The Feeling of Knowing:
Some Metatheoretical Implications for
Consciousness and Control

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The study of the feeling of knowing may have implications for some of the metatheoretical issues concerning consciousness and control. Assuming a distinction between information-based and experience-based metacognitive judgments, it is argued that the sheer phenomenological experience of knowing (''noetic feeling'') occupies a unique role in mediating between implicit-automatic processes, on the one hand, and explicit-controlled processes, on the other. Rather than reflecting direct access to memory traces, noetic feelings are based on inferential heuristics that operate implicitly and unintentionally. Once such heuristics give rise to a conscious feeling that feeling can then affect controlled action. Examination of the cues that affect noetic feelings suggest that not only do these feelings inform controlled action, but they are also informed by feedback from the outcome of that action. © 2000 Academic Press

The recent upsurge of interest in metacognition derives in part from the belief that the experimental study of the processes involved in knowing about knowing may provide insights into some of the fundamental issues concerning consciousness and its role in behavior. In this article, I explore two fundamental metatheoretical issues in the study of human consciousness and control from the perspective of the recent work in metacognition, particularly the experimental research on the feeling of knowing. That work seems to me to suggest a general way of thinking about these issues. Some of the ideas to be presented here have been hinted on in two previous papers, and here I present them in some detail (Koriat, 1998b; Koriat & Levy-Sadot, 1999).

The first issue concerns the relationship between metacognition and consciousness. This issue has implications not only for the study of metacognition but, more generally, for the nature and function of consciousness and subjective experience in general. The second issue concerns the question of whether consciousness should be conceptualized as exerting a causal role on behavior or whether it is itself a reflection and interpretation of one's behavior and performance.

In what follows I shall first examine the idea that metacognitive processes represent an integral part of conscious-controlled functioning, and then I point out some observations that invite a more complex conceptualization. Relying on the distinction between an explicit and controlled mode of operation and an implicit-automatic mode, a distinction is drawn between metacognitive judgments and metacognitive feelings.

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A crossover view of metacognitive feelings is then presented, according to which these feelings allow a transition from the implicit-automatic mode to the explicit-controlled mode of operation. Results supporting this view are then briefly presented, and some general metatheoretical implications are outlined.

METACOGNITION AND CONSCIOUSNESS

Metacognitive processes normally accompany a great deal of our daily activities, supervising and controlling various aspects of these processes. Thus, when we make an appointment, we often have to take precautions not to miss it. The extent to which we take such precautions depends on our assessment of their potential effectiveness as well as on our assessment of the chances of missing the appointment if these precautions are not taken. When we learn new material, we generally monitor our comprehension and mastery of that material and regulate the allocation of learning resources accordingly. And when attempting to retrieve information from memory, we may have a feeling of knowing that signals to us that the sought-after information is indeed available in store and worth searching for. What is important about such subjective feelings, then, is that they seem to guide and affect our behavior (e.g., Koriat & Goldsmith, 1996; Nelson & Narens, 1990).

As illustrated by the examples just mentioned, we may distinguish between two types of metacognitive components—monitoring and control (Nelson, 1996). Monitoring refers to the subjective assessment of one's own knowledge, whereas control refers to the processes that presumably use the output of monitoring to regulate cognitive processes and behavior.

Both metacognitive monitoring and metacognitive control have been invoked in discussions of consciousness, and both seem to be also pertinent to the cardinal distinction in current-day cognitive psychology between implicit and explicit cognitions. Consider monitoring first. The subjective monitoring of knowledge, that is, knowing about knowing, appears to constitute one of the defining properties of consciousness, because consciousness would seem to imply not only that I know something, but also that I know that I know it. Thus, consciousness can be said to bind together knowledge and metaknowledge. This binding is also commonly seen to characterize explicit cognition in contrast with implicit cognition. For example, a critical difference between blindsight and normal sight (see Weiskranz, 1997) is in ''metaknowledge'': In both cases the person may exhibit behavioral evidence suggesting that the visual information is registered, but only in the latter case is the person also aware of possessing or accessing that information. Similarly, the major difference between explicit and implicit memory, as commonly conceptualized, is that in the case of explicit memory not only does a person retain some information from the past, but he also subjectively knows that he knows it. In implicit memory, in contrast, the information may be retained without the person knowing that he knows it.

Control, in the sense of voluntary control over behavior, is also assumed to be intimately tied to our notion of consciousness. In Posner and Snyder's (1975) conceptual framework, controlled processes as opposed to automatic processes, are seen to be characteristic of conscious functioning. Block (1995) associated consciousness with the reflective pursuit of one's goals, arguing that without consciousness one

loses the ''rational control of action.'' In Schacter's (1989) model the conscious system is assumed to function as the gateway to an executive control system that regulates attention and initiates voluntary activities. Only activations that gain access to consciousness can be used by the executive system and thus influence voluntary activities (see also Marcel, 1986). Jacoby went even further, using voluntary control as a diagnostic of consciousness (e.g., Jacoby, Lindsay, & Toth, 1992; Jacoby, Ste-Marie, & Toth, 1993). In his work, consciousness is operationally defined in terms of the control over thought and behavior. By distinguishing between cognitively controlled and aware processes on the one hand, and automatic and unconscious processes on the other hand, he emphasizes the inhibitory function of awareness in opposing influences that would otherwise prevail in memory and behavior (Jacoby, 1999; Jacoby, Jennings, & Hay, 1996).

In sum, on the basis of these comments, it would seem natural to place metacognitive monitoring and control at the heart of the notion of consciousness. Therefore, it should be surprising to find out that some leading experts arrived at the conclusion that metacognitive processes are, in fact, more properly seen as being part of unconscious and implicit functioning (Kelley & Jacoby, 1996b; Reder & Schunn, 1996). Thus, Kelley and Jacoby, for example, concluded that ''metacognition and implicit memory are so similar as to not be separate topics'' (p. 287). In order to clarify the origin of these conclusions, I shall now examine several observations suggesting that metacognitive processes actually have two faces: They partake with both an implicit-automatic mode of functioning as well as with a more explicit and controlled mode (see Koriat, 1998b). I will begin with an example that illustrates some of the unique characteristics of metacognitive processes.

SOME CHARACTERISTICS OF THE FEELING OF KNOWING

Consider the type of feeling of knowing that sometimes accompanies memory search. We are all familiar with the state of consciousness associated with the tip-of-the-tongue (TOT) experience, as when one struggles to retrieve an elusive name from memory. This state was eloquently described by William James (1893) as follows:

> Suppose we try to recall a forgotten name. The state of our consciousness is peculiar. There is a gap therein; but no mere gap. It is a gap that is intensely active. A sort of wraith of the name is in it, beckoning us in a given direction, making us at moments tingle with the sense of our closeness and then letting it sink back without the longed-for term. If wrong names are proposed to us, this singularly definite gap acts immediately so as to negate them. They do not fit into its mould. And the gap of one word does not feel like the gap of another, all empty of content as both might seem necessarily to be when described as gaps (p. 251).

There are three features that I would like to point out about this state. First, although clearly the TOT represents a state of awareness, the awareness is about something that the person does not (yet) know. This is, in fact, what is fascinating about it. In a sense, the TOT phenomenon illustrates a dissociation between subjective and objective indexes of knowing—between the subjective conviction that one ''knows'' the sought-after name, and the actual inability to produce it. This type of dissociation is just the opposite of that characteristic of implicit cognition, when the person's overt

behavior discloses some signs indicating that the person ''knows'' something, and yet the person himself is unaware of possessing such knowledge. Naturally, the feeling of knowing associated with the TOT state raises the question of how does a person know that he ''knows'' the sought-after target in the face of being unable to produce it? This question becomes particularly acute in view of the empirical findings indicating that feeling-of-knowing (FOK) judgments elicited following retrieval failures are moderately valid in predicting the success of retrieving the elusive target or recognizing it from among distractors at some later time (See Schwartz & Metcalfe, 1992). Thus, a subjective index of knowing is diagnostic of actual knowledge despite the dissociation noted above between them.

The second feature concerns the quality of the subjective experience itself. As disclosed by the quote from William James, the feeling of knowing has the quality of direct, unmediated experience. The experience is that one can sense the missing word or name, not just infer its existence. It is this quality of the feeling of knowing that has given rise to a ''trace access'' account (Hart, 1965), according to which the FOK is the output of a specialized monitoring mechanism that has direct access to the memory trace of the elusive target. Indeed, people in a TOT state have sometimes the feeling that they can sense the emergence of the target into consciousness, and can judge its ''closeness'' or imminence (Brown & McNeill, 1966; Schwartz, Travis, Castro, & Smith, in press). The question that emerges, then, is what is the special nature of this kind of subjective, immediate knowledge, particularly when it concerns something that the person, in some sense, does not know. Some might refer to this type of knowledge as an intuitive feeling, a hunch, or ''just knowing'' (Block, 1995). It is the kind of knowledge that feels self-evident, not needing any justification (see Epstein & Pacini, 1999).

A third feature still, concerns the possible behavioral consequences of the feeling of knowing. A common experience associated with the TOT state is a driving force to bring it to an end by retrieving the sought-for target (Smith, 1994). Putting this motivational component aside, the TOT state, like other types of metacognitive feelings and judgments, has an informative value for the person: People are likely to spend more effort searching for the answer to a question when they feel that they know it than when they feel that they do not. Thus, regardless of the origin or validity of the feeling of knowing associated with a TOT state, this state seems to have motivational consequences. People are influenced by their metacognitive feelings even when they do not know why they have these feelings.

Taken together, the characteristics of the feeling of knowing just mentioned appear to disclose the complex, paradoxical nature of metacognitive processes, making it difficult to classify them squarely with conscious, explicit processes.

THE TWO FACES OF METACOGNITION

The thesis that I would like to advance is that although metacognitive feelings appear to be an integral part of conscious, explicit cognition, they are actually two-sided: They serve to interface between implicit-unconscious-automatic processes on the one hand, and explicit-conscious-controlled processes on the other. It is this unique, double-sided nature of metacognition that provides the study of metacogni-

tive processes with the potential of shading some light on the type of communication that exists between two layers of consciousness.

I will explicate this thesis later but before doing so, I would like to relate a personal note about this idea. My interest in metacognitive processes began many years ago in connection with my interest in creativity and the creative process (Koriat, 1970). The reports of highly creative people about their thought processes suggest that a great deal of the cognitive work goes on underneath, beyond the conscious control of the person (see Dorfman, Shames, & Kihlstrom, 1996; Ghiselin, 1952; Monsay, 1997). These reports give the impression that during the period when a person is struggling to find a solution to a problem, he actually operates on two levels of experience, searching at one level of experience what he already knows at some other, lower level of experience. Thus, although solutions and discoveries sometimes emerge into consciousness as sudden insights, examination of the history of the person's thought reveals signs of the existence of these solutions much earlier.

Furthermore, although many processes go on implicitly and unconsciously, there are indications that the person can somehow subjectively monitor these underground processes (Policastro, 1995). For example, some of the personal reports give the impression that during the creative process the person can intuitively feel that he or she is about to reach the solution, and can detect its imminence. Indeed, many thinkers have emphasized the importance of intuition in guiding their thinking, in knowing whether they are on the right track or on the wrong track.

These observations about creativity have led some theoreticians (see Kris, 1952) to propose that creative individuals can somehow be ''in touch with their unconscious.'' I was intrigued by this proposal, because certainly it could not imply that creative people are *conscious* of their unconscious. This drew my interest to the possibility that the special quality of intuitive feelings, as the direct monitoring of the presence of something that the person does not yet know, may be telling about the way in which unconscious, implicit processes communicate themselves to consciousness.

It occurred to me that a similar cross talk between knowledge and metaknowledge also occurs, on a miniature scale, in the feeling of knowing or in the TOT phenomenon, when we can monitor the presence of a word before we access it. Thus, I thought that study of the feeling of knowing might also cast some light on the interface between subconscious and conscious processes. Judging from the findings on metacognition that have been gathered over the years, it seems that I had a premonition, because that is what the work on metacognitive monitoring appears to point to, as I will try to explain.

Let me first summarize my general thesis:

1. We may distinguish very crudely between two levels of experience, each with its own mode of operation. The higher level involves an explicit mode of operation, characterized by relatively high degrees of consciousness and control, whereas the lower level involves an implicit mode of operation, characterized by relatively low degrees of consciousness and by automatic influences.

2. With regard to metacognitive judgments involving one's own knowledge, a distinction should be drawn between information-based and experience-based judgments. The two types of judgments involve different types of processes.

3. Information-based metacognitive judgments are based on an analytic process that operates primarily at the higher level of experience, using cognitive processes that are relatively more conscious and controlled.

4. Experience-based metacognitive judgments, such as the feeling of knowing associated with the TOT state, are unique in that they involve a transition from the lower to the higher level of experience. They are implicit as far as their antecedents are concerned, but explicit as far as their phenomenal status and behavioral consequences are concerned.

5. The function of experience-based metacognitive judgments is to augment self control, that is, to allow some degree of personal control over processes that would otherwise influence behavior directly and automatically, outside the person's consciousness and control.

Let me now spell out this conceptual scheme.

TWO MODES OF OPERATION

I propose a distinction between two layers of experience involving two modes of operation (Neisser, 1963). This distinction is very crude and will probably not survive strict experimental scrutiny, but it may serve as a useful organizing conceptual scheme.

In the implicit-automatic mode of operation, characteristic of the lower level of functioning, a variety of elements registered below full consciousness may influence behavior directly and automatically, without the mediation of conscious control. The assumption is that subconscious influences can flow directly into behavior without the mediation of consciousness and voluntary control. Indeed, there have been many demonstrations of the effects of subconscious processes on a variety of judgments (see Bargh, 1997). More important for the present thesis, however, are indications that subconscious influences can find their way directly to overt action. Unfortunately, experimental psychologists interested in cognitive processes rarely examine how these processes affect overt behavior. Luckily, though, there are several anecdotal observations, and more recently, some experimental evidence as well, that supports this thesis. An example of the operation of such effects comes from Claparede's (1911) amnesic woman who refused to shake hands with him after he pricked her with a pin, even though she did not explicitly remember that he had done so. This example indicates that goal-directed behavior, not just routine, overlearned responses, may ensue from memories of which the person is unaware. A similar effect occurs in the case of posthypnotic suggestions, when people are induced to carry out goal-oriented actions that they did not consciously choose and without being aware of the reasons for their behavior (Hilgard 1965). Gazzaniga (1985) also reported that when a message was flashed to the right hemisphere of a split brain patient (''walk'') the behavior occurred, but the person provided some plausible reason for it afterward (e.g., ''going into my house to get a Coke'').

More direct experimental evidence comes from the work in social psychology on automatic influences on behavior (see, e.g., Bargh, 1997). For example, in a study by Bornstein, Leone, and Gallay (1987) participants were subliminally presented with a photograph of one of two confederates with whom they later interacted. They were

found then to express greater agreement with the primed than with the unprimed confederate. Similarly, in a study by Bargh, Chen, and Burrows (1996), college students were asked to play a game in which some of the words were intended to activate the elderly stereotype (e.g., ''Florida,'' ''forgetful,'' ''retired''). Without being aware of this activation, they were found to be slower than a control group in walking down the corridor after exiting the lab room. These and other findings (see Disjksterhuis, Knippenberg, Spears, Postmes, Stapel, Koomen, & Scheepers, 1998) indicate that a variety of processes can find their way directly into behavior without the mediation of conscious control. Their important implication is that consciousness is not the sole gateway to action.

In contrast, in the explicit-controlled mode of operation, people are more or less aware of the considerations that affect their behavioral choices, and their goal-directed actions are performed with some degree of deliberate choice and self-control. This is the mode of operation that characterizes most of our daily activities: I remember that I must call the doctor, I pick up the phone and make the call. Thus, a course of action is chosen on the basis of one's desires and one's conscious appraisal of the situation. Goal-directed actions are then undertaken in a self-initiated, self-controlled manner.

Clearly, most of our behaviors represent a mixture of influences from both implicit, subconscious activations, and conscious considerations. This mixture is nicely demonstrated by slips of actions that ensue from automatic influences on deliberate behavior, resulting in actions that are not as intended (Reason, 1983).

DISTINGUISHING BETWEEN EXPERIENCE-BASED AND INFORMATION-BASED JUDGMENTS

The distinction between the two modes of operation just outlined is important for distinguishing between two processes leading to metacognitive judgments, information-based (or theory-based) and experience-based (or affect-based). This distinction has been discussed in the broader context of judgmental processes in general (e.g., Epstein & Pacini, 1999; Kelley & Jacoby, 1996a; Strack, 1992). In the context of metacognition, we should distinguish between a situation in which one's monitoring of one's own knowledge is based on an explicitly inferential process, and one in which it is based on a sheer subjective feeling. Koriat and Levy-Sadot (1999) used the terms noetic judgments (or judgment of knowing) and noetic feelings (or feeling of knowing) and showed how this distinction applies to the various forms of monitoring one's own knowledge. Consider, for example, a person who fails to retrieve the answer to a general-information question. She may still be able to make a deliberate, educated inference about the plausibility that the solicited answer will be subsequently recalled or recognized. Such a noetic judgment would be typically based on domain-specific memories and beliefs (see Nelson, Gerler, & Narens, 1984), and may sometimes take the form ''I *ought* to know the answer,'' or ''there is little chance that I would know the answer'' (see Costermans, Lories & Ansay, 1992).

Noetic judgments in general may be seen to be part and parcel of the explicit mode of operation and to involve similar processes to those underlying many other types of deliberate inferences and predictions. Many everyday inferences are based on a

variety of beliefs and memories that the person can generally bring to consciousness and take into account in choosing a controlled and deliberate course of action. For example, I may reason that a friend is likely to be now in her office, and I may decide to call her. Because both the inferential process and the behavioral decision that follows from it take place within the same level of experience, the interplay between them is relatively fluent and dynamic: I may phone, fail to get an answer, then realize that it is actually Thursday, and that on Thursdays she is usually somewhere else, and choose a different course of action.

A similar exchange may also take place between monitoring and control when the monitoring of one's own knowledge is based on specific informational content. Consider a situation in which a person taking a course examination is asked to write short answers to 8 questions of her choice out of 12 (see Koriat & Goldsmith, 1998). Possibly, before deciding to spend time trying to answer a particular question, she might try to reach some assessment of the likelihood that she will be able to provide a good answer, one that will earn her the highest number of points. The considerations that enter into such assessment may include, for example, how much time she has spent studying that particular topic, how long ago she reviewed it, etc. Once she goes ahead and starts answering the question, she may realize that she actually cannot recover a few pertinent details, may cross out what she wrote, and move on to another question.

Although the monitoring and control processes involved in such a situation are of psychological interest, they are not different from many types of reasoning and decision making processes that do not involve the monitoring of one's own knowledge. If this were all there was to metacognition, I doubt that it would have attracted as much attention as it did.

Contrast this situation with that of the TOT state described earlier. Here too the person can provide some judgment about his knowledge, but that judgment is based on a direct subjective *feeling* rather than on explicit inferences made on the basis of retrieved beliefs and memories. Although in the TOT state some partial information may come to mind, the monitoring of one's knowledge is not based on the *content* of that information, and, in fact, in most cases the person generally has no way of evaluating the validity of the accessed partial clues or specifying their source (see Koriat, 1994). Nevertheless, like noetic judgments, noetic feelings too may affect deliberate action. For example, if the exam mentioned above includes a question about the name of a famous figure, the person may decide to dwell more on that question if she feels that the name is on the tip-of-the-tongue than if not.

Assuming that metacognitive judgments can rest on a sheer feeling, the primary question then is where do these feelings come from?

THE DIRECT-ACCESS ACCOUNT OF THE FEELING OF KNOWING AND ITS METATHEORETICAL IMPLICATIONS

One possibility is that feelings of knowing are immediately given: They detect directly the presence and, perhaps, the strength of memory traces. Indeed, as noted earlier, the phenomenology of the FOK has motivated a direct-access (or trace-access) account of the basis for these feelings (see Nelson et al., 1984; Schwartz, 1994). This

account assumes the existence of a specialized internal monitor that directly detects the presence of the elusive target in store, and it is this monitor that is consulted in making FOK judgments. Hart (1965; 1967) who advanced such an account for FOK judgments that are elicited following a recall failure, emphasized the functional value of having such an internal monitor, because it can save the time and effort searching for information that is not stored in memory. One merit of this account is that it provides a simple explanation for the accuracy of FOK judgments in predicting actual memory performance, because both subjective and objective indexes of knowing are assumed to be affected by the strength of the memory trace. This type of account has been implicit in many discussions in the literature (see, e.g., Yaniv & Meyer, 1987).

A similar, direct-access account has also been proposed for judgments of learning (JOLs) obtained in the course of studying new material. The hypothesis is that people assess the future recallability of an item by reading the strength of the memory trace that is formed following study (see, e.g., Cohen, Sandler, & Keglevich, 1991; Mazzoni & Nelson, 1995). This hypothesis assumes that participants can monitor directly trace strength and can also assess on-line the moment-to-moment increase in trace strength that occurs as more time is spent studying an item.

The traditional use of confidence judgments in the context of the signal detection approach to recognition memory also implies direct access to the strength of the memory trace. The assumption is that there exists a continuum of memory strength, and people make old/new judgments by setting a criterion level of strength (or familiarity) beyond which an ''old'' response is emitted. For a recent discussion of the contrast between this approach and the more recent metacognitive approaches to confidence judgments, see Van Zandt (submitted).

In the direct-access view, the feeling of knowing is granted a special status, having privileged access to stored information that cannot yet be accessed. Hence, the validity of the feeling of knowing is taken for granted, needing no justification. Traditionally, the notion of ''self-evidence'' has occupied a central role in intuitionistic theories, which assume that some ultimate truths are directly or intuitively apprehended (Westcott, 1968; See Koriat, 1975). Although the assumption of self-evident validity appears consistent with the phenomenology of the FOK (see Epstein & Pacini, 1999), it has certain metatheoretical implications that should be spelled out. Consider, for example, the TOT state. In this state not only does the person have a positive feeling of knowing, but often he can also provide partial information about the elusive target, such as its first letter or its length (e.g., Brown & McNeill, 1966; Koriat & Lieblich, 1974). Sometimes, however, the partial information retrieved proves to be wrong in retrospect, possibly stemming from ''neighboring'' targets, rather than from the solicited target (which the person can sometimes later identify as the one he has actually been searching for; Koriat & Lieblich, 1977). A direct-access view, which takes the validity of the FOK for granted, would assume that the FOK continues to monitor the *correct* memory target despite the fact that the partial information that a person succeeds to access actually derives from a different source. This implies, in a sense, that metamemory can circumvent the output of memory: It has privileged access to stored knowledge beyond what is accessible to memory (Koriat, 1994).

Indeed, this assumption seems to be implicit in some of the common experimental

practices in the study of FOK judgments, which, for an outsider, would seem to entail a confusion between the perspective of the subject and that of the experimenter (see Koriat, 1993). Thus, a common practice in FOK studies is to solicit FOK judgments from a participant not only when he fails to retrieve the correct answer (omission error), but also when he makes a commission error, that is, produces an answer that, according to the *experimenter's* standards, is incorrect. The implicit assumption is that although memory may deliver a ''wrong'' candidate, the feeling of knowing still has privileged access to the *correct* target. Thus, intuitive noetic feelings are assumed to have a special status, being self-evidently valid.

A related metatheoretical assumption concerns the role of consciousness in affecting behavior. As noted earlier, noetic judgments and feelings exert measurable influences on behavior. The direct-access view of the basis of metacognitive monitoring leads to a conception of consciousness and subjective experience as the ultimate cause, that is, as the starting point from which one's own actions originate. This assumption contrasts with that which I will examine next, in which metacognitive feelings are seen themselves to be the result of other processes, some of which, in fact, derive from the person's own actions and performance (see Kelley & Jacoby, 1998).

THE HEURISTIC ORIGIN OF THE FEELING OF KNOWING

In recent years there has been a growing consensus among students of metacognition that experience-based metacognitive judgments are also inferential, but the type of inference process involved differs from that underlying information-based judgments. Whereas information-based judgments entail deliberate, analytic inferences that rely on beliefs and memories, metacognitive feelings are mediated by the implicit application of nonanalytic heuristics (see Jacoby & Brooks, 1984; Kelley & Jacoby, 1996a; Koriat & Levy-Sadot, 1999). These heuristics operate below full consciousness, relying on a variety of cues. Such heuristics and cues affect metacognitive judgments by influencing subjective experience itself.

Several cues have been proposed as determinants of JOL, FOK, and subjective confidence. With regard to JOL and FOK, these include the ease or fluency of processing of a presented item (Benjamin & Bjork, 1996; Begg, Duft, Lalonde, Melnick, & Sanvito, 1989; Koriat, 1997), the familiarity of the cue that serves to probe memory (Metcalfe, Schwartz, & Joaquim, 1993; Reder & Ritter, 1992; Reder & Schunn, 1996), the accessibility of pertinent partial information about a solicited memory target (Dunlosky & Nelson, 1992; Koriat, 1993; Morris, 1990), and retrieval fluency, that is, the ease with which information is accessed (Kelley & Lindsay, 1993; Koriat, 1993; Mazzoni & Nelson, 1995). Subjective confidence in the correctness of retrieved information has also been claimed to rest on the ease with which information comes to mind (Kelley & Lindsay, 1993; Nelson & Narens, 1990; Zakay & Tuvia, 1998).

These various cues, which I have referred to collectively as ''mnemonic'' cues (Koriat, 1997), have much in common and differ in their quality from those that enter into consideration in forming an information-based judgment. Whereas the latter concern the content of domain-specific knowledge—beliefs and memories—the

former are indifferent to the content of the information. Rather, these cues pertain to global, structural aspects of the processing of information (Koriat and Levy-Sadot, 1999).

The idea that subjective experience can be influenced and shaped by unconscious inferential processes has received a great deal of support in the work of Jacoby, Kelley, and their associates on the fluency heuristic (see Kelley & Jacoby, 1998). In their attributional view of memory, conscious experiences are treated as constructions that are based on inferences. Thus, the subjective experience of familiarity is assumed to result from the unconscious attribution of fluent processing to the past (Jacoby & Dallas, 1981; Jacoby, Kelley, & Dywan, 1989). Because the presentation of a stimulus enhances its fluent processing on a subsequent encounter, when that enhanced fluency is attributed to the past, the result is veridical recognition. However, fluent processing can also be produced by other factors (e.g., subliminal priming and perceptual manipulations), and when this fluency is misattributed to the past, the outcome is memory illusions (see Jacoby & Whitehouse, 1989; Whittlesea, 1993; Whittlesea, Jacoby, & Girard, 1990).

Inherent in this approach are two assumptions. First, the subjective experience of familiarity is not a primitive construct, but is itself an outcome of an inferential process that attributes perceptual fluency to the past. Second, subjective experience is not inherently valid. Even the perceived duration of a stimulus or the perceived truth of a sentence can be swayed by irrelevant, contaminating influences (e.g., Begg et al., 1996; Masson & Caldwell, 1998).

THE ACCESSIBILITY MODEL OF THE FEELING OF KNOWING

Let me now illustrate some of the points mentioned earlier, with reference to the accessibility model of the feeling of knowing that I have proposed (Koriat, 1993, 1994, 1995). This model assumes that people have no knowledge of their own memory over and above what they can retrieve from it. They cannot monitor directly the presence of information that they cannot momentarily access. However, they can still take advantage of what they can retrieve to make inferences about what they cannot access. Thus, there is no separate monitoring module that has privileged access to information that is not already contained in the output of retrieval. Rather, the cues for the FOK reside in the products of the retrieval process itself. Whenever we search our memory for a name or a word, many clues often come to mind, including fragments of the target, semantic attributes, episodic information, and a variety of subtle activations emanating from other sources. Although such clues may not be articulate enough to support an analytic inference, they can still act in concert to produce the subjective feeling that the solicited target is available in memory.

It is important to stress that according to the model, people are assumed to also have no direct access to the correctness of the partial information that comes to mind. Therefore, both correct and incorrect clues contribute to the enhancement of the FOK. What matters is the overall accessibility of information, that is, the number of clues accessed and the ease with which they come to mind. In a TOT state, for example, the accessibility of partial information is what precipitates a sheer feeling of knowing, regardless of the source or correctness of the partial information accessed. This im-

plies that the feeling itself has no greater validity than the partial information that is retrieved. If retrieval goes astray as a result of irrelevant activations, so will monitoring.

Why, then, are FOK judgments relatively accurate in predicting actual memory performance if they merely monitor the overall accessibility of information? According to the accessibility account, the accuracy of metamemory stems from the accuracy of memory itself. Memory is accurate by and large in the output-bound sense (see Koriat & Goldsmith, 1994, 1996): Information that comes to mind during retrieval is more likely to be correct than wrong. This is part of what we mean by memory. Thus, most of the items recalled in a free-recall test are correct, and only a small proportion represents commission errors. Therefore the mere amount of information recalled reflects primarily the amount of correct partial information recalled. Whereas FOK judgments are primarily based on the overall amount of accessed information, it is the accuracy of that information which is critical for the validity of these judgments.

In a similar manner, people can also monitor, to some extent, the accuracy of what they recall, but they seem to infer it from the ease with which information comes to mind. For example, Robinson, Johnson, and Herndon (1997) showed that the latency of answering a question is diagnostic of the correctness of the answer produced in a recall test or chosen in a recognition test, and that confidence judgments are negatively correlated with response latency. In a similar manner, when recall fails, the ease with which partial information is retrieved is a relatively valid cue for the correctness of that information. Indeed, ease of retrieval has been found to contribute to FOK over and above the contribution of the overall amount of information retrieved, and it may also contribute to FOK accuracy (Koriat, 1993).

The accessibility account illustrates several assumptions that are shared by other researchers in the field, and which apply to other noetic feelings as well. First, it assumes that FOK is not based on direct monitoring of a memory trace, but is mediated by an inferential process. Second, the accessibility account does not assume an explicit, information-based deduction (e.g., ''because information comes fluently to mind then I must be able to retrieve the target in the future''). Rather, the process involves the application of global, general-purpose heuristics that operate implicitly and automatically to influence and shape the subjective experience of knowing. The special nature of this process—the fact that it affects the feeling of knowing implicitly and unconsciously—can explain the phenomenology of this feeling as the direct monitoring of the elusive target. Third, the accessibility account suggests that despite the quality of ''self evidence'' that the FOK and other noetic feelings have, these feelings are not inherently valid. Rather, their validity is a function of the diagnostic value of the mnemonic cues on which they rest. In fact, in one study (Koriat, 1995) it was demonstrated that knowing and feeling of knowing can be dissociated to the extent of being negatively correlated: The stronger one is convinced that one knows the answer to a question, the less likely it is that one actually knows it! These and other results testify to the fleeting nature of subjective convictions, and to their unconscious determinants.

Some of the assumptions underlying the accessibility account are also shared by proponents of the cue-familiarity account of the FOK. According to the cue-familiar-

ity hypothesis (e.g., Metcalfe, 1993; Reder, 1987), FOK judgments are based on the overall familiarity of the stimulus that is designed to cue the memory target. Thus, when a person is presented with a question, a rapid FOK is computed, based on the overall familiarity of the question. Indeed, several studies have indicated that advance priming of the cues that prompt memory enhances FOK judgments without affecting memory performance itself (Reder, 1988; Metcalfe et al., 1993).

The cue familiarity account, like the accessibility account, may also be seen to imply that the FOK is driven by a nonanalytic heuristic that operates implicitly (see Reder & Schunn, 1996). In fact, a recent study (Koriat & Levy-Sadot, submitted) suggests that the two heuristics, cue familiarity and accessibility, exert their influence on FOK in a cascaded manner: At a very early stage in memory search, FOK judgments are primarily determined by cue familiarity, whereas at a somewhat later stage, accessibility may also come to play a role, contingent on a relatively high level of cue familiarity.

The idea that noetic feelings are heuristically driven has generated a special interest in recent years in the study of possible dissociations between subjective and objective indexes of knowing, that is, between knowledge and metaknowledge. This interest does not necessarily reflect an attempt to discredit metaknowledge. Rather the study of such dissociations has been assumed to throw light on the processes underlying the subjective monitoring of knowledge. Thus, impressive results documenting systematic discrepancies between metacognitive feelings and actual performance have been obtained not only with regard to FOK judgments following recall failure (e.g., Koriat, 1995; 1998a; Koriat & Lieblich, 1977; Schwartz & Metcalfe, 1992), but also with regard to judgments of learning (e.g., Begg et al., 1989; Benjamin, Bjork, & Schwartz, 1998; Zechmeister & Shaughnessy, 1980) and confidence judgments (e.g., Chandler, 1994; Kelley & Lindsay, 1993; Nelson & Narens, 1990). These reported dissociations are probably the exception rather than the rule, because the heuristics underlying noetic feelings tend to have some degree of validity, by and large. Nevertheless, these reports are important in showing that self-evident intuitions can be wrong!

THE CONTROL FUNCTION OF METACOGNITIVE FEELINGS

As noted earlier, it seems that the interest in metacognition derives, in part, from the conviction that metacognitive judgments are not mere epiphenomena but actually influence one's controlled behavior (Nelson, 1996). This conviction has been conceptualized in terms of a causal link between metacognitive monitoring and metacognitive control (Barnes, Nelson, Dunlosky, Mazzoni, & Narens, 1999): The self-regulation of one's own behavior (control) is based on one's judgments about one's own knowledge (monitoring). We should now discuss the effects of metacognitive feelings on behavior. Although much of the evidence concerning the relationship between monitoring and control rests on correlational data, there is little doubt that subjective feelings serve as a potent basis for behavior. Thus, whatever is the origin of feelings of knowing, and whatever is their validity, people simply follow their lead whenever an alternative basis is either unavailable or its use requires cognitive resources that the person cannot spare (see Strack, 1992).

With regard to the FOK, the main evidence for the effects of FOK judgments on

behavior comes from studies indicating that FOK judgments are positively correlated with the time spent on a question before giving up (e.g., Costermans et al., 1992; Gruneberg, Monk, & Sykes, 1977; Nelson, Dunlosky, White, Steinberg, Townes, & Anderson, 1990; Reder, 1987, 1988). This evidence suggests that FOK drives search continuation (see Barnes et al., 1999).

Some correlational evidence in support of the ''monitoring-affects-control'' hypothesis comes also from JOLs elicited during study. When learners are allowed to control the time spent studying each item in a list, they allocate more time to difficult than to easy items. It has been proposed that this relationship is mediated by a monitoring process (Nelson and Leonesio, 1988): Participants continuously monitor the on-line increase in encoding strength that occurs as more time is spent studying an item and cease study when a desired level of mastery has been reached. Indeed, an inverse relationship has been repeatedly observed between study time and metacognitive judgments (Mazzoni & Cornoldi, 1993; Mazzoni, Cornoldi, & Marchitelli, 1990; Dunlosky & Connor, 1997; Thiede & Dunlosky, 1999).

With regard to subjective confidence, results by Koriat and Goldsmith (1996) illustrate the idea that people trust their feelings of confidence and use them to guide their behavior. We examined the question of how a person on a witness stand, who is sworn to tell the whole truth and nothing but the truth, decides whether to volunteer a piece of information that comes to mind or to withhold it. We asked students to answer general-information questions under both a forced-report and a free-report condition. In the forced-report condition they were forced to answer all questions and indicate their confidence in the correctness of the answer. In the free-report condition they had to choose which answers they were willing to volunteer under a payoff schedule that put a premium on accurate reporting. Indeed the mean within-subject gamma correlation between the confidence associated with an answer, measured in the forced-choice phase of the experiment, and the tendency to report that answer in the free-report phase was .93 for recognition, and .97 for recall! Thus, people rely heavily, almost completely, on their confidence judgments in choosing which items to report. This strategy is useful for enhancing the accuracy of what they report, because people's confidence judgments are generally accurate in discriminating between their correct and wrong candidate answers. What is particularly interesting, however, is that in another experiment people were found to rely very heavily on their confidence judgments even under conditions in which these judgments had little validity in distinguishing between correct and incorrect answers (see also Fischhoff, Slovic, & Lichtenstein, 1977).

In sum, people are blind followers of their metacognitive judgments and intuitions. They take the validity of their feeling of knowing for granted and generally use that feeling as the basis for their behavior. Only under exceptional situations, when people are aware of the conditions that contaminate their subjective experience, do they try either to correct for the presumed contamination or use an alternative basis for their responses (Jacoby & Whitehouse, 1989; Strack, 1992; Whittlesea et al., 1990).

THE CROSSOVER MODE OF OPERATION AND ITS ROLE

I will now sum up my position regarding the relationship between metacognition and consciousness and outline some of its additional implications. Metacognitive

feelings occupy a special status in the distinction between an explicit-controlled mode of operation and an implicit-automatic mode. They are implicit as far as their antecedents are concerned but explicit in both their phenomenological quality and their consequences. Thus, they play the role of a go-between, allowing a transition between an implicit-uncontrolled mode of operation and an explicit and relatively controlled mode. On the one hand, metacognitive feelings are influenced and shaped by nonanalytic heuristics that operate implicitly and automatically to produce a sheer metacognitive feeling. The validity of that feeling derives from the predictive validity of the mnemonic cues utilized, which can sometimes be rather limited or even misleading (Benjamin, Bjork, & Schwartz, 1998; Koriat, 1995). On the other hand, once a metacognitive feeling is formed, it becomes part of the conscious, explicit mode of operation, and it can serve as the basis for controlled action. We have referred to the mode of operation centered around metacognitive feelings as the ''crossover'' mode of operation (Koriat, 1998b; Koriat & Levy-Sadot, 1999). The assumption underlying the crossover view is that the feeling of knowing, which is at the heart of consciousness, is itself determined by unconscious processes.

In my view, the important function of the crossover mode is that of expanding the range of actions over which a person has some degree of control. Metacognitive feelings serve as a conscious summary representation of a variety of unconscious processes. Because these processes involve the application of relatively useful heuristics, their summary in the form of a sheer subjective feeling tends to have some degree of validity. Such unconscious processes generally find their way into thought and action beyond the person's consciousness and control (Bargh, 1997; Reder & Schun, 1996). However, when they act en masse to produce a subjective feeling of knowing, that feeling allows the person the freedom to act on such feelings or not to act on them. The subjective feeling itself has then an informative value for the conscious self (see Schwarz & Clore, 1996), which the implicit processes that give rise to it do not have. It should be stressed that people have little control over which cues to take into account in forming a noetic feeling, and how to weight them, so that self control (and a conscious-controlled mode of operation) begins only after the feeling itself has been crystallized.

Furthermore, the embodiment of unconscious influences in the form of a subjective, conscious feeling allows that feeling to be integrated with information about goals and beliefs in deciding how to bring it to bear on one's judgments and behavior (see Schacter, 1989). For example, during learning, the selection of items for restudy is also affected by the person's goals, not only by the JOLs associated with each item. When the goal is to learn as many items as possible, then the items associated with low JOLs are selected, whereas when the goal is to study only a few items, then it is the items associated with higher JOLs that are selected (Thiede & Dunlosky, 1999). Similarly, the effects of subjective confidence on the selection of items to be reported depend on the level of incentive for accurate reporting (Koriat & Goldsmith, 1996). Furthermore, when a person is aware that subjective experience is contaminated by irrelevant factors, he may choose not to rely on it and to use an alternative basis instead (Jacoby, Kelley, & McErlee, 1999; Kelley & Jacoby, 1996a). These results illustrate how the effects of metacognitive judgments on behavior may be modulated by other goals and considerations.

Possibly, the freedom of behavior afforded by metacognitive feelings is, neverthe-

less, somewhat more limited than that characteristic of information-based metacognitive judgments. The latter operate uniformly within an explicit-conscious mode of operation. They form an integral part of reasoning and decision-making, and perhaps they can be more readily negotiated and modified by various considerations (see Koriat, Lichtenstein, & Fischhoff, 1980).

A final word about the quality of metacognitive feelings. As noted earlier, I was attracted to the study of metacognition as a result of my interest in the creative process. I was particularly interested in the idea that creative people are ''in touch with their unconscious,'' and that they are sometimes guided by intuitive feelings that they cannot explain. The special quality of intuitive feelings appeared to me to reflect how what is yet unknown communicates its existence to conscious thought and feeling. Intuitive feelings do not have an articulate content but emerge as an unexplainable ''hunch'' or ''feel.'' The study of metacognitive feelings suggests that this phenomenological quality indeed derives from the fact that the origin of these feelings lies in a variety of subtle processes that occur below full consciousness, leading to a sheer noetic feeling. A similar quality can be observed, for example, in the report of blindsight patients about visual information (Weiskrantz, 1986), or in that of split-brain patients when reporting about information presented to the right hemisphere (Sergent, 1990; see Koriat, Edry, & de Marcas, submitted; Koriat & Levy-Sadot, 1999). There have been scattered reports about the special quality of the subjective experience of knowing associated with responding to stimuli of which the person is not fully aware (e.g., Marcel, 1983; Weiskrantz, 1986). Still, however, the scarcity of experimental work on the manifestations of implicit influences on subjective experience is conspicuous when contrasted with the extensive work on the manifestations of these influences on performance and behavior (Richardson-Klavehn & Bjork, 1988). A notable exception is the work of Jacoby, Kelley, and their associates on unconscious influences on several aspects of subjective experience, particularly the sense of familiarity (Kelley, 1999; Kelley & Jacoby, 1996a; 1996b; Whittlesea, 1993; Whittlesea & Williams, 1998).

THE FEEDBACK LOOP FROM CONTROLLED ACTION TO MONITORING

The crossover mode of operation assumed to characterize the mediating role of metacognitive feelings implies that conscious experience is neither only a cause nor only an effect, but represents an intermediate step in psychological processes. In addition, however, the assumptions about the specific determinants of subjective experience also touch upon another cardinal metatheoretical issue, that concerning the relationship between consciousness and behavior. In the analysis of the crossover mode, I have emphasized the assumption that metacognitive feelings, and conscious subjective experience for that matter, play a causal role in affecting behavior. This assumption contrasts with the proposal that subjective experience may, in fact, follow from behavior rather than cause behavior (see Kelley & Jacoby, 1998). This latter assumption underlies, for example, the James–Lange view of emotion. According to this and related conceptions, subjective experience is based on an interpretation and attribution of one's own behavior. Thus, we feel fear because we run away rather than vice versa. How does the view of metacognition outlined here fare with this assumption?

In general, the view underlying the relationship between metacognitive judgments and behavior is contained in the postulated relationship between monitoring and control: the assumption that monitoring affects control (see Nelson, 1996; Koriat & Goldsmith, 1996). This view implies a unidirectional, forward link from metacognitive feelings and judgments to behavior. Is there a possibility, however, for a backward connection from behavior to metacognitive monitoring? Some recent work in our lab (Koriat, Ma'ayan, & Levy-Sadot, in preparation) supports this possibility and also illuminates another important aspect of metacognitive processes.

That work concerns the relationship between monitoring and control processes in the course of studying new material. It is well known that under self-paced learning conditions subjects control the allocation of study time in accordance with a variety of goals. For example, they invest more time studying items that are associated with higher than those associated with lower incentives, items that are likely to be tested than those that are less likely to be tested and so on (e.g., Dunlosky & Thiede, 1998).

In parallel, as noted earlier, it has been repeatedly shown that when people study a list of items, they spend more time on the items judged to be more difficult than on those judged to be easier. This relationship has been interpreted in the light of the monitoring-affects-control hypothesis, under the assumption that people attempt to compensate for the relative difficulty of different items by allocating more study time to the more difficult items. Indeed, JOLs associated with an item on one trial have been found to be inversely related to the amount of time spent studying that item on a subsequent trial.

Several observations from our experiments, however, raised doubts about this interpretation suggesting instead that it is actually the study time allocated to an item that affects the JOL associated with that item. The idea is that in self-paced learning, learners typically allocate sufficient time and effort studying a particular item until they feel that they have achieved some degree of mastery of the item, or perhaps, until further study no longer yields a satisfactory return. Their poststudy JOLs, then, are based in part on the amount of effort spent in attempting to master the item, under a ''memorizing effort'' heuristic that an item that is quickly mastered stands a better chance to be recalled than one that takes longer to master. Thus, self-paced study time is the very tool by which participants manage to appreciate the recallability of a specific study item.

Indeed, the results of Koriat et al. indicate that poststudy JOLs on one trial are inversely correlated with study time on that trial. That is, the more time spent studying an item, the *lower* is the confidence that it would be recalled in the future. This inverse correlation, in fact, contributes to JOL's validity because the more time spent studying an item the *less* likely it is to be recalled. Furthermore, both correlations increased with practice studying a list of items, consistent with Koriat's (1997) cue-utilization model of JOLs. According to that model, on the first study trial, JOLs are affected primarily by the intrinsic properties of the study items according to a priori beliefs about their relative difficulty. With practice studying the items, however, JOLs shift from theory-based judgments toward greater reliance on internal mnemonic cues having to do with ease of processing. Mnemonic-based judgments are more valid and their validity seems to increase with practice. Hence the increase with practice in the negative correlations of study time with both JOLs and recall.

These findings seem to have implications for the metatheoretical issue of the cause-and-effect relation between subjective experience and behavior. Strictly speaking, study time is under the control of the person and is used as a means to regulate one's own memory performance. What the results of Koriat and Ma'ayan suggest is that mnemonic-based metacognitive judgments may be based on the feedback that ensues from the controlled allocation of study time. The assumption is that under typical self-paced learning conditions, the study time allocated to an item reflects the ease of encoding of the particular item by the learner. This, in turn, is affected by the intrinsic difficulty of the item, the previous experience of the learner with that item, and so on. Therefore, the amount of study effort spent by the learner becomes a useful cue for the ease of processing the item and also for its future memorability.

Indeed, the common denominator underlying the variety of mnemonic cues mentioned in the literature as possible determinants of metacognitive feelings is that they all somehow reflect one's own performance. As Koriat and Levy-Sadot (1999) proposed, these cues ''lie in structural aspects of the information-processing system. This system, so to speak, engages in a self-reflective inspection of its own operation and uses the ensuing information as a basis for metacognitive judgments'' (p. 496). Thus, it is the feedback from one's own processing and performance that serves as the stuff that gives rise to noetic feelings.

This idea underlies the assumption of the accessibility model, that monitoring and retrieval are not modularly organized, with monitoring preceding retrieval. Rather ''it is by attempting to search for the solicited target that one can judge the likelihood that the target resides in memory and is worth continuing to search for'' (Koriat, 1995, p. 312). A similar idea underlies some of the work on the relationship between confidence judgments and response latency (e.g., Kelley & Lindsay, 1993; Robinson et al., 1997). This work suggests that the amount of effort expended in retrieving an answer from memory serves as a cue for the correctness of the answer retrieved.

These comments imply that not only do metacognitive feelings ensue from implicit heuristics, but also that the cues for these heuristics generally reside in the feedback from one's own processing and performance. It is by attempting to study an item and noticing the amount of effort invested in committing it to memory that we monitor the extent to which we have mastered it. It is by attempting to retrieve an answer and monitoring the accessibility of partial clues that come to mind that we can appreciate whether we ''know'' the answer. It is by retrieving a solicited answer and noting the amount of effort expended in its retrieval that we form our confidence in the correctness of that answer. In all these cases, noetic feelings seem to be based on the person's witnessing the outcome of his or her own controlled processing. Hence we might consider the possibility of a feedback loop from controlled action to subjective monitoring, and perhaps more generally, from behavior to consciousness (see Koriat et al., in preparation).

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REFERENCES

Bargh, J. A. (1997). The automaticity of everyday life. In R. S. Wyer, Jr. (Ed.), *Advances in social cognition* (Vol. 10, pp. 1–61). Mahwah, NJ: Erlbaum.

Bargh, J. A., Chen, M., & Burrows, L. (1996). Automaticity of social behavior: Direct effects of trait construct and stereotype activation on action. *Journal of Personality and Social Psychology,* **71,** 230–244.

Barnes, A. E., Nelson, T. O., Dunlosky, J., Mazzoni, G., & Narens, L. (1999). An integrative system of metamemory components involved in retrieval. In D. Gopher & A. Koriat (Eds.), *Attention and performance XVII—Cognitive regulation of performance: Interaction of theory and application* (pp. 287–313). Cambridge, MA: MIT Press.

Begg, I., Duft, S., Lalonde, P., Melnick, R., & Sanvito, J. (1989). Memory predictions are based on ease of processing. *Journal of Memory and Language,* **28,** 610–632.

Begg, I. M., Robertson, R. K., Gruppuso, V., Anas, A., & Needham, D. R. (1996). The illusory-knowledge effect. *Journal of Memory and Language,* **35,** 410–433.

Benjamin, A. S., & Bjork, R. A. (1996). Retrieval fluency as a metacognitive index. In Reder, L. M. (Ed.), *Implicit memory and metacognition* (pp. 309–338). Hillsdale, NJ: Erlbaum.

Benjamin, A. S., Bjork, R. A., & Schwartz, B. L. (1998). The mismeasure of memory: When retrieval fluency is misleading as a metamnemonic index. *Journal of Experimental Psychology: General,* **127,** 55–68.

Block, N. (1995). On a confusion about a function of consciousness. *Behavioral and Brain Sciences,* **18,** 227–287.

Bornstein, R. F., Leone, D. R., & Galley, D. J. (1987). The generalization of subliminal mere exposure effects: Influence of stimuli perceived without awareness on social behavior. *Journal of Personality and Social Psychology,* **53,** 1070–1079.

Brown, R., & McNeill, D. (1966). The ''tip of the tongue'' phenomenon. *Journal of Verbal Learning and Verbal Behavior,* **5,** 325–337.

Chandler, C. C. (1994). Studying related pictures can reduce accuracy, but increase confidence, in a modified recognition test. *Memory and Cognition,* **22,** 273–280.

Claparede, E. (1951). Recognition and 'me-ness'. In D. Rapaport (Ed.), *Organization and pathology of thought* (pp. 58–75). New York: Columbia University Press. [Reprinted from Archives de Psychologie, 1911, 11, 79–90].

Cohen, R. L., Sandler, S. P., & Keglevich, L. (1991). The failure of memory monitoring in a free recall task. *Canadian Journal of Psychology,* **45,** 523–538.

Costermans, J., Lories, G., & Ansay, C. (1992). Confidence level and feeling of knowing in question answering: The weight of inferential processes. *Journal of Experimental Psychology: Learning, Memory, and Cognition,* **18,** 142–150.

Disjksterhuis, A., Knippenberg, A., Spears, R., Postmes, T., Stapel, D. A., Kooman, W., & Scheepers, D. (1998). Seeing one thing and doing another: Contrast effects in automatic behavior. *Journal of Personality and Social Psychology,* **75,** 862–871.

Dorfman, J., Shames, V. A., & Kihlstrom, J. F. (1996). Intuition, incubation, and insight: Implicit cognition in problem solving. In G. Underwood (Ed.), *Implicit cognition* (pp. 257–296). Oxford, England: Oxford University Press.

Dunlosky, J., & Connor, L. T. (1997). Age differences in the allocation of study time account for age differences in memory performance. *Memory and Cognition,* **25,** 691–700.

Dunlosky, J., & Nelson, T. O. (1992). Importance of the kind of cue for judgments of learning (JOLs) and the delayed-JOL effect. *Memory and Cognition,* **20,** 373–380.

Dunlosky, J., & Thiede, K. W. (1998). What makes people study more? An evaluation of factors that affect self-paced study. *Acta Psychologica,* **98,** 37–56.

Epstein, S., & Pacini, R. (1999). Some basic issues regarding dual-process theories from the perspective

of cognitive-experiential self-theory. In S. Chaiken & Y. Trope (Eds.), *Dual process theories in social psychology* (pp. 462–482). New York: Guilford.

Fischhoff, B., Slovic, P., & Lichtenstein, S. (1977). Knowing with certainty: The appropriateness of extreme confidence. *Journal of Experimental Psychology: Human Perception and Performance,* **3,** 552–564.

Gazzaniga, M. S. (1985). *The social brain.* New York: Basic Books.

Ghiselin, B. (1952). *The creative process.* Berkeley/Los Angeles: University of California Press.

Gruneberg, M. M., Monks, J., & Sykes, R. N. (1977). Some methodological problems with feelings of knowing studies. *Acta Psychologica,* **41,** 365–371.

Hart, J. T. (1965). Memory and the feeling-of-knowing experience. *Journal of Educational Psychology,* **56,** 208–216.

Hart, J. T. (1967). Memory and the memory-monitoring process. *Journal of Verbal Learning and Verbal Behavior,* **6,** 685–691.

Hilgard, E. R. (1965). *Hypnotic susceptibility.* New York: Harcourt, Brace & World.

Jacoby, L. L. (1999). Ironic effects of repetition: Measuring age-related differences in memory. *Journal of Experimental Psychology: Learning, Memory, and Cognition,* **25,** 3–22.

Jacoby, L. L., & Brooks, L. R. (1984). Nonanalytic cognition: Memory, perception and concept learning. In G. H. Bower (Ed.), *The psychology of learning and motivation: Advances in research and theory* (Vol. 18, pp. 1–47). San Diego: Academic Press.

Jacoby, L. L., & Dallas, M. (1981). On the relationship between autobiographical memory and perceptual learning. *Journal of Experimental Psychology: General,* **110,** 306–340.

Jacoby, L. L., Jennings, J. M., & Hay, J. F. (1996). Dissociating automatic and consciously-controlled processes: Implications for diagnosis and rehabilitation of memory deficits. In D. J. Herrmann, M. K. Johnson, C. L. McEvoy, C. Hertzog, & P. Hertel (Eds.), *Basic and applied memory research: Theory in context* (pp. 161–193). Mahwah, NJ: Erlbaum.

Jacoby, L. L., Kelley, C. M., & Dywan, J. (1989). Memory attributions. In H. L. Roediger, III & F. I. M. Craik (Eds.), *Varieties of memory and consciousness: Essays in honour of Endel Tulving* (pp. 391–422). Hillsdale, NJ: Erlbaum.

Jacoby, L. L., Kelley, C. M., & McElree, B. D. (1999). The role of cognitive control: Early selection vs late correction. In S. Chaiken & Y. Trope (Eds.), *Dual process theories in social psychology* (pp. 383–400). New York: Guilford Press.

Jacoby, L. L., Lindsay, D. S., & Toth, J. P. (1992). Unconscious influences revealed: Attention, awareness, and control. *American Psychologist,* **47,** 802–809.

Jacoby, L. L., Ste-Marie, D., & Toth, J. F. (1993). Redefining automaticity: Unconscious influences, awareness, and control. In A. D. Baddeley & L. Weiskrantz (Eds.), *Attention, selection, awareness, and control. A tribute to Donald Broadbent* (pp. 261–282). Oxford, England: Clarendon Press.

Jacoby, L. L., & Whitehouse, K. (1989). An illusion of memory: False recognition influenced by unconscious perception. *Journal of Experimental Psychology: General,* **118,** 126–135.

James, W. (1893). *The principles of psychology,* (Vol. 1). New York: Holt.

Kelley, C. M. (1999). Subjective experience as a basis of ''objective'' judgments: Effects of past experience on judgments of difficulty. In D. Gopher & A. Koriat (Eds.), *Attention and performance XVII—Cognitive regulation of performance: Interaction of theory and application* (pp. 515–536). Cambridge, MA: MIT Press.

Kelley, C. M., & Jacoby, L. L. (1996a). Adult egocentrism: Subjective experience versus analytic bases for judgment. *Journal of Memory and Language,* **35,** 157–175.

Kelley, C. M., & Jacoby, L. L. (1996b). Memory attributions: Remembering, knowing, and feeling of knowing. In Reder, L. M. (Ed.), *Implicit memory and metacognition* (pp. 287–308). Hillsdale, NJ: Erlbaum.

Kelley, C. M., & Jacoby, L. L. (1998). Subjective reports and process dissociation: Fluency, knowing, and feeling. *Acta Psychologica,* **98,** 127–140.

Kelley, C. M., & Lindsay, D. S. (1993). Remembering mistaken for knowing: Ease of retrieval as a basis for confidence in answers to general knowledge questions. *Journal of Memory and Language, 32,* 1–24.

Koriat, A. (1970). *Creativity and the structure of memory.* Unpublished doctoral dissertation, University of California, Berkeley.

Koriat, A. (1975). Phonetic symbolism and the feeling of knowing. *Memory and Cognition, 3,* 545–548.

Koriat, A. (1993). How do we know that we know? The accessibility model of the feeling of knowing. *Psychological Review, 100,* 609–639.

Koriat, A. (1994). Memory's knowledge of its own knowledge: The accessibility account of the feeling of knowing. In J. Metcalfe & P. Shimamura (Eds.), *Metacognition: Knowing about knowing* (pp. 115–135). Cambridge, MA: MIT Press.

Koriat, A. (1995). Dissociating knowing and the feeling of knowing: Further evidence for the accessibility model. *Journal of Experimental Psychology: General, 124,* 311–333.

Koriat, A. (1997). Monitoring one's own knowledge during study: A cue-utilization approach to judgments of learning. *Journal of Experimental Psychology: General, 126,* 349–370.

Koriat, A. (1998a). Illusions of knowing: The link between knowledge and metaknowledge. In V. Y. Yzerbyt, G. Lories, & B. Dardenne (Eds.), *Metacognition: Cognitive and social dimensions* (pp. 16–34). London: Sage.

Koriat, A. (1998b). Metamemory: The feeling of knowing and its vagaries. In M. Sabourin, F. Craik, & M. Robert (Eds.), *Advances in psychological science* (Vol 2, pp. 461–469). Hove, England: Psychology Press.

Koriat, A., Edry, E., & de Marcas, G. (submitted). *What do we know about what we cannot remember? Accessing the semantic attributes of words that cannot be recalled.*

Koriat, A., & Goldsmith, M. (1994). Memory in naturalistic and laboratory contexts: Distinguishing the accuracy-oriented and quantity-oriented approaches to memory assessment. *Journal of Experimental Psychology: General, 123,* 297–315.

Koriat, A., & Goldsmith, M. (1996). Monitoring and control processes in the strategic regulation of memory accuracy. *Psychological Review, 103,* 490–517.

Koriat, A., & Goldsmith, M. (1998). The role of metacognitive processes in the regulation of memory performance. In G. Mazzoni & T. O. Nelson (Eds.), *Metacognition and cognitive neuropsychology: Monitoring and control processes* (pp. 97–118). Mahwah, NJ: Erlbaum.

Koriat, A., & Levy-Sadot, R. (1999). Processes underlying metacognitive judgments: Information-based and experience-based monitoring of one's own knowledge. In S. Chaiken & Y. Trope (Eds.), *Dual process theories in social psychology* (pp. 483–502). New York: Guilford.

Koriat, A., & Levy-Sadot, R. (submitted). *The combined contributions of the cue familiarity and the accessibility heuristics to the feeling of knowing.*

Koriat, A., Lichtenstein, S., & Fischhoff, B. (1980). Reasons for confidence. *Journal of Experimental Psychology: Human Learning and Memory, 6,* 107–118.

Koriat, A. & Lieblich, I. (1974). What does a person in a ''TOT'' state know that a person in a ''don't know'' state doesn't know? *Memory & Cognition, 2,* 647–655.

Koriat, A., & Lieblich, I. (1977). A study of memory pointers. *Acta Psychologica, 41,* 151–164.

Koriat, A., Ma'ayan, H., & Levy-Sadot, R. (in preparation). *The intricacies of monitoring and control processes: The dual function of study time in self-paced learning.*

Kris, E. (1952). *Psychoanalytic explorations in art.* New York, NY: International universities in press.

Marcel, A. J. (1983). Conscious and unconscious perception: Experiments on visual masking and word recognition. *Cognitive Psychology, 15,* 197–237.

Marcel, A. J. (1986). Consciousness and processing: Choosing and testing a null hypothesis. *Behavioral and Brain Sciences, 9,* 40–41.

Masson, M. E. J., & Caldwell, J. I. (1998). Conceptually driven encoding episodes create perceptual misattributions. *Acta Psychologica,* **98,** 183–210.

Mazzoni, G., & Cornoldi, C. (1993). Strategies in study time allocation: Why is study time sometimes not effective? *Journal of Experimental Psychology: General,* **122,** 47–60.

Mazzoni, G., Cornoldi, C., & Marchitelli, G. (1990). Do memorability ratings affect study-time allocation? *Memory & Cognition,* **18,** 196–204.

Mazzoni, G., & Nelson, T. O. (1995). Judgments of learning are affected by the kind of encoding in ways that cannot be attributed to the level of recall. *Journal of Experimental Psychology: Learning, Memory and Cognition,* **21,** 1263–1274.

Metcalfe, J. (1993). Novelty monitoring, metacognition and control in a composite holographic associative recall model: Implications for Korsakoff amnesia. *Psychological Review,* **100,** 3–22.

Metcalfe, J., Schwartz, B. L., & Joaquim, S. G. (1993). The cue-familiarity heuristic in metacognition. *Journal of Experimental Psychology: Learning, Memory and Cognition,* **19,** 851–861.

Monsay, E. H. (1997). Intuition in the development of scientific theory and practice. In R. Davis-Floyd & P. S. Arvidson (Eds.), *Intuition: The inside story* (pp. 103–120). New York: Routledge.

Morris, C. C. (1990). Retrieval processes underlying confidence in comprehension judgments. *Journal of Experimental Psychology: Learning, Memory, and Cognition,* **16,** 223–232.

Neisser, U. (1963). The multiplicity of thought. *British Journal of Psychology,* **54,** 1–14.

Nelson, T. O. (1996). Consciousness and metacognition. *American Psychologist,* **51,** 102–116.

Nelson, T. O., Dunlosky, J., White, D. M., Steinberg, J., Townes, B. D., & Anderson, D. (1990). Cognition and metacognition at extreme altitude on Mount Everest. *Journal of Experimental Psychology: General,* **119,** 367–374.

Nelson, T. O., Gerler, D., & Narens, L. (1984). Accuracy of feeling-of-knowing judgments for predicting perceptual identification and relearning. *Journal of Experimental Psychology: General,* **113,** 282–300.

Nelson, T. O., & Leonesio, R. J. (1988). Allocation of self-paced study time and the ''Labor-in-vain effect''. *Journal of Experimental Psychology: Learning, Memory, and Cognition,* **14,** 676–686.

Nelson, T. O., & Narens, L. (1990). Metamemory: A theoretical framework and new findings. In G. H. Bower (Ed.), *The Psychology of learning and motivation: Advances in research and theory* (Vol. 26, pp. 125–173). San Diego: Academic Press.

Policastro, E. (1995). Creative intuition: An integrative review. *Creative Research Journal,* **8,** 99–113.

Posner, M. I., & Snyder, C.R.R. (1975). Attention and cognitive control. In R. Solso (Ed.), *Information processing and cognition: The Loyola symposium.* Hillsdale, NJ: Erlbaum.

Reason, J. (1983). Lapses of attention in everyday life. In W. Parasuraman, D. Davis, & J. Beatty (Eds.), *Aspects of consciousness* (Vol. 1, pp. 515–549). London: Academic Press.

Reder, L. M. (1987). Strategy selection in question answering. *Cognitive Psychology,* **19,** 90–138.

Reder, L. M. (1988). Strategic control of retrieval strategies. *The Psychology of Learning and Motivation,* **22,** 227–259.

Reder, L. M., & Ritter, F. E. (1992). What determines initial feeling of knowing? Familiarity with question terms, not with the answer. *Journal of Experimental Psychology: Learning, Memory, and Cognition,* **18,** 435–451.

Reder, L. M., & Schunn, C. D. (1996). Metacognition does not imply awareness: Strategy choice is governed by implicit learning and memory. In L. M. Reder (Ed.), *Implicit memory and metacognition* (pp. 45–78). Hillsdale, NJ: Erlbaum.

Richardson-Klavehn, A., & Bjork, R. A. (1988). Measures of memory. *Annual Review of Psychology,* **39,** 475–543.

Robinson, M. D., Johnson, J. T., & Herndon, F. (1997). Reaction time and assessment of cognitive effort as predictors of eyewitness memory accuracy and confidence. *Journal of Applied Psychology,* **82,** 416–425.

Schacter, D. L. (1989). On the relations between memory and consciousness: Dissociable interactions

and conscious experience. In H. L. Roediger & F. I. M. Craik (Eds.), *Varieties of memory and consciousness: Essays in honour of Endel Tulving* (pp. 355–389). Hillsdale, NJ: Erlbaum.

Schwartz, B. L. (1994). Sources of information in metamemory: Judgments of learning and feeling of knowing. *Psychonomic Bulletin and Review, 1,* 357–375.

Schwarz, N., & Clore, G. L. (1996). Feelings and phenomenal experiences. In E. T. Higgins & A. W. Kruglanski (Eds.), *Social psychology: Handbook of basic principles* (pp. 433–465). New York: Guilford.

Schwartz, B. L., & Metcalfe, J. (1992). Cue familiarity but not target retrievability enhances feeling-of-knowing judgments. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 18,* 1074–1083.

Schwartz, B. L., Travis, D. M., Castro, A. M., & Smith, S. M. (in press). The phenomenology of real and illusory tip-of-the-tongue states. *Memory and Cognition.*

Sergent, J. (1990). Furtive incursions into bicameral minds: Integrative and coordinating role of subcortical structures. *Brain, 113,* 537–568.

Smith, S. M. (1994). Frustrated feelings of imminent recall: On the tip of the tongue. In J. Metcalfe & A. P. Shimamura (Eds.), *Metacognition: Knowing about knowing* (pp. 27–45). Cambridge, MA: Bradford.

Strack, F. (1992). The different routes to social judgments: Experimental versus informational strategies. In L. L. Martin & A. Tesser (Eds.), *The construction of social judgments* (pp. 249–275). Hillsdale, NJ: Lawrence Erlbaum Associates.

Thiede, K. W., & Dunlosky, J. (1999). Toward a general model of self-regulated study: an analysis of selection of items for study and self-paced study time. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 25,* 1024–1037.

Van Zandt, T. (submitted). *ROC curves and confidence judgments in memory.*

Weiskrantz, L. (1986). *Blindsight: A case study and implications.* Oxford: Clarendon Press.

Weiskrantz, L. (1997). *Consciousness lost and found.* Oxford: Oxford University Press.

Westcott, M. R. (1968). *Toward a contemporary psychology of intuition.* New York: Holt, Rinehart, and Winston.

Whittlesea, B. W. A. (1993). Illusions of familiarity. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 19,* 1235–1253.

Whittlesea, B. W., Jacoby, L. L., & Girard, K. (1990). Illusions of immediate memory: Evidence of an attributional basis for feelings of familiarity and perceptual quality. *Journal of Memory and Language, 29,* 716–732.

Whittlesea, B. W., & Williams, L. D. (1998). Why do strangers feel familiar, but friends don't? A discrepancy-attribution account of feelings of familiarity. *Acta Psychologica, 98,* 141–165.

Yaniv, I., & Meyer, D. E. (1987). Activation and metacognition of inaccessible stored information: Potential bases for incubation effects in problem solving. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 13,* 187–205.

Zakay, D., & Tuvia, R. (1998). Choice latency times as determinants of post-decisional confidence. *Acta Psychologica, 98,* 103–115.

Zechmeister, E. B., & Shaughnessy, J. J. (1980). When you know that you know and when you think that you know but you don't. *Bulletin of the Psychonomic Society, 15,* 41–44.