalytic tradition (e.g., Fromkin, 1973; Motley, 1985). In settings of the sort investigated by social psychologists, as well as in more standard memory experiments, indirect tests of memory reveal effects that are very specific to the details of prior experience (Smith, 1990).

Unconscious Influences on Perception of the Present

Helmholtz (1867/1968) proposed that visual perception is the product of unconscious inferential activity and noted that memory can affect the subjective experience of the physical present. Similarly, Marcel (1983b) argued that conscious experience is constructed by way of higher order representations that transform the information from lower order sensory and cognitive processing. A conscious percept is said to result from the constructive act of fitting perceptual hypotheses to the lower level data "to make sense of as much data as possible at the highest and most functionally useful level possible" (p. 248). By Marcel's account, subjective experience is better seen as an attribution or interpretation about cognitive and sensory processing than as a direct mirror of it. Drawing on neuropsychological data, Gazzaniga (1988) also proposed that consciousness is not identical with processing but, rather, arises from interpretive processes. Finally, Schachter and Singer (1962) suggested that the subjective experience of emotion reflects an inference or attribution process.

We propose that ease of processing provides a cue for attributions to the use of memory (Jacoby, Kelley, & Dywan, 1989). As a function of prior experience, performance of a task becomes more fluent. For example, prior experience can enhance the perception of briefly flashed words or visually degraded pictures (Jacoby & Brooks, 1984; Jacoby & Dallas, 1981), the completion of word fragments (Tulving, Schacter, & Stark, 1982), the ability to solve problems or answer questions (Jacoby & Kelley, 1987; Kelley & Lindsay, 1992; Needham & Begg, 1991), and the speeded reading of text (Kolers, 1976). Fluent processing due to prior experience may underlie the feeling of familiarity that is often used as a basis for recognition memory judgments (Jacoby & Dallas, 1981; Jacoby & Witherspoon, 1982). However, people can misattribute the fluent processing that comes from prior experience to sources other than the past, thereby giving rise to illusions or distortions of perception.

Our research on the effects of prior experience on noise judgments provides evidence that the inference process is often an unconscious one and that it extends to fundamental physical properties. In one experiment Jacoby, Allan, Collins, and Larwill (1988) presented previously heard and new sentences against a background of white noise of varying loudness. Subjects judged the background noise as less loud when the sentences were old rather than new. Presumably, old sentences were easier to perceive than new sentences, and that ease of perception was misattributed to a lower level of background noise. That is, people were unable to separate out the contribution of memory to perception when judging noise level and so had the subjective experience of a lower level of background noise when the sentence had been previously heard. Jane Collins, a McMaster student, has conducted a series of studies showing that the effect of prior experience on noise judgments can be automatic; even when informed about the effect and told to avoid it, subjects continued to judge the background noise accompanying old sentences as less loud than that accompanying new sentences.[1] Experiments by another McMaster student, Sandra Huard (1990), have shown that these effects last over 24 hours. These results demonstrate that a single encounter with a stimulus can have quite long-lasting effects on our perception of present events.

Measures of subjective experience may be useful as indirect tests of other processes in addition to those involved in memory. We have done preliminary research using noise judgments as an indirect test of categorization and as an indirect test of attitudes. For attitudes, the goal is to show that one's "gut feeling" about an issue is sometimes very different from the attitude expressed in response to a direct question. That is, we predict dissociations between performance on indirect versus direct tests of categorization and of attitudes similar to those found for memory. Measures of subjective experience, such as noise judgments, are expected to reflect emotional reactions to presented stimuli. In an experiment that has not yet been written for publication, Collins, McLeod, and Jacoby obtained evidence that the perceived loudness of the background noise against which questions are asked is influenced by the affective tone of the questions. For example, the background noise accompanying the question, If you were caught drinking and driving, would you tell your parents? was judged as much less loud than the same objective level of background noise presented with a neutral question. Our intent is to use noise judgments as a new and improved Rorschach test. Among the possible advantages is that noise judgments are easily scored and measures of subjective experience might be more sensitive than most standard projective tests. Others have discussed the possibility of indirect tests

having greater validity than direct tests of attitudes (e.g., Dovidio & Fazio, 1991; Greenwald, 1989).

Extensive practice is not necessary for prior events to influence perception. A single prior presentation is sufficient to lengthen the apparent duration of a word that is flashed (Witherspoon & Allan, 1985) or lower the background noise accompanying presentation of a sentence (Jacoby et al., 1988). Fluent processing may also be misattributed to a statement's being true, an argument's seeming to flow, or a problem's being easy (Jacoby & Kelley, 1987). The effect of "mere exposure" on preference judgments may also be a case of the misattribution of fluent processing that is due to prior experience (Kunst-Wilson & Zajonc, 1980; Mandler, Nakamura, & Van Zandt, 1987; Seamon, Brody, & Kauff, 1983). Consistent with this idea, Bornstein (1989, Chapter 7, this volume) reported results showing greater effects of briefly presented stimuli when subjects were unaware, rather than aware, of those stimuli and so could not attribute their influence to prior presentations. It would appear that people attribute effects on performance to whatever source is most obvious or plausible, which often depends on the judgments that they are asked to make.

We hold that unconscious influences originate from a sort of context effect. The present serves as a powerful context for the interpretation and subjective experience of the past, and the past serves as an equally powerful context for the interpretation and subjective experience of the present. Context effects can be viewed as unconscious influences because people often fail to note or appreciate the significance of context as a determinant of behavior. As a case in point, consider the role of context in unintentional plagiarism (Brown & Murphy, 1989). We've probably all had the experience of telling a joke to the person from whom we had learned that joke. The person (and perhaps other aspects of the context) serve as retrieval cues for the joke. Thus, nature might be so perverse as to lead us to retell an anecdote to the very person who initially told it to us. In support of this possibility, Allen and Jacoby (1990) presented evidence to show that reinstating context can produce unconscious influences of memory.

Trope (1986) discussed unconscious effects of context in his two-stage model of dispositional attributions in person perception. His model holds that the context in which a person is encountered may automatically influence the identification of his or her affective state (happy, angry, etc.). The results of that identification process serve as input for dispositional attributions (e.g., happy or angry personality). In support of his theory, Trope showed that the interpretation of emotionally ambiguous faces was influenced by situational information provided with the

pictured faces. For example, faces that were perceived as happy when presented in one context were perceived as angry when presented in another context. That unconscious use of contextual information then set the stage for dispositional attributions (i.e., attributing the emotion to the personality of the pictured person vs. the situation). In a similar vein, Gilbert (1989, 1990) reported a number of studies showing that dividing attention increases the extent to which subjects attribute an actor's behavior to dispositional as opposed to situational factors. By Gilbert's account, dividing attention impairs subjects' ability to perform the relatively effortful cognitive processes required to correct their rapid and automatic dispositional attributions. In general, the argument is that passive, unconscious influences of context must be distinguished from the more active, conscious use of contextual information.

Lewicki and his colleagues have investigated other unconscious processes that have implications for social perception (e.g., Lewicki, Hill, & Sasaki, 1989) and have argued that classifications of complex, ambiguous stimuli may give rise to encoding biases, which are then perpetuated by subsequent encounters with similar stimuli. For example, an individual who has developed a bias to classify people with crooked noses as "dishonest" may encode a person with a crooked nose as dishonest even in the absence of dishonest behavior. Without disconfirming feedback, such categorizations may incrementally add to the stored "evidence" supporting the bias. That is, the person would be encoded as "another dishonest person with a crooked nose." In support of this idea, Lewicki et al. showed that giving subjects repeated opportunities to use an encoding bias (in the absence of any feedback) gradually increased the strength of that bias.

Our approach is quite compatible with the views proposed by these social psychologists. Their research shows that the interpretation of social objects is influenced by both past experience and present context. Importantly, when such interpretive processes operate automatically (i.e., unconsciously), their products are experienced as direct or "true" perceptions rather than as consciously mediated interpretations (cf. McArthur & Baron, 1983). Our research has emphasized unconscious influences of memory for specific perceptual events (e.g., hearing a sentence), but memory for past emotional states, evaluations, and so forth, may also be automatically retrieved and thereby color subjective experience (cf. Johnson & Sherman, 1990). Further, although we have focused on the effects of memory for a single event, everyday experiences doubtless serve as retrieval cues for multiple prior episodes. The important points are that memory can influence the interpretation of later events and that these effects are often automatic in that they require neither intent to use

memory nor awareness of doing so. Moreover, subjective experience is often the basis for judgment and action.

Illusions of Remembering and of Seeing

In the preceding sections we have described cases in which effects of memory are misattributed to some other source, as in noise judgments. In this section we describe cases in which the subjective experience of remembering and the subjective experience of seeing arise from misattributions and, consequently, are illusory. The possibility of illusions of seeing has implications for the criteria used to demonstrate perception without awareness. If reports of awareness cannot be taken as veridical indicators of perception, then demonstrations of unconscious perception cannot be dismissed on the grounds that subjects sometimes report awareness of presented items.

Subjective reports tell their own kind of truth, namely, narrative truth (Spence, 1982), even though they may not match with objective records of what "really happened." People's knowledge and beliefs can distort their recollections of past events (e.g., Bartlett, 1932; Ross, 1989; Sulin & Dooling, 1974). By our account, people's theories of what must have happened lead them to fluently think of those outcomes when they attempt recall, and fluently generated thoughts may be experienced as recollections. Fluent performance is generally a reliable cue to the use of memory because past experience so often does facilitate later performance; these transfer effects are remarkably specific (Jacoby & Hayman, 1987; Kolers, 1976; Masson, 1986). If ease of processing is a cue that serves as the basis for the experience of remembering, then experimental manipulations of processing should influence the subjective experience of remembering. That is, it should be possible to produce illusions of remembering by manipulating the ease of processing by means other than past experience. Doing so would show that the subjective experience of remembering can occur without a corresponding memory representation.

Direct manipulations of the ease of perceptual processing produced by varying the perceptual characteristics of an item can produce an illusion of memory. Whittlesea, Jacoby, and Girard (1990) rapidly presented short lists of words to subjects and followed each list with a recognition memory test word. Ease of perceiving the test words was manipulated by varying their visual clarity within a narrow range that was not noticed by subjects (as assessed by reports at the end of the session). This produced an illusion of remembering; that is, subjects misinterpreted the variations in visual clarity of the test item as reflecting an influence of memory. Test words whose visual presentation was clearer were more likely to be judged old, although the manipulation of clarity was orthogonal to that of prior presentation. This illusion of memory was eliminated when subjects were informed that visual clarity was manipulated, so that they could correctly attribute variation in perception to variation in the physical stimulus.

A common strategy for exploring unconscious perception is to present items so briefly as to prevent awareness but still show effects on an indirect test. For example, Forster used this strategy to provide evidence that unconscious perception influences stem completion performance (Forster, Booker, Schacter, & Davis, 1990). Briefly presented masked words affected subsequent completion performance even though subjects did not report awareness of the masked words. Of course, Forster's results would not convince the nonbeliever that unconscious perception really exists. Critics such as Holender (1986) or Eriksen (1960) would argue that Forster's subjects actually saw some of the flashed words even though they did not report doing so. To debunk the claim of unconscious perception, the critic might design an experiment in which subjects are directly asked whether the word given as a completion had been briefly presented. A finding of non-zero discrimination would then be used to argue that the effect of the briefly flashed word was mediated by conscious rather than unconscious perception.

However, there is an asymmetry here. Claims of lack of awareness are scrutinized much more carefully than are claims of awareness. In a recent experiment in our lab we turned the tables by looking for awareness without perception in a situation similar to that used by Forster et al. (1990) to look for perception without awareness. Similar to Marcel's (1988) argument that consciousness is constructed, we argue that awareness relies on an inference process that can be misled in ways that can produce illusions of seeing. In our experiment either a word or a blank field was flashed, followed by a word fragment that subjects completed. Subjects knew that if any word was flashed, it was the completion word for the fragment on that trial. After completing the word fragment, subjects judged whether the completion word or a blank had been flashed. The important manipulation concerned the word fragments that were presented. Some of those fragments were very easy to complete whereas others were somewhat more difficult. By presenting fragments that could be easily completed, we meant to produce an illusion of seeing. The notion was that if subjects could complete a word fragment very fluently, they would unconsciously infer that the completion word had been flashed; that is, they would attribute ease in solving to prior perception.

The results were in line with our predictions. Even when nothing was flashed, subjects were more likely to claim that the solution word had

been presented when the fragment was easy rather than difficult to complete. This result was observed even though subjects were reasonably good at discriminating whether a word or a blank had been flashed.

Reports of awareness are often taken as evidence that the subject has seen something and hence that unconscious perception need not have occurred. Holender (1986) challenged most purported demonstrations of unconscious perception on the grounds that subjects may have consciously perceived some of the supposedly unconscious stimuli. In a reply to Holender's critique, Erdelyi (1986) pointed out that there are many different measures of conscious awareness and raised the question, "How do we decide that a particular indicator [e.g., GSR] . . . is not simply another indicator of consciousness?" (p. 31). Here we point out that there are many different measures of unconscious processes and raise the question, "How do we decide that a particular direct test (e.g., presence/absence judgments) is not simply another measure of unconscious processes?" As our demonstration of illusions of seeing makes clear, the answer to both questions is, "We can't." At a given level of *d'* and Beta for presence/absence judgments, for example, some subjects may have the experience of guessing on every trial whereas other subjects may have the experience of seeing words on some trials and blanks on others. Beta has to do with the criterion for responding, not for experiencing. Signal detection analyses are blind to subjective experience (see Macmillan, 1986). The subjective experience of perception is as much an attribution as is the subjective experience of remembering.

If we are ever to get a handle on subjective experience, we must abandon attempts to measure what it *is* and instead measure what it *does*. As further elaborated in the next section, we believe that subjective experience is the basis of volitional control. People do not calculate *d'*s and Betas as guides to action; to the extent that action is controlled by volition, it is guided by subjective experience. Moreover, subjects are unlikely to initiate control (and unlikely to know how to go about doing so) when they feel that they are guessing. From our perspective, experimental psychologists have much to gain by taking a lesson from the layperson: unconscious influences should be defined in terms of effects that are beyond one's control. Unconscious processing is not a matter of thresholds but, rather, a matter of control.

Subjective Experience Serves as a Basis for Judgments and Action

People's subjective experience has important implications for their subsequent behavior. For example, a person would behave differently if difficulties in comprehension are experienced as resulting from the loudness of background noise rather than from a lack of relevant prior experience. Subjective experience can determine how a person responds to a source of influence, as discussed by Bowers (1975) in his analysis of the subtle control of behavior. Bowers argued that when external controls on behavior are obvious (as with operant techniques), behavioral changes often do not persist, either because the external contingencies change or because the person resists their influence ("reactance"). When external controlling factors are subtle, however, behavioral changes may be misattributed to internal factors (e.g., choice), thereby creating an "illusion of freedom" (Kelley, 1967, p. 227). The newly established behavior can become independent of the external controlling factors and persist even when they are removed; that is, the person may "assume" control.

Intentional control of action depends upon awareness, but, as shown in the studies described earlier, awareness (subjective experience) is itself subject to unconscious influences (Jacoby & Kelley, 1990; Kelley & Jacoby, 1990). The relationship between unconscious influences, subjective experience, and attributional processes was investigated by Barbara Chalfonte (1989) while she was a graduate student at McMaster. The main purpose of her experiment was to demonstrate qualitative differences between conscious and unconscious perception as a function of delay between target and test-probe presentation. On each trial, subjects were presented with a brief, masked exposure of either a word or a blank field. The subject's task was to attempt to identify the flashed word and then to solve an anagram that was presented either 100 or 5,000 ms after the offset of the postmask. The identification data were used to tentatively classify the brief presentation as consciously or unconsciously perceived; conditionalizing the data on identification performance, Chalfonte assessed whether the ability to solve anagrams was differentially affected by delay following conscious and unconscious perception of the solution word. Consistent with her predictions, when the briefly presented solution words were identified, anagrams were solved very quickly and solution time did not differ as a function of delay between target and anagram. In contrast, when the flashed solution words were *not* identified, facilitation in solving anagrams occurred only at the short delay; performance at the long (5000 ms) delay was no different than that following presentation of a blank field. The significant interaction between delay and report supports the tentative classifications of conscious and unconscious perception by showing that the two had qualitatively different effects on task performance (Dixon, 1981; Jacoby & Whitehouse, 1989; Merikle & Cheesman, 1986).

In addition to solving anagrams, Chalfonte's subjects rated how difficult they thought each anagram would be for others. The notion here was that subjective experience is often used as a basis for judgments. Ease of solving a problem may be used as a basis for judging its difficulty, but only if that ease is attributed to inherent properties of the problem. If ease of obtaining a solution is attributed to a recent presentation, subjective experience is "spoiled" and people are forced to use more analytic, theory-based rules for judgment (Jacoby & Kelley, 1987). Chalfonte found that when the briefly flashed solution word was reported, anagram-difficulty ratings were relatively high and did not differ as a function of delay. Although awareness of seeing a flashed solution word allowed subjects to solve the anagram very rapidly, anagram-difficulty ratings were not lower than they were following nonreported presentations. Presumably, knowing that they had just seen the flashed solution prevented subjects from using subjective experience as a basis for judgment. In contrast, when subjects did not report the flashed solution word, anagrams were rated as significantly easier at the short, as opposed to long, delay. Thus, conscious perception of the solution word facilitated solution time but did not lower difficulty ratings; unconscious perception of the solution word both facilitated solution time and led subjects to believe that the anagram would be easy for others to solve. Taken together, these results accord with the research described in preceding sections in showing that awareness of the source of an effect can influence how that effect is interpreted. Moreover, interpretation will often determine subsequent judgments and actions; for example, unconscious perception of the solution can lead people to think that a difficult problem is an easy one.

Unconscious perception can also give rise to illusions of remembering. For example, Jacoby and Whitehouse (1989) found that unconscious perception of a new word immediately prior to its presentation as a recognition test item increased the probability that subjects would falsely identify it as old. Presumably, the unconsciously perceived preview of the test word facilitated its processing and the relative ease of processing gave rise to a feeling of familiarity that was attributed to the prior study list. Importantly, when subjects were made aware of the flashed words (by increasing their duration), the probability of false recognition was lower when the flashed word matched the subsequent recognition test item than when it did not match. Being aware that the test item had just been presented, subjects could discount or correctly attribute the source of their fluent processing. Thus, awareness of the preview word had important consequences for subsequent phenomenological experience and behavior. The strategy of placing conscious and unconscious processes in opposition allows one to demonstrate their individual operation. We discuss this strategy in greater detail in the next section.

THE ADVANTAGES OF OPPOSITION FOR REVEALING UNCONSCIOUS INFLUENCES

Consciously controlled processing is often described as a prerequisite for intentional action (e.g., Kuhl, 1986; Shallice, 1988). Consciousness also serves the equally important function of inhibiting action by opposing influences that would otherwise prevail. For example, by monitoring our ongoing performance we can refrain from repeating our stories to the same audience, avoid plagiarism, or resist external sources of control. Thus, controlled processing can allow one to oppose undesirable unconscious influences. The opposition of consciously controlled and unconscious influences can also be used as a methodological tool to clearly separate their contributions to performance.

As noted earlier, supposed demonstrations of unconscious perception have been called into question on the grounds that the experimenter has mistakenly measured conscious rather than unconscious processes. Similarly, performance on indirect tests of memory may be contaminated by conscious recollection (Richardson-Klavehn & Bjork, 1988). For example, the enhanced completion of word fragments for studied words relative to new words may sometimes rely on intentional conscious retrieval of studied words. Problems of interpretation arise when both conscious and unconscious processes would facilitate task performance (a "facilitation" paradigm). These problems can be avoided by arranging the situation such that conscious and unconscious influences produce opposite effects (an "interference" paradigm). Such a strategy of looking for opposite effects is a variant of methods that pit automatic processes against conscious intentions, as in the Stroop task, and is also a variant of the strategy of searching for qualitative differences in performance in conditions associated with conscious versus unconscious processes (e.g., Cheesman & Merikle, 1986; Dixon, 1981; Jacoby & Dallas, 1981).

In the domain of memory, we have used the "false fame" effect to set conscious and unconscious processes in opposition (Jacoby, Woloshyn, & Kelley, 1989). In the first phase of these studies (Experiments 2 and 3), people read a list of nonfamous names, such as "Sebastian Weisdorf." In the second phase those previously read names were mixed with famous and new nonfamous names and presented for fame judgments. We correctly informed subjects that all of the names they had read in the first list were nonfamous and that if they recognized a name on the fame

test as one from the first list, they could be certain that the name was nonfamous. Thus, conscious recollection of a name from the list opposed the effect of the increase in familiarity that name would gain from being read on the list. Given this arrangement, any increase in the probability of mistakenly labeling as famous an old, as compared with a new, nonfamous name must result from an unconscious influence of memory for its prior presentation. Conscious recollection of the prior presentation of a name would produce an opposite effect by allowing subjects to identify the name as nonfamous.

The attention to an event that is necessary to produce later awareness of memory for the event may differ from the attention that is necessary to produce unconscious influences (see Dixon, 1981, for a review). Using the false-fame paradigm, we placed conscious and unconscious memory in opposition to investigate differential effects of attention (Jacoby, Woloshyn, & Kelley, 1989). Attention to the list of nonfamous names was either full or divided by requiring subjects to simultaneously monitor a string of digits presented auditorially. Dividing attention resulted in old nonfamous names later being more likely to be mistakenly called famous than new nonfamous names. The opposite occurred when full attention was given to reading the list of nonfamous names; presumably, subjects consciously recognized old names from the list and therefore knew that they were nonfamous. Further analyses of these studies provide evidence that dividing attention reduced subjects' ability to recognize a name as having been read earlier but had little or no effect on gains in familiarity produced by that earlier reading.

Additional research using the false-fame paradigm suggests that, like divided attention, aging and neurological insult may produce deficits in controlled processing while leaving unconscious influences of memory largely intact (Dywan & Jacoby, 1990; Dywan, Segalowitz, Henderson, & Jacoby, 1992; Squire & McKee, 1992). Effects similar to our false-fame effect are observed when elderly subjects judge whether faces are famous (Bartlett, Strater, & Fulton, 1991) and when amnesics make lexical decisions (Smith & Oscar-Berman, 1990).

Others (Eich, 1984; Grand & Segal, 1966; Koriat & Feuerstein, 1976) have reported evidence that dividing attention is more disruptive for performance on direct than indirect tests of memory. Unfortunately, these studies cannot provide definitive evidence of differential effects of dividing attention on conscious and unconscious influences of memory because they used procedures in which conscious and unconscious influences would produce effects in the same direction. Consequently, dissociations could arise even if the direct and indirect tests did not measure different functions of memory but differed only in sensitivity. This possibility is ruled out by the opposition strategy. Our finding that prior

presentation has opposite effects under conditions of full versus divided attention clearly reveals a qualitative difference between conscious and unconscious influences.

The results of our false-fame experiments lend credence to the layperson's concerns: There is good reason to worry that behavior can be controlled by unconscious influences that are counter to one's present purposes. Indeed, such effects may be ubiquitous. Divided attention is the norm in everyday life; our results indicate that dividing attention produces effects that are very similar to those credited to subliminal perception. The effect of dividing attention is to limit the possibility of conscious control. In contrast, dividing attention may have little effect on unconscious influences. To determine whether or not this is the case, one needs some way of separating conscious and unconscious contributions to performance. In the next section we describe a procedure devised to separate conscious and unconscious influences of memory. In a subsequent section that procedure is used to separate conscious and unconscious perception.

SEPARATING AUTOMATIC FROM CONSCIOUSLY CONTROLLED BASES FOR JUDGMENTS: THE PROCESS DISSOCIATION PROCEDURE

Memory theorists have discussed the distinction between automatic and controlled processing with reference to both encoding and retrieval. For example, Hasher and Zacks (1979) suggested that whereas the encoding of some attributes of an event is automatic, the encoding of other attributes requires effort and is consciously controlled. In regard to retrieval, dual-process theories (e.g., Atkinson & Juola, 1974; Jacoby & Dallas, 1981; Mandler, 1980) hold that both recollection and familiarity serve as bases for recognition memory decisions. Recollection depends on more consciously controlled processing at retrieval whereas familiarity may be relatively automatic in that it is generally faster, less effortful, and less reliant on intention. Indirect tests of memory (e.g., fragment completion) are intended to measure automatic uses of memory whereas direct tests are intended to measure intentional, aware, uses of memory. However, there is not a one-to-one mapping between the direct versus indirect test distinction and the automatic versus consciously controlled processing distinction. Automatic forms of processing play a role in performance on direct as well as indirect tests (e.g., Jacoby & Hollingshead, 1990).

In the fame judgment experiments described earlier (Jacoby, Woloshyn, & Kelley, 1989), we placed the effects of conscious and unconscious

influences in opposition so that we could separately study the two. We have also used this procedure to separate the contributions of recollection and familiarity to recognition memory performance. Our interest in the processes underlying recognition memory is related to our more general interest in the nature of unconscious processes. We view familiarity as a form of unconscious influence in that, unlike conscious recollection, familiarity does not support selective responding. That is, in the absence of recollection one cannot specify the source of familiarity, just as one cannot specify the source of an effect produced by unconscious perception.

In what follows we contrast the conclusions that can be drawn from studies in which recollection and familiarity produce effects in the same direction (a facilitation paradigm) with those that can be drawn from studies in which these two bases for recognition judgments act in opposition (an interference paradigm). Finally, we show how comparisons of performance in facilitation and interference paradigms can be used to obtain separate estimates of conscious and unconscious processes such as recollection and familiarity. Such estimates make it possible to investigate the effects of variables such as divided attention and meaningfulness of encoding on consciously controlled and automatic processing.

Separating Automatic and Controlled Components in Recognition Memory

Jacoby (1992) examined the effects of dividing attention during study on the later use of recollection and familiarity as bases for recognition memory judgments. The study also explored how variation in the processing of meaning has its effect on recognition memory (e.g., Craik & Lockhart, 1972). We expected that the recognition benefit produced by more meaningful processing during study would reflect an increase in the probability of recollection rather than an increase in familiarity.

An outline of the procedure appears in Figure 3.1. In Phase 1, subjects were asked to judge whether pairs of words presented visually were related or unrelated. Attention to this relatedness-judgment task was either full or was divided by requiring subjects to simultaneously monitor a string of digits presented auditorially. In Phase 2 of the experiment all subjects *heard* a list of words that they were told to study for a later memory test (both groups studied this list with full attention). In Phase 3, subjects were given two visually presented forced-choice recognition memory tests, one with facilitation instructions and one with interference instructions (explained below). In both tests each test pair consisted of an old word from either the Phase 1 word pairs or from the list heard in Phase 2 paired with a new word.

PHASE 1

40 word pairs (20 Related, 20 Unrelated) visually presented for relatedness judgments
Attention: Full versus Divided

PHASE 2

60 single words aurally presented with instructions to remember them for a later test

PHASE 3

Inclusion Test
Word heard in Phase 2: Respond "Old"
Word read in Phase 1: Respond "Old" $R + F(1 - R)$

Exclusion Test:
Word heard in Phase 2: Respond "Old"
Word read in Phase 1: Respond "New" $F(1 - R)$

FIGURE 3.1. Outline of procedure for separating bases for recognition memory.

The Facilitation Paradigm: Recollection and Familiarity Acting in Concert

On the "inclusion test," subjects were instructed to pick the word from each pair that had earlier been presented in *either* Phase 1 or Phase 2. On the inclusion test, as on most recognition memory tests, subjects could use either recollection or familiarity as a basis for recognition memory judgments, and use of the two bases would produce responses in the same direction. As suggested by the results reported earlier for the fame judgment experiments, divided as compared to full attention while making the Phase 1 relatedness judgments was expected to reduce later recollection but to leave gains in familiarity largely intact. Furthermore, because of their more meaningful processing, words presented in related pairs were predicted to hold an advantage in recollection over words presented in unrelated pairs.

Results from the inclusion test following full and divided attention are shown in Table 3.1 ("Observed Probabilities"). As predicted, words presented in related pairs were more likely to be recognized as old than were words presented in unrelated pairs. For both related and unrelated pairs, divided as compared to full attention to judging relatedness reduced later recognition memory performance. One could argue that the effect of divided attention was to reduce subjects' ability to later use

TABLE 3.1. Observed Probabilities of Accepting Test Items and Estimated Probabilities of Recollection and Familiarity as a Function of Attention at Study, Item Type, and Test Instructions

	Observed probabilities		Estimated probabilities			
	Item type		Recollection		Familiarity	
	Related	Unrelated	Related	Unrelated	Related	Unrelated
Full attention						
Inclusion	.83	.70	.52	.32	.646	.558
Exclusion	.31	.38				
Divided attention						
Inclusion	.75	.61	.28	.12	.652	.557
Exclusion	.47	.49				

Note. Estimated recollection = P(accept|to-be-included) − P(accept|to-be-excluded).
Estimated familiarity = P(accept|to-be-excluded) / (1 − Recollection).
Example: On words from related pairs in the Full Attention condition, estimated recollection was .83 − .31 = .52, and estimated familiarity was .31 / (1 − .52) = .646.
From Jacoby, 1992.

recollection as a basis for recognition memory judgments. Although the results are consistent with this claim, they are not conclusive. This is because recollection and familiarity would produce results in the same direction; thus, a reduction in either or both could be responsible for the poorer recognition memory performance following divided attention. What is needed is a means of placing familiarity and recollection in opposition to more clearly separate their effects.

The Interference Paradigm: Recollection and Familiarity Acting in Opposition

To separate familiarity and recollection, the "exclusion test" required subjects to select a word on the memory test *only* if it was one that they had *heard* in Phase 2. Subjects were warned that some of the test words had been presented in Phase 1 but that they should not be selected. This is analogous to the instructions in the false-fame experiments (Jacoby, Woloshyn, & Kelley, 1989), in which subjects were told that any name recognized from the study list should be judged nonfamous. Here subjects were told that if they could recollect having earlier encountered a word as a member of either a related or an unrelated pair presented in Phase 1, they could be certain that the word was *not* one that they had heard earlier and that, consequently, that word should not be selected. Thus, whereas the inclusion test instructed subjects to include words presented in related and unrelated pairs, the exclusion test instructed them to exclude those words. This difference in test instructions was the only difference between the inclusion and exclusion tests.

Having encountered a word in Phase 1 was expected to increase its familiarity and thereby increase the probability of its being falsely recognized as having been heard earlier. An increase in false recognition of to-be-excluded items would necessarily reflect familiarity-based responding rather than recollection, because conscious recollection would have an opposite effect. If subjects recollected having earlier encountered a word as a member of either a related or unrelated pair, they could be certain that it had not been heard during Phase 2 and therefore would know not to select it. Thus, familiarity acted to increase the probability that an old test word would be selected, regardless of its source. Recollection, in contrast, supported selective responding on the basis of source. Put differently, the effect of familiarity was in the same direction (toward selecting an item) on both the inclusion and exclusion tests; this is what defined it as an automatic influence. Recollection, in contrast, had opposite effects in the two tests; this is what defined it as a controlled influence.

Dividing attention was expected to reduce later recollection and thereby leave effects of familiarity due to presentation in Phase 1 largely unopposed. The effect of divided attention and the effect of word-pair relatedness on recognition in the exclusion test are shown in Table 3.1. As predicted, dividing subjects' attention when they were judging whether words in a pair were related increased the probability of those words later being falsely recognized as heard.

Results from the exclusion test allow one to demonstrate the existence of automatic effects of memory. However, those effects are underestimated because they are countervailed by controlled uses of memory. Interference paradigms do not yield quantitative estimates of separate processes, and so cannot be used to detect invariance in a particular kind of process across different conditions or populations. For example, some studies have found that amnesics perform at normal levels on indirect tests of memory whereas others report that amnesics are impaired on indirect as well as direct tests (see Shimamura, 1986). Neither tests nor populations are factor-pure—that is, indirect tests may draw on recollection as well as familiarity and it is doubtful that amnesics have zero recollection. In order to answer questions such as "Is familiarity-based responding at a normal level?" one must be able to separately estimate the contribution of both familiarity and recollection to performance on a given test.

Separately Estimating Recollection and Familiarity: The Process Dissociation Procedure

Jacoby (in press) introduced a method for obtaining separate estimates of the contributions of familiarity and recollection to recognition memory judgments. The procedure involves comparing performance in the facilitation or inclusion test condition (in which familiarity and recollection have the same effect) with performance in the interference or exclusion test condition (in which familiarity and recollection have opposing effects). In the inclusion condition, subjects can correctly accept to-be-included items on the basis of either recollection or familiarity. Thus, the probability of accepting a to-be-included item is the sum of the probability of the item being recollected (R) and the probability of the item being familiar (F) and not recollected ($1 - R$):

$$P(\text{accept}|\text{to-be-included}) = R + F\ (1 - R).$$

To-be-excluded items that subjects incorrectly accept must be familiar (F) and not be recollected ($1 - R$), else subjects would not accept them. Thus, the probability of incorrectly accepting a to-be-excluded item is expressed by the follwing equation:

$$P(\text{accept}|\text{to-be-excluded}) = F\ (1 - R).$$

Using these equations and the observed probabilities, estimates of the contributions of recollection and familiarity can be derived with simple algebra (Table 3.1, "Estimated Probabilities"). As predicted, dividing attention at study dramatically reduced estimates of recollection (from .52 to .28 for words from related pairs, and from .32 to .12 for words from unrelated pairs) but had no effect on estimates of familiarity (from .646 to .652 for words from related pairs, and from .558 to .557 for words from unrelated pairs). Note that the effects of more meaningful processing were not restricted to recollection but increased familiarity as well (cf. Gardiner, 1988). Similar results were obtained in other experiments by Jacoby (1992) in which attention was divided at test rather than at study. In those experiments estimates of both recollection and familiarity were higher for items studied as anagrams to be solved than for items studied as words to be read. Further, estimates of familiarity were found to fit the observed probabilities of erroneously accepting to-be-excluded old items when attention was divided at test. These results show that dividing attention at study or at test can block subjects' use of recollection as a basis for recognition judgments, thus leaving familiarity-based responding relatively unopposed. Most important, the invariance in familiarity across conditions could not have been established by equating processes with tasks and then examining task dissociations, because tasks

are rarely process-pure. We further discuss these issues after describing the application of the process dissociation procedure to separately estimate effects of conscious and unconscious perception.

UNCONSCIOUS PERCEPTION

The history of research investigating unconscious perception has been marked by supposed demonstrations of unconscious perception followed by critiques and research designed to uncover methodological flaws in those supposed demonstrations (see, e.g., Balota, 1986). To dismiss demonstrations of unconscious perception, critics have shown that people may be aware of some of the supposedly subliminal stimuli (e.g., Bernstein & Welch, 1991). One response to a critic is to dutifully attempt to refine procedures such that people are never aware of the presentation of any of the supposedly subliminal stimuli. This response amounts to an attempt to develop a process-pure test, a test that exclusively measures unconscious perception (see Reingold & Merikle, 1990). A second response is to abandon any attempt to claim that a test is process-pure and, instead, to develop procedures that can be used to separately estimate the contributions of unconscious and conscious perception to a task. It is this second course that we have chosen. Our attack on unconscious perception parallels our attack on unconscious influences of memory described in the preceding section.

Difficulties for interpreting the results of investigations of unconscious perception have been created by the use of facilitation paradigms, that is, paradigms in which conscious perception would produce effects in the same direction as would unconscious perception. The aware perception of even part of a briefly presented stimulus might sometimes be sufficient to enhance performance on a supposed measure of unconscious perception, although partial perception might not be sufficient to allow subjects to report the item (Eriksen, 1960). As argued in the case of demonstrations of unconscious influences of memory, these difficulties can be circumvented by arranging a situation such that conscious perception would produce effects opposite to those of unconscious perception (i.e., an interference paradigm).

Jim Debner, a graduate student at McMaster, placed conscious and unconscious influences in opposition in a procedure that is in some ways similar to that used by Forster et al. (1990) in their investigation of unconscious perception. Words flashed for a brief duration were sandwiched between words presented for a longer duration (one before and one after the briefly flashed word), followed by presentation of a word stem that subjects were to complete (see Figure 3.2 for a more complete

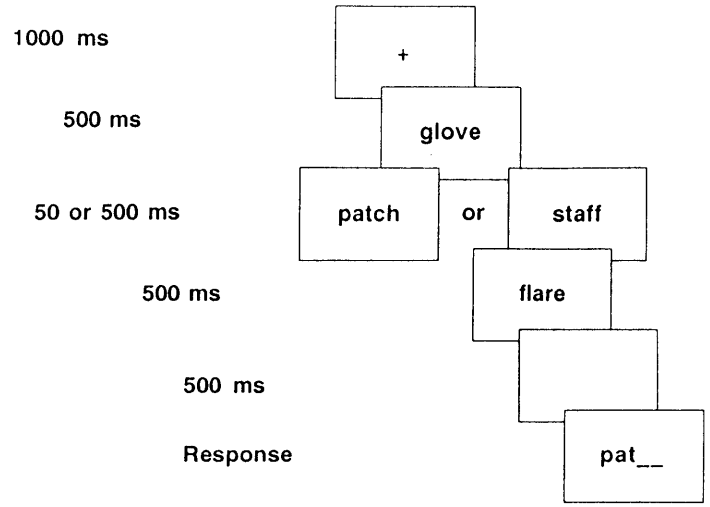

FIGURE 3.2. Procedure for separating conscious from unconscious perception.

description of the procedure). On some trials the flashed word could be used to complete the word stem whereas on other trials it could not. In an exclusion test condition subjects were told not to use the presented words to complete the word stems. Unconscious perception would be evidenced by the finding that even in the exclusion test condition subjects were more likely to give a flashed word as a completion than if the word had not been flashed. In this case one could be certain that an increase in the probability of responding with a flashed word was not caused by aware perception because subjects were instructed not to complete stems with words that were earlier flashed. There is, however, the worry that subjects might fail to follow instructions. To assess that possibility, words in the sandwiched position were sometimes presented for a duration that was long enough to allow aware perception. Also, the first and third words (i.e., the "sandwiching" words) sometimes could be used to complete the word stems. Failure to follow instructions in the exclusion test condition would be evidenced by the finding that words whose presentation allowed aware perception were used to complete word stems.

Results from the exclusion test condition are shown in the top row of Table 3.2. Baseline performance was indexed by trials on which none of the briefly presented words could be used to complete the stem that followed (.36). Flashing a completion word for 50 ms increased the probability that subjects would use that word to complete the stem (.50), providing clear evidence of unconscious perception. The higher level of

TABLE 3.2. Observed Probabilities of Completing Word Stems with Target Items

	Presentation condition		
Test condition	500 ms	50 ms	Baseline[a]
Exclusion	.10	.50	.36
Inclusion	.96	.63	.38

Note. Estimated probability that items flashed for 50 ms were consciously perceived = .13. Estimated unconscious influence adjusted for baseline = .57 − .37 = .20.

[a]In the baseline condition the briefly flashed word could not be used to complete the subsequent fragment.

responding with flashed words was not because of a failure to follow instructions. Sandwiched words that were presented for a duration that allowed their aware perception were seldom given as stem completions (.10). Even this index is probably inflated by unconscious influences of memory, and therefore overestimates the probability of subjects failing to follow instructions. Words in the third position, whose presentation immediately preceded that of the stem (minimizing the burden on memory), were given as completions with a probability of only .04.

Were subjects aware of the presentation of any of the briefly presented words? To address that question, subjects were also given an inclusion test. In that test, subjects were instructed to complete each stem with one of the words presented on that trial or, if they were unable to do so, with the first word that came to mind. With the exception of that change in test instructions, the procedure for the inclusion test was the same as for the exclusion test. Results from the inclusion test are shown in the second row of Table 3.2. Relative to the baseline (.38), flashing a word for 50 ms increased the probability that subjects would give that word as a completion (.63). It is clear that subjects followed the inclusion instructions because they almost always gave words presented for a longer duration as completions for word stems (.96).

Can results from the inclusion test be used as a measure of conscious perception? No. In fact, that test closely resembles the procedure typically used in experiments designed to demonstrate unconscious perception. The inclusion test is unlikely to serve as a process-pure measure of either conscious or unconscious perception but, rather, likely involves a mix of the two. Similarly, the exclusion test is unlikely to provide a process-pure measure of unconscious perception. Performance on that test also likely involves a mix of processes, with conscious perception sometimes countermanding the effects of unconscious perception. What is needed is a means of separately estimating the effects of conscious and unconscious perception.

The procedure used to separately estimate effects of conscious and

unconscious perception parallels the procedure used to separate conscious from unconscious influences of memory.[2] In the inclusion test the probability of completing stems with briefly flashed words is equal to the probability of consciously perceiving the flashed words (C) plus the probability of unconsciously perceiving words (U) that were not consciously perceived ($1 - C$):

$$P(\text{completion word}|\text{to-be-included}) = C + U(1 - C).$$

To-be-excluded words that subjects mistakenly gave as completions must not have been consciously perceived ($1 - C$) but must have been unconsciously perceived (U) or else the probability of giving those words as completions in the short-duration presentation condition would not exceed that in the baseline condition:

$$P(\text{completion word}|\text{to-be-excluded}) = U(1 - C).$$

The above equations, of course, are identical to those given for memory, with C (conscious perception) being substituted for R (recollection), and U (unconscious perception) being substituted for F (familiarity). Using those equations and the observed probabilities, estimates of conscious perception and of unconscious perception can be computed by means of simple algebra. The difference between the inclusion and the exclusion test in the short-flash condition provides an estimate of the probability of an item being consciously perceived (.13). Given that estimate, one can compute the probability of an item being unconsciously perceived (.57). It should be noted that the estimate of unconscious perception includes the baseline probability of giving a target word as a completion. A more accurate measure of unconscious perception is gained by subtracting the baseline probability from the estimate of unconscious perception (i.e., $.57 - .37 = .20$). Thus, stem completion performance was controlled to a substantial degree by unconscious perception.

Use of the process dissociation procedure holds advantages over directly asking people to report flashed words as a measure of aware perception. First, one avoids the questionable assumption that a direct test is process-pure in exclusively measuring conscious perception. Unconscious perception does likely contribute to performance on direct tests of perception. Second, by use of the process dissociation procedure one measures subjective experience within the context of the same task that is used to measure unconscious perception. In contrast, directly asking a person to report a flashed word might direct attention toward the word, making perception conscious; if not asked to report the flashed word, unconscious perception would result. Finally, the process dissociation procedure goes beyond merely demonstrating the existence of unconscious influences and allows us to explore the factors that affect their magnitude.

TASKS AND PROCESSES

The strategy of separating different processes by estimating their effects within a task contrasts with the strategy of searching for dissociations between tasks. When one interprets task dissociations, tasks are often treated as being process-pure (i.e., a particular kind of test is treated as a pure measure of a particular cognitive system or process). However, tasks are probably never process-pure (e.g., Dunn & Kirsner, 1989; Reingold & Merikle, 1990). For example, consider the conditions that have been said to give rise to responses based on automatic processes. The use of an automatic basis for responding is probably more likely when subjects must respond rapidly, when attention is divided, and when an indirect test is given (e.g., Posner & Snyder, 1975). However, it is doubtful that any of those conditions produce responding that is purely automatic (Allport, 1989; Neumann, 1984). Likewise, it is doubtful that responses are purely consciously controlled even when subjects are given ample time to respond under conditions of full attention.

The process dissociation procedure described earlier allows one to avoid treating tasks as process-pure by providing a means of separating effects of different types of processing within a task. The goal is the same as that motivating others' attempts to estimate the influence of different bases for recognition memory decisions (e.g., Mandler, 1980). However, the process dissociation procedure is different from other procedures in that it allows one to derive quantitative estimates of processes within a single task (see Jacoby, 1991, for further discussion). The intent of separating processes within a task is the same as in signal detection theory (e.g., Swets, Tanner, & Birdsall, 1961). It is meant to separate different bases for responding and to reveal invariance in one basis for responding across variation in the other.

The emphasis on differences in processing that accompanies the search for task dissociations has obscured the importance of finding invariance (cf. Stevens, 1951). One major contribution of our experiments on recognition memory is that they show that an unconscious influence of memory (i.e., the use of familiarity as a basis for judgments) remains constant over manipulations of attention that have large effects on the intentional use of memory. We have obtained that result in several experiments in addition to the one described here. Finding that unconscious influences of memory are invariant across manipulations of attention shows that aware (controlled) uses of memory rely on attention in a way that automatic uses of memory do not. We view manipulations of attention as analogous to perceptual manipulations and thus expect that similar findings of invariance could be produced with brief visual presentations.

The fundamental contrast in studies of unconscious perception is

between a condition in which subjects claim to be responding to consciously perceived stimuli and a condition in which subjects claim that they are unaware of the stimuli and are merely guessing (Adams, 1957). One reason for renewed interest in this area is the proposal that findings of qualitatively different patterns of responding under these two conditions can provide unambiguous evidence for the existence of unconscious perception (Dixon, 1981). Although qualitative differences do provide evidence that the conditions differ in some way, their use has been questioned on the grounds that similar dissociations can also be obtained between different conscious processes (Erdelyi, 1986; Holender, 1986). In our view, the interpretation of qualitative differences is problematic because it rests on the questionable assumption that different conditions constitute factor-pure measures; that is, that the "aware" condition involves only conscious processing, and that the "unaware" condition involves only unconscious processing (cf. Reingold & Merikle, 1988, 1990). We avoid this problem by inferring awareness from conscious control and defining unconscious influences as effects that cannot be controlled. When effects of memory or perception are directly opposed to subjects' intentions, one can be certain that those effects are mediated by unconscious processes. Moreover, by contrasting cases in which a particular source of influence is opposed to subjects' intentions with cases in which that influence acts in concert with their intentions, separate quantitative estimates of those two sources of influence can be obtained.

We have gone into some detail describing the process dissociation procedure because we think it is likely to be useful in a variety of domains. In addition to recognition memory and unconscious perception, we have used the procedure to estimate intentional and automatic processes in cued recall and Stroop performance. Ian Begg has extended the procedure to separate logic from intuition in syllogistic reasoning. Other experiments are planned to separate conscious from unconscious influences of attitudes (cf. Devine, 1989). Of course, as the approach is extended to other domains, details of the experimental conditions and/or equations will need to be modified (see Jacoby, 1991, for discussion of the assumptions underlying the process dissociation procedure). The results of our initial investigations give us confidence that the procedure can indeed be extended to a broad range of psychological issues.

UNCONSCIOUS PROCESSING, AUTOMATICITY, AND HABIT: AN INTEGRATION

It is the possibility of perception without awareness that has truly captured the layperson's interest. However, perception without awareness

might be best treated as a member of a larger class of phenomena, namely, those that reflect automaticity. The notion of automaticity sounds much more innocuous than does that of unconscious influences and also brings a different literature to mind. Dating back to James (1890/1962), automaticity (or "habit") has been investigated extensively. Even critics of the notion of subliminal perception grant a role for habit in the form of effects on performance without awareness of the source of those effects. Eriksen (1960), for example, noted that "there would seem to be little doubt that a considerable amount of human behavior occurs without awareness of the behavior at the time of its occurrence" (p. 297). The effects of habit are similar to those of perception without awareness. For both habit and perception without awareness, behavior is described as largely initiated by the stimulus environment without the intervention of conscious intention. As is argued for unconscious processes, habit usually acts to a person's advantage (as beautifully described by James, 1910, pp. 143-144) but can also act in opposition to current purposes (as shown in Reason's, 1979, description of "action slips").

However, there are potentially important differences between habit and perception without awareness. One difference is that people may have been consciously aware of the events that gave rise to habits at the time those events occurred whereas awareness is fully denied for claims of perception without awareness (cf. Kihlstrom, Chapter 1, this volume). There are reasons to question the importance of that difference. First, research on "learning without awareness" (e.g., Thorndike & Rock, 1934; cf. Lewicki, 1986; Reber, 1989) shows that people may not always be aware of the events that give rise to habits any more than they are in the case of perception without awareness. Second, unconscious perception might actually involve a fleeting awareness. Although the interval of time between presentation of an item and its test is shorter in investigations of perception without awareness than in investigations of memory, forgetting may occur during that interval. At the extreme, it is impossible to discriminate between fleeting awareness and true perception without awareness, and, fortunately, it does not seem terribly important to do so. This follows from our final and most important point: Awareness at the time an effect operates is more critical than any earlier difference in awareness. If one is to avoid a source of influence, one must be aware of that influence when it exerts its effect. Both habit and perception without awareness may best be described as unconscious influences; in both cases behavior is affected by processes that are not under current volitional control.

Differences of awareness notwithstanding, automaticity (habit) is typically described as arising only after extended training (e.g., Schneider & Shiffrin, 1977) whereas unconscious influences are often ascribed to

the occurrence of a single event. However, there are probably trade-offs among factors such as amount of training, retention interval, and retrieval conditions. Given good cues for retrieval, a single prior presentation of an item can produce what is, in effect, a habit, that is, an automatic influence of perception or of memory (Jacoby, 1991). Logan (1988) has described automaticity as relying on memory for multiple instances rather than on the development of an abstract representation (cf. Schneider & Shiffrin, 1977). We have emphasized the role of specific episodes but differ from Logan on the number of episodes or instances required for performance to become automatic. Our argument is that automaticity can develop without extensive practice; if retrieval cues are sufficiently specific, the use of memory for a single episode can give rise to "one-trial automaticity" or "one-trial habit."

Difficulties surrounding the definition of automaticity may appear to undercut the advantage of equating automatic processes with unconscious processes. Bargh (1989; see also Neumann, 1984) criticized the standard definition of automaticity by arguing that the criteria of being capacity-free, outside of awareness, and unintentional are seldom simultaneously met. Each of those criteria has been used to design tasks with which automaticity is equated. For example, automaticity has been equated with performance under conditions of divided attention (limited capacity). Such criteria treat automaticity as an inherent property or characteristic of particular cognitive processes. In contrast, we define automaticity solely in terms of the relation between performance in a facilitation paradigm and that in an interference paradigm. Automatic influences are unintentional in that they remain the same regardless of whether they facilitate or interfere with performance of a task. Defining control and automaticity in this way allows use of the process dissociation procedure to separate the contribution of intentional and automatic processes. Doing so avoids problems that arise when automaticity is identified with a particular combination of training or test conditions or with some characteristic of a response, such as its rapidity.

Is performance ever controlled solely by external stimuli or solely by conscious intentions? After extensive learning, automatic responses are said to become as encapsulated and uncontrolled as reflexes. However, even reflexes can be modified by attention (see review by Anthony, 1985). Neumann (1984) argued that automaticity is not a characteristic of stimulus-driven processing but, rather, is an emergent property of the exercise of specific skills in an environment. Those aspects of a task that are fully specified by the combination of memory for the skill and the current environment may be performed automatically. Further, Neumann suggested that automaticity cannot be driven by stimuli separately from skills that are brought into play by intentions. For example, "priming" in lexical decision is not a result of the prime automatically activating the target but, rather, reflects the exercise of the skill of predictive reading. More generally, automatic processing arises when stimulus parameters are integrated with memory for skills in the context of consciously controlled goals and intentions. One clear implication of this view is that automatic processing is context-dependent rather than invariant across contexts. Further, current goals set the stage for automatic processes. In our fame experiments, for example, the automatic effect of prior exposure to nonfamous names arose in the context of the fame judgment task; prior exposure to those names might have had a different automatic effect—or no effect at all—in other contexts.

Although effects of brief visual presentations have been given great prominence, impoverished perceptual conditions are probably less common than attentional factors as causes of unconscious influences. When attention is focused on attaining a high-level goal, lower level processes that support that goal may be carried out largely without awareness (Neumann, 1984). The importance of focus of attention is also implicated by Polanyi's (1958) distinction between tool and object. By that distinction, knowledge used as a tool, such as the use of language to read a letter, is transparent or unconscious. For example, when having a conversation, one's intent is to participate in a social interaction, not to make speech sounds, identify the sources of ideas, or categorize the traits of one's interlocutor. So long as the high-level intention is being actualized, the lower level processes that enable it are largely automatic. Much the same notion has been expressed by Wicklund (1986) in his discussion of static versus dynamic orientations. According to Wicklund, a dynamic orientation arises when environmental demands are perfectly matched by a person's behavioral repertoire; such a fit between person and environment results in the "flow" experience described by Csikszentmihalyi (1975). It is only when flow breaks down, or when higher level intentions are not being actualized, that people assume a static orientation in which they attempt to control a situation by analyzing and labeling its component aspects.

One implication of these ideas is that people are especially susceptible to unconscious influences when they are "in flow" and so are not analytically monitoring sources of influence. This highlights the positive nature of unconscious processing; although often cast in negative terms, automatic uses of memory (skills) and of perception (environment) are essential for expert performance. A related point, already noted earlier, is that unconscious influences of memory are likely to be highly context-dependent. Conscious attention to a source of influence operates to decontextualize that influence: To analyze an event is to "take it out of context." A source of influence that is not made an object of attention is

therefore more likely to be contextually bound. This view is supported by evidence of the specificity of transfer effects in skilled performance, for example, reading (Jacoby, Levy, & Steinbach, 1992). It is because of the extreme specificity of transfer effects that automatic processes are so often adaptive: Memories are retrieved and integrated with perceptual information in precisely those situations in which they are most appropriate.

As described earlier, dividing attention either during study or at test can produce effects that parallel those resulting from perception without awareness. Although a useful tool, there really is nothing special about presenting items in impoverished perceptual conditions such as those obtained by briefly flashing an item. Indeed, larger unconscious influences can probably be produced by manipulations of attention than by flashing items for a brief duration. In that regard, it is interesting to consider the controversy surrounding the effects of subliminal "backmasked" messages that are supposedly embedded in some rock music (Vokey & Read, 1985). Given our work on the effects of dividing attention, there may be more to fear from the supraliminal messages in "background music" than from any subliminal messages hidden in that music. The backgrounding of the music, akin to dividing attention, likely makes one more open to the lyrics as a source of unconscious influences and persuasion. Parents might therefore have better reason to worry about the ill effects of "backgrounding" than those of "backmasking."

SUMMARY AND CONCLUSIONS

We have answered the layperson's question in the affirmative: Techniques that rely on unconscious influences *can* be used to make a person act in ways that are counter to his or her own purposes. Contrary to a naive realist view, neither the past nor the present is always as it seems. Subjective experience results from an attribution process in which mental events are interpreted in the context of current circumstances, and that attribution process can be in error. Misattributing the source of fluent processing can produce illusions of memory and illusions of perception. Unconscious influences of memory can result from a single episode, thus producing what amounts to one-trial automaticity. Such effects on subjective experience are not easily avoided, and they have important implications for behavior.

Unconscious influences seem more benign when it is recognized that they are of the same general class as habit and automaticity. Such influences are often beneficial and serve as the foundation for skilled performance. However, it is our bad habits that are most obvious to ourselves

and to others. Placing unconscious influences in opposition to subjects' current purposes serves as a methodological tool for demonstrating the existence of unconscious influences but does not provide a true estimate of their magnitude. To measure the contributions of both automatic and consciously controlled processes to task performance, the process dissociation procedure combines results from a facilitation paradigm with those from an interference paradigm. Stated more simply, control is measured as the difference between performance when subjects are "trying to" versus "trying not to" be affected by a source of influence. Given an estimate of the contribution of consciously controlled processes, one can then derive an estimate of the contribution of unconscious or automatic processes. In effect, this approach redefines automatic processes as those that produce the same effect regardless of whether that effect is in concert with or in opposition to one's intentions.

Research reliant on the process-pure assumption has made the existence of unconscious influences controversial. It is our hope that the process dissociation procedure will allow us to move beyond debates about the existence of unconscious influences and on to debates about the nature and magnitude of such effects. Further, by identifying unconscious processes with habit and automaticity, we mean to rob them of their mystery. Automaticity and habit have rich research histories that can be used to guide investigations of the unconscious.

Having learned from our lectures, the more sophisticated layperson might now ask: "When can unconscious influences be expected to have their largest effect?" Our tentative answer is: "When you least expect them."

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NOTES

1. Interestingly, Collins found that this effect depends on the synchronous onset of the sentence and the background noise. If onset of the sentence precedes that of the background noise by a sufficient interval, the noise and sentence are perceived as separate "streams" coming from separate sources, and effects of prior experience with sentences on noise judgments are no longer obtained.

2. In the present set of equations used to model unconscious perception, we ignore the base-rate probability of generating a completion word independent of conscious or unconscious perception (which can be estimated from trials on which the flashed words could not be used as completions) because it is the same for both the inclusion and exclusion conditions.

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PART II . . . . . .

THE CLINICAL PERSPECTIVE