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## Self and Identity as Memory

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Modern thought literally begins with the self. René Descartes, beginning his *Meditations* of 1641 from a stance of methodical doubt, quickly discovered that there was one thing he couldn't doubt: that he himself existed. This conclusion, in turn, was based on his experience of himself as a conscious being—hence, “*Cogito, ergo sum*” and “*Sum res cogitans*.” More recently, the editors of the *New York Times Magazine*, in one of six special issues celebrating the year 2000, dubbed the previous 1,000 years “The Me Millennium”:

A thousand years ago, when the earth was reassuringly flat and the universe revolved around it, the ordinary person had no last name, let alone any claim to individualism. The self was subordinated to church and king. Then came the Renaissance explosion of scientific discovery and humanist insight and, as both cause and effect, the rise of individual self-consciousness. All at once, it seemed, Man had replaced God at the center of earthly life. And perhaps more than any great war or invention or feat of navigation, this upheaval marked the beginning of our modern era. There are now 20 times as many people in the world as there were in the

year 1000. Most have last names, and many of us have a personal identity or a reasonable expectation of acquiring one. (“The Me Millennium,” 1999, p. 20)

This sense of self is critical to our status as persons. In fact, philosophers often use the terms “self” and “person” interchangeably: A capacity for self-awareness is necessary for full personhood. One has a sense of self if one is able to entertain first-person thoughts and if one possesses first-person knowledge. The eye cannot see itself, but the self somehow knows itself: The simultaneous status of self as subject and object of awareness is one of the enduring problems of philosophy. For human beings, at least, and perhaps for some other animals as well, cognition is not simply directed at the external environment. Our minds also turn inward, permitting us to acquire, store, retrieve, and use knowledge about ourselves—which raises a further issue, stated eloquently by Gordon Allport:

This puzzling problem arises when we ask, “Who is the I that knows the bodily me, who has an image of myself and a sense of identity over time, who knows that I have appropriate

strivings?" I know all these things, and what is more, I know that I know them. But who is it who has this perspectival grasp? . . . It is much easier to *feel* the self than to *define* the self. (1961, p. 128)

Although the self is a thorny metaphysical problem for philosophers, raising questions about mind and body, the homunculus, and whether teleporters can replicate subjective identity, as well as material existence (Gallagher, 2000; Gallagher & Shear, 1999), cognitive psychology offers a simple answer to Allport's question: The self is a mental representation of oneself, including all that one knows about oneself (Kihlstrom & Cantor, 1984; Kihlstrom et al., 1988). The *I* who knows the *me* is the same *I* who knows everything else, and the mental representation of this knowledge is no different, except perhaps in intimacy and richness, than is the mental representation of anything else I know. The solution is perhaps too simple, but it was the solution offered by William James (1890/1980), and it is a start.

#### What Kind of Knowledge Is Self-Knowledge?

In general, psychology and cognitive science distinguish between two forms of knowledge representation (J. R. Anderson, 1995; Paivio, 1971; see also Paivio, 1986): *perception-based* knowledge representations take the form of *mental images* representing in analog form the physical appearance of objects and the configuration of objects and features in space, whereas *meaning-based* knowledge representations store propositional knowledge about the semantic relations among objects, features, and events. A person's self-knowledge can be construed in similar terms. In fact, the technical distinction between perception-based and meaning-based self-knowledge is anticipated in ordinary language when we refer to the *self-concept* and the *self-image*. Taking the folk-psychological notions of self-concept and self-image literally has yielded a substantial body of research and theory on the self (e.g., Kihlstrom & Klein, 1994).

#### The Self as Concept

A concept is a mental representation of a category—a set of objects that share some

features in common, somehow distinct from objects in other categories. In the classical Aristotelian view, concepts are proper sets, defined by a list of features that are both singly necessary and jointly sufficient to identify an object as an instance of a category. Every instance of a concept has every defining feature, and any object that possesses the entire set of defining features is an instance of the concept.

From the classical point of view, then, the self-concept is identified by a set of features that are singly necessary and jointly sufficient to identify oneself as different from all other persons. This list of features could be utterly trivial: One of the authors (J. K.) of this chapter is the only person who ever lived who was born on October 24, 1948, in Norwich, New York, to Harriet Foster and Waldo Helge Kihlstrom. If he had an identical twin brother, that sibling would (at least) have been born at a slightly different time. In more substantive terms, however, Allport's ideographic view of personality supposes that there is a unique set of psychological features—he called them *central traits*—that distinguish every individual person from every other individual person (Allport, 1937). Assuming that we ourselves are aware of our traits, in Allport's view these psychological characteristics then become the defining features of the self-concept.

Along the same lines, Hazel Markus and her colleagues have suggested that the *self-schema* incorporates those features that are important to one's self-concept, not merely those that are descriptive of the self (e.g., Markus, 1977). In her research, subjects are classified as "self-schematic" for a particular attribute if they rate that feature high in both self-descriptiveness and importance to the self-concept. Although one can debate the role that self-descriptiveness and self-importance should play in identifying the self-schema (e.g., Burke, Kraut, & Dworkin, 1986; Nystedt, Smari, & Boman, 1991), one can well imagine a self-concept defined by that unique set of features for which the individual is "schematic."

In any case, the classical proper-set view of the self as a set with only a single instance aptly recognizes our experience of ourselves as unique—that we are not the same as anyone else. Research by McGuire and his colleagues has found that people who are in

the minority with respect to age, birthplace, gender, ethnicity, and other physical, social, and demographic features are more likely to mention them when asked to describe themselves (e.g., McGuire & McGuire, 1988). Apparently, people notice aspects of themselves, and incorporate these attributes into their self-concepts, to the extent that these features render them distinctive.

On the other hand, philosophers and cognitive scientists have identified a number of problems with the classical view of concepts as proper sets, problems that have led to the progressive elaboration of a number of revisionist views of conceptual structure (e.g., Smith & Medin, 1981). Chief among these alternatives is the *probabilistic* view of concepts as *fuzzy* sets represented by summary prototypes whose characteristic features are only imperfectly correlated with category membership. Instead of sharing some set of singly necessary and jointly sufficient defining features, instances of a concept are related to each other by a principle of family resemblance.

The view of the self as a cognitive prototype quickly won wide acceptance within social cognition (Cantor & Mischel, 1979; Hampson, 1982), but it has never been clear what the self was a prototype of. On the one hand, it might be that there is a monolithic, unitary self-concept whose characteristic features permit us to distinguish ourselves probabilistically from other people. On the other hand, the notion of family resemblance suggests that there might well be more than one self represented in the individual's cognitive system. That is to say, the self-as-prototype might be abstracted from multiple, context-specific mental representations of self—self at work, self at home, self with friends, and the like. Clinical cases of multiple personality disorder (also known as dissociative identity disorder) bring the multiplicity of self into bold relief (Kihlstrom, 2001). But we do not have to be mentally ill to harbor in our minds a multiplicity of selves. Despite our tendency to describe each other in terms of stable traits, human social behavior is widely variable across time and place, and our self-knowledge must represent this kind of variability.<sup>1</sup>

Just as various problems with the classical view of concepts led to the development of an alternative prototype view, so problems

with the prototype view have led to further revisionist views (e.g., Medin, 1989). For example, an exemplar-based view represents concepts as collections of instances instead of as summaries of the features of category members. In addition, a *theory-based* view holds that concept exemplars are related to each other by some theory of the domain in question, rather than by any kind of similarity. In principle, both these views can be applied to the self-concept, but as yet there has been no sustained effort to do so (Kihlstrom & Klein, 1994).<sup>2</sup>

### The Self as Image

A large literature on mental images in *nonsocial* perception provides us with a starting point for perception-based mental representations of the self (e.g., Kosslyn, 1980, 1983, 1988; Shepard & Cooper, 1983). For example, perception-based representations in the nonsocial domain take at least three forms. First, and most familiar, are mental images per se, seen in “the mind’s eye” and heard in “the mind’s ear,” which preserve sensory detail—what our faces and bodies look like, what our voices sound like, the feel of our skin and body hair (e.g., Farah, 1988). Then there are *spatial images*, which preserve information about the spatial relations among features and objects—up–down, left–right, front–back—in the absence of sensory details (e.g., Farah, Hammond, Levine, & Calvanio, 1988). Finally, there are representations of serial order, which preserve information about the temporal relations of events, such as first–last, before–after, early–late, and remote–recent (Mandler & Dean, 1969), and other rank-ordered features such as richer–poorer and taller–shorter (Trabasso & Riley, 1975)—again, independent of sensory modality. Knowledge of sensory details, spatial relations, and serial order may be verbally expressed, but because they are independent of meaning, they are properly classified as perception-based rather than meaning-based in nature.

Compared with meaning-based representations, perception-based representations of the self have not been much studied in social cognition (Kihlstrom & Klein, 1994). The *anlage* of the self-image may be found in the body schema postulated by Sir Henry Head

to account for the ability of animals, including humans, to maintain stability of posture and adjust to their physical surroundings (Head, 1926), and in the *body image* defined by Schilder as “the picture of our own body which we form in our mind, that is to say, the way in which the body appears to ourselves” (Schilder, 1938, p. 11; see also Fisher & Cleveland, 1958). A number of clinical syndromes appear to involve pathologies of the body image, including autotopagnosia, phantom limb, schizophrenia, eating disorders such as anorexia and bulimia, and, of course, body dysmorphic disorder (Kihlstrom & Klein, 1994).

Procedures for the assessment of the body image and other perception-based representations of the self have not been well developed. One of the most popular instruments, the Body-Image Aberration Scale, is a verbal self-report questionnaire, not a perceptual task (Chapman, Chapman, & Raulin, 1978). Nonverbal, analog representations are more closely tapped by the Body-Image Assessment (Williamson, Davis, Goreczny, & Blouin, 1989) and similar tasks (Fallon & Rozin, 1985; Rozin & Fallon, 1988), in which subjects rate themselves on a set of line drawings of swimsuit-clad males and females. Distorting mirrors (Orbach, Traub, & Olson, 1966; Traub, Olson, Orbach, & Cardone, 1967; Traub & Orbach, 1964) and photographs (Yarmey & Johnson, 1982) have also been employed in the assessment of aspects of the self-image, although none of these procedures has been particularly well developed.

Despite the general lack of standardized assessment protocols, the literature contains a scattering of studies on the self-image as a perception-based knowledge representation. For example, although the failure to recognize one's own voice has been taken as evidence of self-deception (Gur & Sackeim, 1979; Sackeim & Gur, 1985; but see also Douglas & Gibbins, 1983; Gibbins & Douglas, 1985), infants as young as 5 months old are known to recognize their own voices, as well as their own faces (Legerstee, Anderson, & Schaffer, 1998). Moreover, people prefer left-right reversals of photos of themselves (i.e., as they would see themselves in a mirror), and they prefer unreversed photos of others (i.e., as they would view them head-on). Evidence such as this

clearly indicates that the self-image preserves both spatial relations and visual detail (Mita, Dermer, & Knight, 1977). Thus the little work that has been done in this area does seem to indicate that, in addition to verbal knowledge about our characteristic features, we also possess analog representations of what we look and sound like. However, research on the self-image (or, for that matter, on perception-based representations of other people) has yet to draw on experimental paradigms developed in the study of imagery in the nonsocial domain.

### The Self as Memory

Whether perception-based or meaning-based, self-knowledge is represented in the individual's memory. Accordingly, in addition to viewing the self as a concept or as an image, it is useful to think of the self as one's memory for oneself (Klein, 2001). This is not an entirely new idea. In his *Essay Concerning Human Understanding* (1690, Book II, Chapter 27), John Locke famously identified the self with memory. Whereas Descartes had found the self in the immediate conscious experience of thinking (“I think, therefore I am”), Locke found identity in the extension of consciousness backward in time. In Locke's view, a person's identity extends to whatever of his or her past he or she can remember. Consequently, past experiences, thoughts, or actions that the person does not remember are not part of his identity. For Locke, identity and selfhood have nothing to do with continuity of the body or even continuity of mind. Selfhood consists entirely in continuity of memory. A person who remembers nothing of his or her past literally has no identity.

Because Locke identified self with identity, such a person will not have any sense of self, either. This conclusion may at first strike the reader as unreasonable. After all, even with no memory, there would still be the Cartesian self of immediate experience. However, it must be remembered that Locke was an empiricist, opposed in principle to Descartes's nativism. Like all knowledge, self-knowledge must be derived a posteriori from experiences of sensation and reflection. Without the capacity to record such experiences in memory, there can be no

self—just an organism responding reflexively to environmental stimuli. On the other hand, the notion of self as memory makes no sense unless there is a person, namely oneself, to be represented in the memory. Perhaps the notion of *I*, *me*, and *mine* is derived empirically, but perhaps this primitive sense of the self, as distinct from other objects and people in the environment, is given a priori.

Despite these sorts of difficulties, Locke's identification of the self with memory proved very popular over the years. David Hume, in the *Treatise of Human Nature* (1739–1740, Book I, Part 4, Section 6), generally affirmed the connection between identity and memory, adding that the role of memory is to permit us to comprehend the causal relations among events. This ability, however, enables us to extend our identity beyond those acts and experiences that we can personally remember, so that our self-narrative also includes events that we know *must* have happened, given what we *do* remember—whether they actually happened or not. Thus, whereas Locke's view of the self-as-memory is based on our ability to *reproduce* our experiences from memory, Hume's is based also on our ability to *reconstruct* our experiences in memory. Freud, for his part, also adopted the Lockean view, with the proviso that the important memories are *unconscious*, as opposed to consciously accessible (Freud, 1916–1917/1963).

### Identity and Forms of Memory

The Lockean view of the self is almost entirely empirical, because in his view people's identities are built up a posteriori from memories of their own sensory experiences, as well as their reflections on these experiences. But experiences do not exhaust the knowledge that is represented in memory (J. R. Anderson, 1976, 1983). For example, Endel Tulving distinguished between *episodic* and *semantic* memory (Tulving, 1983). *Episodic memory* is autobiographical memory for the events and experiences of one's past. Every episodic memory, by definition, entails a mental representation of the self as the agent or patient of some action or as the stimulus or experiencer of some state (Kihlstrom, 1997). Examples of

episodic memories are *I gave a present to Lucy on her birthday* and *Lucy made me very happy yesterday*. Because our sense of self is very much tied up with the "story" of what we have experienced and what we have done, the relevance of episodic memory to Locke's and Hume's concepts of the self is obvious.

By contrast, *semantic memory* is more generic, context-free knowledge about the world. In contrast to episodic knowledge, every bit of which necessarily entails some reference to the self, much semantic memory makes no reference to the self at all. Such items of knowledge as *Apples are red, green, or yellow fruits* or *Columbus discovered America in 1492* do not involve the self in any way. However, some items of semantic knowledge do relate to the self. The date and place of one's birth, the names of one's parents and siblings, ethnic identity and religious affiliation, and one's own personality and sociodemographic attributes do not refer to any discrete episodes in one's life: I don't *remember* being born, but I do *know* when and where it happened. Examples of semantic self-knowledge are *I am a member of the middle class*, *I am more than 6 feet tall*, and *I am a neurotic extravert*. Self-relevant semantic knowledge is also part of one's identity: It is tantamount to the self-concept and self-image, translated into the vocabulary of memory theory.

Episodic and semantic memories, in turn, are forms of *declarative knowledge* (Winograd, 1972, 1975). They constitute our fund of factual knowledge about the world; factual knowledge of this sort can be represented as sentence-like propositions. But declarative knowledge is not the only knowledge stored in the mind. There is also *procedural knowledge*: our cognitive repertoire of rules and skills, by which we manipulate and transform declarative knowledge. Procedural knowledge can be represented as a collection of *productions* specifying the actions (motor or mental) that will achieve some goal under specified conditions (J. R. Anderson, 1976, 1983). Examples of procedural knowledge, somewhat simplified for purposes of exposition, are *If the goal is to shift gears, then press down on the clutch* and *If the goal is to convert Fahrenheit to Celsius, then subtract 32 and multiply the result by 5/9*.

Note that there is no reference to the self in these productions. Moreover, in contrast to declarative knowledge, which is available (if not always accessible) to conscious awareness, procedural knowledge is, by definition, unavailable to direct conscious introspection under any circumstances (Kihlstrom, 1987). For this reason, it seems unlikely that procedural knowledge per se is included in the mental representation of the self. However, we can learn about our procedural knowledge indirectly, through informal and formal analyses of our own performances on cognitive and motor tasks. As we acquire skills and teach them to others, we become aware of the skills we have—which is not the same thing as being aware of the production systems that underlie skilled activity. Put another way, we acquire a form of *meta-knowledge* about our repertoire of cognitive and mental skills (Flavell, 1979, 1999; see also Mazzoni & Nelson, 1998; Metcalfe & Shimamura, 1994; Nelson, 1992; Reder, 1996)—declarative knowledge that is available to consciousness (Nelson, 1996) and that can therefore become part of the self-concept. All meta-knowledge is potentially relevant to the self, because all meta-knowledge concerns people's knowledge of they themselves know, including what they themselves know what to do. Meta-cognitions such as *I know how to drive a standard-shift car* and *I know how to tie a necktie in a Windsor knot* underlie self-efficacy expectations (Bandura, 1977, 2000; see also Mischel, 1973; Mischel, Shoda, & Rodriguez, 1989), part of a broader repertoire of social intelligence that makes up personality from a cognitive point of view (Cantor & Kihlstrom, 1987). But meta-knowledge is declarative, not procedural, in nature. Accordingly, the following discussion focuses entirely on declarative knowledge about the self and, particularly, on the relations between episodic and semantic knowledge about the self.<sup>3</sup>

#### Associative Network Models of the Self as Memory

Precisely how are episodic and semantic self-knowledge organized in memory? In a generic associative network model of memory, such as the various versions of the ACT model (ACT is an acronym for Adaptive

Control of Thought or, perhaps tongue-in-cheek, Another Cognitive Theory; J. R. Anderson, 1983, 1993; J. R. Anderson & Lebière, 1998), the self (or each of a multiplicity of context-specific selves) can be represented as a node (which we might call the *ego node*) representing the self, just as there are other nodes in memory representing other people, places, and things with which we are familiar. Fanning out from this ego node would be other nodes corresponding to one's episodic and semantic knowledge about oneself. In this way, individual nodes representing self-relevant knowledge such as *I gave a present to Lucy on her birthday*, *Lucy made me happy yesterday*, *I am a member of the middle class*, *I am more than 6 feet tall*, *I am a neurotic extravert*, *I know how to drive a standard-shift car*, and *I know how to tie a necktie in a Windsor knot* would fan out from a central node representing oneself as the agent, patient, stimulus, or experiencer of all the events recorded in episodic memory, the object of all the self-descriptive statements recorded in semantic self-memory, and the possessor of all the knowledge indexed in meta-memory. In such a structure, the retrieval of self-knowledge begins by activating the ego node through perception or thought and then tracing the activation as it spreads through associated links to nodes representing various bits of episodic and semantic self-knowledge (Figure 4.1, Panel A).

Such a structure, known as an *independent storage model* because each piece of self-knowledge is stored independently of every other piece of self-knowledge, has the virtue of simplicity. But it also has one very big liability: the *fan effect* and the paradox of interference (J. R. Anderson, 1974; J. R. Anderson & Reder, 1999; Lewis & Anderson, 1976). Put briefly, retrieval latency increases as a function of the number of facts associated with a node in an associative network. In other words, the more one knows about a topic, the harder it is to gain access to any particular item of topic-relevant information. If, as seems likely, the self is a very large knowledge structure stored in memory, the fan effect would seem to imply that it would be relatively difficult to gain access to any particular item of self-knowledge stored in memory—a somewhat counterintuitive implication. To some extent, the

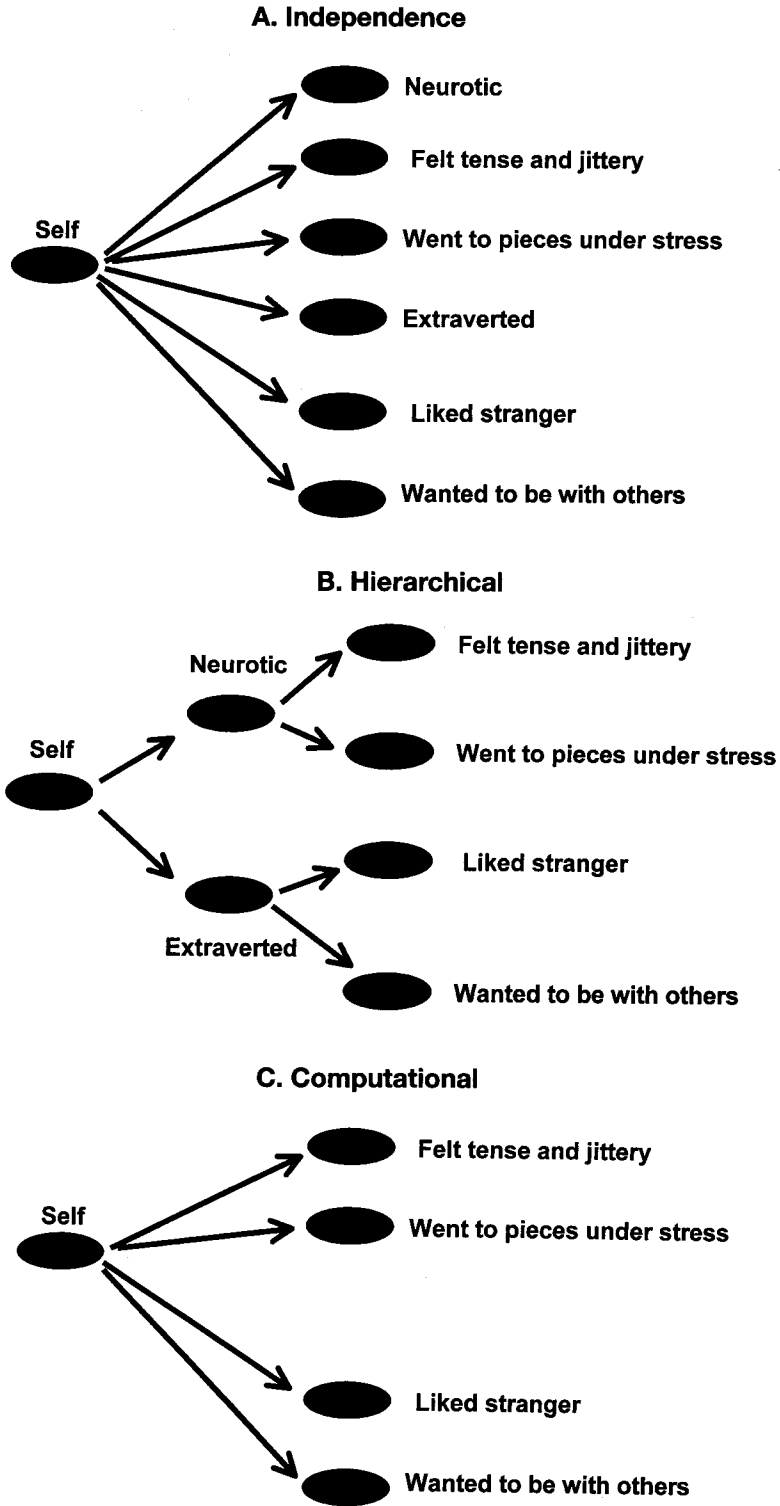


FIGURE 4.1. Possible relations among episodic and semantic self-knowledge in a generic associative-network model of memory, after Kihlstrom and Klein (1994). (A) Independence model. (B) Hierarchical model. (C) Computational model.

paradox of interference can be resolved by imposing hierarchical organization on memory, which creates considerable efficiencies in the process of information retrieval (E. E. Smith, Adams, & Schorr, 1978). For example, instead of each item of self-relevant information being separately and independently associated with the ego node, memories for individual actions and experiences could be organized by their trait implications. That is, all the neurotic behaviors would be grouped together, all the extraverted behaviors, and so forth (Figure 1, Panel B).

Such a hierarchically organized structure is consistent with what is known about the role of category clustering and organizational principles in memory and also congruent with some theoretical models of person memory in general (e.g., Hamilton, Katz, & Leirer, 1980; Ostrom, Lingle, Pryor, & Geva, 1980). In principle, the organization of episodic self-knowledge by semantic self-knowledge—and, for that matter, the hierarchical organization of semantic self-knowledge according to subordinate, basic-level, and superordinate trait categories—would make it easier to retrieve individual pieces of episodic (and semantic) self-knowledge. On the other hand, such an organizational structure also increases the risk of false recognition of conceptually similar behaviors (Reder & Anderson, 1980). Of course, this is precisely the kind of “false alarms effect” uncovered by Rogers, Rogers, and Kuiper (1979). So the hierarchical alternative gains credence both from abstract considerations of efficiency and empirical evidence such as the “false alarms” effect.

As it happens, the two models described here—independence and hierarchical—do not exhaust all the alternatives. It is possible that semantic self-knowledge is not stored in memory at all but rather is computed online as it is required (e.g., when completing personality self-ratings or describing oneself in a “personals” advertisement). Thus, when asked whether (or to what extent) they are neurotic or extraverted, people might first retrieve a sample of their behaviors from episodic memory. Then, employing “cognitive algebra,” they might compute scores for neuroticism and extraversion by integrating across the values for

these traits associated with each of these behaviors (N. H. Anderson, 1974, 1981). For example, people might compute how likeable they are, a piece of semantic self-knowledge, based on episodic self-knowledge of whether, how often, and under what circumstances they have done likable things (N. H. Anderson, 1968). However, the results of these computations are not themselves stored in memory. Rather, they are computed anew each time they are needed. Memory stores only representations of behavior and experience (Figure 4.1, Panel C).

Such a computational scheme would be consistent with Bem’s theory of self-perception of attitudes (Bem, 1967), which holds that people have no introspective access to their attitudes but rather infer them from observations of their own behaviors—just as they infer *other* people’s attitudes from observations of their behaviors. A related view is that our social behaviors are generated automatically and unconsciously in response to eliciting stimuli in the environment, so that the reasons we give for our behaviors are little more than post hoc rationalizations (Bargh, 1984; see also Bargh, 1989, 1994, 1997; Bargh & Chartrand, 1999; Bargh & Ferguson, 2000; Nisbett & Wilson, 1977; Wilson, 1985; Wilson & Stone, 1985). In extending self-perception theory to traits and other psychosocial characteristics, we must consider whether people say that they are neurotic extraverts (for example) not because they have these traits encoded in semantic memory but because they retrieve episodic memories of themselves doing neurotic and extraverted things.

#### Empirical Studies of the Self as Memory

For most of its history, cognitive psychology has attempted to understand memory structures and processes by analyzing aspects of human performance such as savings in relearning (e.g., Ebbinghaus, 1885/1964), retroactive and proactive inhibition (e.g., Postman & Underwood, 1973), organization in free recall (e.g., Bower, 1970; Mandler, 1979), recall and recognition accuracy (e.g., Craik & Lockhart, 1972; Roediger & McDermott, 1994), response latencies (e.g., Reder & Anderson, 1980; Sternberg, 1969),



and the like. This has also been true of research on the self as a memory structure, which has generally followed the paradigms established in the study of person memory within social cognition generally (e.g., Hastie & Carlston, 1980; Kihlstrom & Hastie, 1997; Srull, 1981; Wyer & Carlston, 1994).

### The Self-Reference Effect

Perhaps the earliest empirical attempt to view the self as a memory structure was in work by Rogers and his colleagues on what has come to be known as the self-reference effect (for reviews, see Rogers, 1981; Kuiper & Derry, 1981). Extending the "levels of processing" paradigm introduced by Craik and Lockhart (1972), Rogers, Kuiper, and Kirker (1977) asked subjects to perform a self-referent encoding task: judging whether each of a set of trait adjectives was self-descriptive. On a later recall test, the subjects showed better memory for these items than for items studied under the structural and semantic orienting tasks of the standard levels-of-processing experiment. This *self-reference effect* has since been replicated many times (Figure 4.2, Panel A) and is so reliable that it can be used as a classroom demonstration (Symons & Johnson, 1997). Later studies showed that the recognition of

self-referent material is likely to be accompanied by an experience of *remembering* as opposed to *knowing* (Conway & Dehurst, 1995; Hirshman & Lanning, 1999)—further evidence that self-reference is a powerful encoding condition.

Based on the idea that the experimental conditions in the levels-of-processing experiment promote contact between studied items and increasingly rich and elaborate cognitive structures, Rogers and others (e.g., Keenan & Baillet, 1980) suggested that the self might be the richest, most elaborate knowledge structure in memory. However, this inference is undercut by the fact that reference to other people, particularly if they are well known, can produce equivalent effects (e.g., Bower & Gilligan, 1979). On the other hand, there is no reason why one's knowledge about, say, one's mother might not also constitute a rich and elaborate knowledge structure. More critical was a finding that the self-reference effect was an artifact of the organization of self-referent items into categories (Klein & Kihlstrom, 1986). In the semantic orienting task employed in the typical self-reference experiment, a different question is associated with each item. A word such as "neurotic" might be compared with "anxious," whereas a word such as "extraverted" might be compared with "outgoing." How-

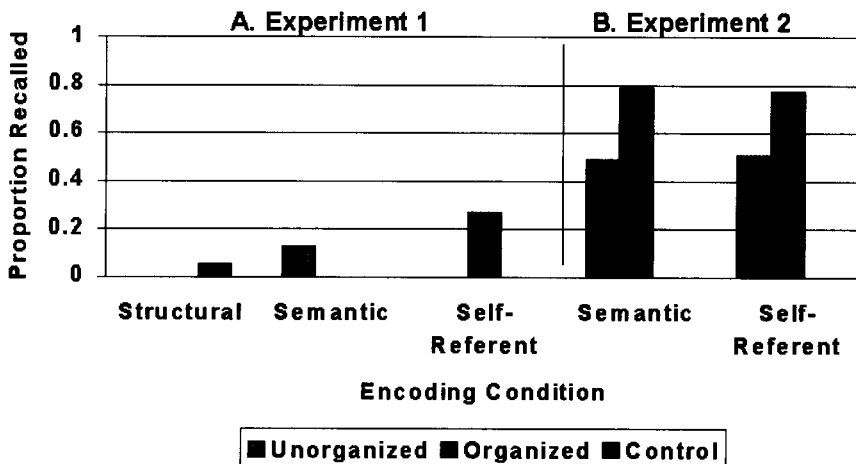


FIGURE 4.2. Influence of organizational processing on the self-reference effect, after Klein and Kihlstrom (1986, Experiments 1 and 2).

ever, in the self-reference condition the orienting question is always the same—whether the trait is self-descriptive. Accordingly, the self-reference orienting task tacitly encourages subjects to group the study items into two categories: those that are and those that are not self-descriptive. Based on the principle that organizational activity facilitates memory, the advantage of self-referenced items might be a function of organization rather than of self-reference.

To address this issue, Klein and Kihlstrom (1986) conducted a series of experiments that unconfounded self-reference and organization. Subjects were asked to study a list of words representing body parts in an experiment in which self-reference and organization were manipulated orthogonally. In a variant on the standard semantic/unorganized condition, the subject was asked if the target word fit in a sentence frame; different frames were used for each item. In the semantic/organized condition, however, the subjects were asked to make a dichotomous category judgment: whether the word referred to an internal or external body part. In a variant on the standard self/organized condition, the subjects were asked whether they had ever had an injury or illness to various body parts.

The results of these experiments were clear (Figure 4.2, Panel B). In the self/unorganized condition, each of the target words was referenced to a *different* self-descriptive question. Comparing the standard semantic and self-referent orienting tasks, the standard self-reference effect emerged. But reversing the organizational qualities of the two tasks also reversed the self-reference effect. In other words, the standard self-reference effect was due entirely to the organizational qualities of the standard self-reference task. Later research showed that elaborative, as well as organizational, activity was implicated in the self-reference effect but that the effects of elaboration were independent of self-reference (Klein & Loftus, 1988; Klein, Loftus, & Burton, 1989). The self may well be the richest, best organized, and most elaborate knowledge structure stored in memory; but because the self-reference effect is an artifact of organizational activity, experiments demonstrating the effect do not provide any evidence that this is the case.

#### Self-Relevance and Recognition

In their program of research, Rogers and his colleagues employed other aspects of memory performance to support their claim that the self is a schematically organized knowledge structure. For example, they showed that memory is enhanced for trait adjectives known to be self-descriptive, even when self-referent judgments are not made at the time of encoding (Kuiper & Rogers, 1979). Moreover, previous research in both nonsocial (Posner & Keele, 1970) and social (Cantor & Mischel, 1977) domains had shown that when subjects study a list of category-relevant words and then receive a memory test, they tend to falsely recognize new category exemplars as if they had been previously studied. This *false alarms effect* is generally interpreted as indicating that subjects routinely abstract categories from related instances that they encounter in experience. Something similar happens with self-relevant material. After subjects study a list of trait adjectives, they are more likely to falsely recognize new items that are self-descriptive than new items that are not self-descriptive (Rogers et al., 1979). In retrospect, this latter result can be viewed as a foreshadowing of the associative memory illusion (Roediger & McDermott, 1994), in which (for example) subjects who study a list of words associatively related to the word *needle* tend to falsely remember that word as having been studied as well. In any case, increases in both accurate and false memory for self-descriptive words, even when subjects do not make self-descriptive judgments at the time of encoding, suggests that self-relevant knowledge information is stored as such in memory.

#### Priming and Self-Referent Processing

Over the past decade, considerable research on the self has employed a *priming* paradigm (Meyer & Schvaneveldt, 1971) to address the question of how episodic knowledge of one's past behaviors and experiences and semantic memory for one's traits and other psychosocial characteristics can be represented in memory (Klein & Loftus, 1993a, 1993b). In associative network models of memory, information retrieval begins by activating nodes that represent cues

(available in the environment or generated through thought); activation then spreads to associated nodes in the network. These nodes then remain activated for some period of time. So long as some level of activation persists, the information represented at that node is easier to retrieve and employ in ongoing cognitive tasks. This phenomenon is called “priming.” So, for example, in a lexical identification task (in which the task is to determine whether a presented item is a legal word), prior presentation of the associatively related word “bread” makes it easier to judge that “butter” is a legal English word. In this way, the results of priming experiments can serve as a basis for inferring the underlying structure of memory. If “bread” primes “butter” but “nurse” does not, we can infer that “bread” and “butter” are associatively linked but that “nurse” and “butter” are not.

In a series of experiments, Klein and his colleagues have used a priming methodology to determine the underlying structure of the mental representation of self in memory (e.g., Klein & Loftus, 1993a). In a typical experiment of this sort, subjects are presented with trait words and asked to answer one of three questions: how the word is defined, whether the word describes themselves, and whether they can recall an incident in which they displayed trait-relevant behavior. For each trait term, two questions are asked in sequence: “describe” followed

by “recall,” “define” followed by “recall,” and “recall” followed by “describe.” There are also control conditions in which each task is repeated. The initial trial of each task constitutes a further control condition in which there is no priming. If the hierarchical model is correct, asking people questions about their traits should facilitate their answers to questions about their behaviors (because activation has to pass through semantic nodes representing traits before it gets to episodic nodes representing behaviors). If the computational model is correct, asking people questions about their behaviors should facilitate their answers to questions about their traits (because nodes representing trait-relevant behaviors have already been activated). The absence of priming would constitute evidence for the independence model.

Figure 4.3 shows representative results of these experiments (Klein et al., 1989, Experiment 2). When the same task is repeated on two successive trials, there is a significant priming effect, compared with the task performed without any prime. However, there is no priming across tasks. Compared with the neutral definition task, describing oneself as extraverted does not prime the retrieval of extraverted behaviors from memory: This is inconsistent with the hierarchical model. Similarly, and in contrast to the predictions of the computational model, retrieving memories of extraverted behaviors

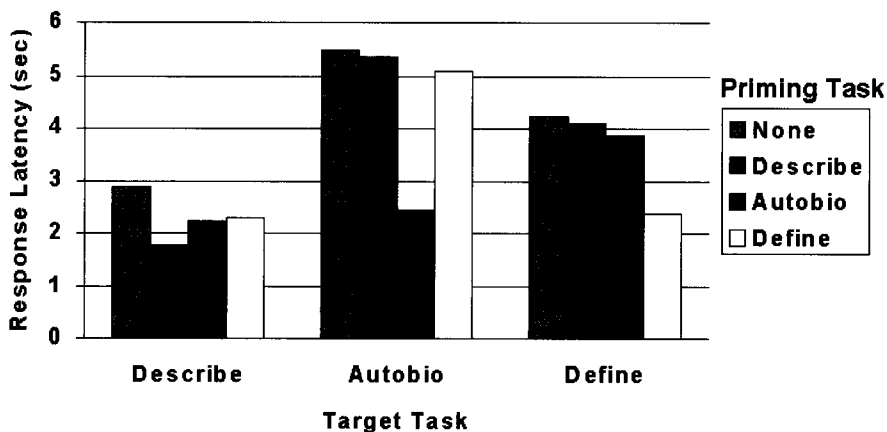


FIGURE 4.3. Priming effects in autobiographical and self-descriptive tasks, after Klein, Loftus, and Burton (1989, Experiment 2).

does not prime the description of oneself as extraverted. The absence of priming of either sort, a null result that has been consistently obtained across a large number of experiments, supports the independence model, in which episodic and semantic knowledge about the self are represented independently of each other. This model, however cumbersome it might seem, is consistent with evidence concerning the representation of other persons in memory (e.g., J. Anderson & Hastie, 1974; Hastie, 1988; Srull, 1981), as well as evidence about the organization of nonsocial knowledge in memory (e.g., J. R. Anderson, 1983).

One potential problem with this line of research is that it depends on the assumption that the "define" task used to establish baselines for priming is truly a control task. If the ostensibly impersonal act of defining a trait nevertheless activates trait-relevant episodic and semantic self-knowledge, then the absence of priming between the episodic and semantic tasks themselves becomes difficult to interpret. Accordingly, a further series of studies employed a control condition in which subjects simply read the words in question without performing any other cognitive operation (Klein, Babey, & Sherman, 1997). There was still no evidence of priming, strengthening the conclusion that items of episodic and semantic self-knowledge are represented independently. A final experiment found a reversed association between the episodic and semantic tasks, depending on the level of trait-descriptiveness—a dissociation that strengthens the inference that the two forms of self-knowledge are, indeed, represented independently.

Additional evidence on the structure of self-knowledge comes from memory experiments employing paradigms other than priming. For example, one study made use of the principle of encoding variability, which states that memory is best for items that are encoded in a number of different ways (Martin, 1968; Postman & Knecht, 1983). In an experiment, subjects encoded items during autobiographical and self-descriptive tasks, alone and in combination (Klein et al., 1989, Experiment 4). Items that were encoded with two different tasks were remembered better than items encoded twice with the same task, again suggesting that autobiographical memory and self-

description are two different ways of processing.

According to the encoding specificity principle (Tulving & Thomson, 1973), information is best remembered if the cues present at retrieval match those that were processed at the time of encoding. In one study, trait words encoded during an autobiographical task were better remembered when retrieved in an autobiographical context than in a self-descriptive context, whereas items encoded in a self-descriptive context showed the opposite pattern of results (Klein, Loftus, & Plog, 1992). This finding suggests that autobiographical retrieval and self-description are different cognitive tasks.

#### Interactions between Episodic and Semantic Self-Knowledge

The priming experiments, as well as studies employing paradigms other than priming, indicate that self-descriptions can be mediated by retrieval of semantic self-knowledge from semantic memory and need not be computed from information retrieved from episodic memory (e.g., Babey, Queller, & Klein, 1998; Klein et al., 1997; Klein, Loftus, & Sherman, 1993; Klein, Loftus, & Sherman, 1992; Klein, Sherman, & Fuhrman, 1992; Klein, Sherman, & Loftus, 1996; Schell, Klein, & Babey, 1996; Sherman & Klein, 1994). This is not to say, however, that episodic and semantic self-knowledge never interact. We know from the person memory literature that semantic memory for an individual's personality traits can affect the encoding and retrieval of episodic memory for that person's actions and experiences (Hastie, 1980, 1981; Hastie & Kumar, 1979; Srull, 1981). There is no reason to think that the situation is any different when the person represented in memory is oneself.

Moreover, episodic memory for behavioral exceptions can qualify self-descriptions retrieved from semantic memory. A person may generally think of him- or herself as extraverted, and this characteristic may be encoded in semantic memory as part of his or her self-concept, but a person who can remember engaging in some introverted behaviors may describe himself as less extraverted than one who cannot. In fact, research employing a variant on the priming

paradigm indicates that self-descriptive processing will prime the retrieval of trait-*inconsistent* episodes, even if (as the earlier studies consistently showed) there is no priming of trait-*consistent* episodes (Babey et al., 1998; Klein, Cosmides, Tooby, & Chance, 2001). These results are consistent with a model of self-description in which subjects retrieve both summary information in semantic memory and episodic memories that are inconsistent with that summary (Klein, Cosmides, Tooby, & Chance, 2002). In this way, episodic memories constrain the scope of generalizations that people make about themselves.

### The Self in Relation to Others

The research described thus far considers the mental representation of the self to be a single, monolithic entity, existing in isolation from mental representations of other people. However, this is probably not the case. Because we identify ourselves partly in terms of kinship and other interpersonal relations and group memberships, other people must form a substantial part of our self-concept (Markus & Cross, 1990; Ogilvie & Ashmore, 1991). It is known, for example, that we endorse traits in ourselves more quickly if they are also characteristic of our marital partners (Aron, Aron, Tudor, & Nelson, 1991; E. R. Smith, Coats, & Walling, 1999; E. R. Smith & Henry, 1996), or if they are also characteristic of groups of which we are members (E. R. Smith et al., 1999; E. R. Smith & Henry, 1996). Based on findings such as these, E. R. Smith and colleagues have developed a connectionist model of social memory in which activation spreads reciprocally between semantic-memory nodes representing oneself, one's partner, or other significant others, including groups. If self and partner possess the same trait, activation is increased at both self and partner nodes, facilitating both self- and other-judgments (E. R. Smith et al., 1999). As the closeness of the relationship decreases, indexed by diminishing the weight on the link between self and other nodes, the degree of self-other priming will also decrease.

Other people also play a role in defining the situations that distinguish one context-specific mental representation of self from

another. In an extension of the priming paradigm employed by Klein and Loftus (e.g., Klein & Loftus, 1993a), a series of studies has examined episodic and semantic self-knowledge within various close relationships (Beer & Kihlstrom, 2001). In one study, for example, college students were presented with a set of interpersonal trait terms. For the priming task, they were asked to remember an incident in which they displayed each trait with their fathers, their mothers, or their romantic partners; a fourth condition, in which they simply defined the trait, served as a control. For the target task, they were asked whether the trait was characteristic of them when they were with their fathers, mothers, or romantic partners. Representative results are depicted in Figure 4.4. For self-with-mother and self-with-father, the first experiment revealed no priming from the episodic to the semantic task, in line with the results of Klein and Loftus (1993a; Panel A). For self-with-partner, however, there was a significant priming effect. The priming effect for self-with-partner was replicated in a second study (Figure 4.4, Panel B). However, no such priming occurred in tasks involving the self-with-best friend. The subjects in these studies being lower division college students, on average, their relationships with their best friends had been going on longer than their relationships with their romantic partners. The pattern of results suggests that the structure of the relational self may change over time. The mental representation of self in long-term relationships, whether with one's parents or with one's romantic partner, appear to be characterized by independent representations of episodic and semantic self-knowledge. For relationships with a shorter time course, however, relational self-knowledge may be organized in a more interdependent fashion.

Although the Beer and Kihlstrom (2001) studies focused on priming *within* each relational self, they also provided evidence about the relations *between* the context-specific mental representations of self. In addition to the episodic self-with-partner task, the semantic self-with-partner task was also preceded by the episodic self-with-mother and self-with-father tasks. When these two conditions were combined to create an aggregate "self-with-parents" condition, there

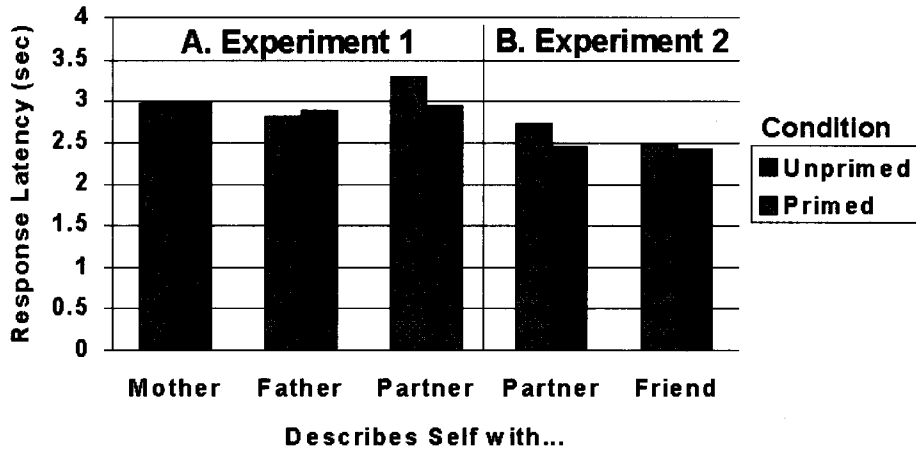


FIGURE 4.4. Priming effects in the relational self, after Beer and Kihlstrom (2001). (A) Self-with-mother, self-with-father, and self-with-romantic-partner (Experiment 1); (B) Self-with-romantic-partner and self-with-best friend (Experiment 2).

was no evidence of priming the mental representation of self-with-partner. Later studies in the series suggested that knowledge of self-with-partner is dependent on episodic information, whereas knowledge of self-with-parents and self-with-best friend is dependent on semantic information. On the surface, at least, the independence between mental relationships of self-with-parents and of self-with-partner would appear to be inconsistent with some forms of adult attachment theory, which suggest that mental representations of self-with-parents serve to filter and structure mental representations of self-with-romantic-partners. Given the ages of the subjects involved in these experiments, however, the critical factor determining the structure of the various mental representations of self may be time spent in the relationship, with the representation becoming more abstract, emphasizing semantic rather than episodic self-knowledge, as the relationship ages.

### Neuropsychological Approaches to the Self as Memory

Taking traditional cognitive psychology as a model for the study of social cognition, a great deal has been learned about the mental representation of self from studies of the performance of normal human subjects in

laboratory tasks derived from the study of nonsocial cognition. Over the past two decades, however, we have seen the emergence of another, complementary approach to the study of cognition: systematic studies of patients who experience specific cognitive deficits as a result of some insult, injury, or disease to the brain. Experimental studies of amnesia, aphasia, agnosia, and other neurological syndromes have offered a view of the cognitive system in dysfunction that, in turn, has shed light on its normal operations (Ellis & Young, 1988; Gazzaniga, 1999; Gazzaniga, Ivry, & Mangun, 1998; Rapp, 2001). Taking the success of cognitive neuropsychology as a model, Klein and Kihlstrom have argued that neuropsychological studies of brain-injured patients and brain-imaging studies of normal subjects, may provide new solutions to old problems and afford new theoretical insights for personality and social psychologists as well (Klein & Kihlstrom, 1998; Klein, Loftus, & Kihlstrom, 1996).<sup>4</sup>

### Studies of Amnesia

Consider, for example, the relation between self and memory. If, as Locke argued, our sense of self and identity is intimately tied up with our recollection of our past, what happens in the case of an amnesic patient? This was, in fact, Bishop Butler's principal

objection to Locke's proposal (Butler, 1791). Although the concept of amnesia was not yet prominent in the medical literature,<sup>5</sup> Locke himself anticipated Butler's objection when he imagined what would happen if a prince's mind, with all its memories, would enter a cobbler's body. H.M., the famous patient with the amnesic syndrome, cannot consciously remember anything that he did or experienced since the surgery that destroyed the hippocampus and other structures of his medial temporal lobes, but he still knows who he is. Of course, H.M.'s amnesia is primarily anterograde in nature, and his identity and sense of self would be maintained by whatever memories he retained from before his surgery. This is fine, so far as it goes, but H.M.'s surgery occurred when he was a young man, and he is aware that he is now much older (Hilts, 1995; Ogden & Corkin, 1991). When he looks in the mirror in the morning, he doesn't think, "Who the hell are you?"

Writing in the early 18th century, Locke did not fully appreciate the distinction between episodic and semantic memory. Although new knowledge is acquired through experience, the knowledge acquired through learning is not incorrigibly linked to a mental representation of the learning episode. We now know that amnesia reflects a specific failure of episodic memory that leaves the patient's semantic memory intact. Amnesic patients are unable to remember events from their lives, but they retain the ability to retrieve generic knowledge about themselves and the world around them (Schacter & Tulving, 1982). Moreover, amnesic patients retain some ability to learn new facts (Schacter, 1987), and this preserved function may permit their identities to be based on "updated" semantic self-knowledge, even if they are lacking a complete record of autobiographical memory. If episodic and semantic self-knowledge are represented independently, as seems to be the case from the research of Klein and Loftus (1993), then even a densely amnesic patient could preserve some sense of identity based on semantic self-knowledge.

The first attempt to address this hypothesis empirically employed patient K.C., who suffered a severe head injury as a result of a motorcycle accident (Tulving, 1993).<sup>6</sup> K.C. is especially interesting because he may be

the most densely amnesic patient ever studied: whereas most other amnesics have at least some premorbid memory, K.C. has both a complete anterograde amnesia covering events since his accident and a complete retrograde amnesia covering his life before that time. Put another way, K.C. has no autobiographical memory at all. Moreover, the same accident that caused his amnesia also resulted in a profound personality change, from quite extraverted to rather introverted. Because of his amnesia, K.C. has no idea what he used to be like, as described by his mother; nor does he have any idea how he has changed. Nevertheless, he possesses a self-concept that accurately reflects his changed personality and comports fairly well with his mother's description of him. K.C. has acquired new semantic knowledge about himself, but he has not retained the experiences on which this self-knowledge is based; and his newly acquired self-knowledge has effectively replaced the knowledge he possessed before the accident.

Similar results were obtained by Klein and his colleagues in a study of W.J., a college freshman who suffered a temporary retrograde amnesia covering the period since her high school graduation as a result of a concussive blow to the head (Klein, Loftus, & Kihlstrom, 1996). Asked to describe herself while she was amnesic, W.J. showed a good appreciation of how she had changed since matriculating, as corroborated both by her boyfriend's ratings of her and her own self-ratings after her memory was restored. Findings such as these lend strength to the conclusion, based on experimental studies of priming, that semantic (trait) knowledge of the self is encoded independently of episodic (behavioral) knowledge.

Another patient studied by Klein and his colleagues yielded similar results: patient D.B., a 79-year-old man who was rendered profoundly amnesic as the result of a stroke (Klein, Cosmides, Costabile, & Mei, 2001; Klein, Loftus, & Kihlstrom, in press). Like Tulving's patient K.C., D.B. was apparently unable to recollect a single episode from any period in his life, either before or after the accident. Nevertheless, like K.C. and W.J., he was able to make reliable and valid ratings of his own personality characteristics. Interestingly, D.B. is also unable to imagine what his life might be like in the future, although he

retained the capacity to predict future events in the public domain. Perhaps our ability to anticipate our futures is tied to our ability to consciously reflect on our pasts (Atance & O'Neill, 2001; Tulving, 1985, 1999). Patient M.L., who sustained a severe retrograde amnesia but little anterograde amnesia following a traumatic brain injury that affected the ventral portions of the right frontal cortex, has difficulty formulating goals and executing plans to achieve them, suggesting that impairments in self-regulation may be linked to impairments in episodic self-knowledge (Levine et al., 1998).

At the very least, these neuropsychological studies offer further evidence favoring the independence of episodic and semantic self-knowledge revealed by the priming experiments described earlier. In those studies, the independence model won by default after the failure of priming to occur in either direction eliminated the organizational and computational models from competition. In the neuropsychological studies, the performance of amnesic patients on self-description tasks consistently provides positive support for the independent-trace model.

#### Beyond Amnesia

Given Locke's ideas about the relationship between identity and memory, amnesia is an obvious place to begin a neuropsychological study of self-knowledge; but other clinical syndromes also promise to reveal important aspects of self-knowledge. In particular, in the syndrome known as anosognosia, patients appear to be unaware of their own cognitive deficits (McGlynn & Schacter, 1989; see also Prigatano & Schacter, 1991). Anosognosia is frequently observed in cases of hemiplegia resulting from frontal-lobe damage, although it can also occur in association with other syndromes resulting from damage to other locations. It is a genuine disruption in self-awareness, distinct from indifference and defensive denial. Because it can be attached to so many different neurological disorders but is not necessarily a characteristic of any of them, anosognosia may prove to be a specific deficit in self-awareness that offers a unique opportunity to confront issues pertaining to the mental representation of the self (Kihlstrom & Tobias, 1991).

Also potentially relevant to the self is a group of syndromes known collectively as the pervasive developmental disorders, including infantile autism, Asperger's disorder, and Williams syndrome. Although autism originally received its name because patients were generally withdrawn from the environment, it is now recognized that at least some forms of the disorder represent specific deficits in social as opposed to nonsocial cognition. Although the neurological basis of autism is unknown at present, it seems possible that autistic individuals have suffered damage to one or more brain modules or systems associated with understanding other people and relating self to others (e.g., Baron-Cohen, 1995; Frith & Frith, 1999; Happe, 1999).

Although experimental studies of autistic individuals have focused on their impaired understanding of other people, it may be that at least some forms of autism also involve impaired understanding of self. For example, a recent study of patient R.J., a 21-year-old autistic male, revealed that he, like the amnesic patients described previously, has a severe deficit in autobiographical memory (Klein, Chan, & Loftus, 1999). Nevertheless, he was able to make personality self-ratings that were both reliable (in terms of stability across testing sessions) and valid (compared with ratings of him made by his mother and by one of his teachers). This dissociation, like the one observed in amnesic patients, constitutes further evidence that episodic and semantic self-knowledge are stored independently. Moreover, R.J.'s spared semantic knowledge of self contrasts with his impaired semantic knowledge of other domains, including inanimate objects, animals, and food (Klein, Cosmides, Tooby, & Chance, 2001). If it should prove that R.J.'s semantic knowledge of other persons is also impaired, such evidence might suggest that there is a specific brain module for mediating self-knowledge whose operations are dissociable from whatever modules underlie knowledge of other people.

The idea is not far-fetched. For example, since the time of Phineas Gage, who, the phrenologists claimed, suffered damage to the lobes of veneration and benevolence, the frontal lobes have been implicated in social behavior (see also Damasio et al., 1994;



Macmillan, 1986, 2000), but they may be implicated in self-awareness, as well as self-regulation. Freeman and Watts (1942), the pioneering psychosurgeons, noted that “the greatest change induced in the individual by operation upon the frontal lobes is in the intimate relationship of the self with the self” (p. 5). More recent clinical and experimental studies indicate that patients with damage to the frontal lobes, and particularly the orbitofrontal cortex, appear to experience profound disruptions in self-reflection and other meta-cognitive functions (Stuss, 1991a, 1991b).

In addition, the central characteristic of frontotemporal dementia, resulting from degeneration of the prefrontal and anterior temporal regions, entails a severe impairment in the self-regulation of social behavior (Brun et al., 1994). Based on such observations, some neurologists are beginning to refer to the orbitofrontal lobes, amygdala, and anterior temporal lobes as a “social brain”—a module or system that regulates various aspects of social behavior (Miller, Hou, Goldberg, & Mena, 1999). Although formal neuropsychological research on these structures has focused primarily on aspects of social behavior, studies of self-knowledge and other aspects of social intelligence (Cantor & Kihlstrom, 1987; Kihlstrom & Cantor, 2000) may help define “social dementia” in cognitive terms (Perry et al., 2001).

#### Brain Imaging Studies

If indeed there are brain structures that constitute a module or system for maintaining a sense of self, these might be “visible,” in a sense, using advanced brain-imaging techniques such as positron emission tomography (PET) or functional magnetic resonance imaging (fMRI). In fact, a recent study used PET to image the brain while subjects rated themselves on a list of trait adjectives (Craik et al., 1999). As comparison tasks, subjects rated the prime minister of Canada on the same traits; they also judged the social desirability of each trait and the number of syllables in each word. One analytic technique, known as statistical parametric mapping, indicated that the self-rating, other-rating, and desirability-rating tasks invoked the same areas of the brain—sites in the left

frontal cortex known to be associated with semantic processing. However, another analytic technique, known as a partial least-squares analysis, revealed activations of the right and left medial frontal lobe (Brodmann’s Areas 9 and 10), the right middle frontal gyrus (BA 10), and the inferior frontal gyrus (BA 45). This provocative study, taken together with the evidence from the autistic patient R.J., suggests that different social-cognitive brain systems might well underlie self-knowledge and knowledge of others.

Another recent study used fMRI to image the brain while subjects viewed morphed pictures of their own faces (compared with an unfamiliar face) or when they read trait adjectives that were or were not self-descriptive (Kircher et al., 2000, 2001). Both tasks activated the left fusiform gyrus, whereas the face task also activated the right limbic and left prefrontal areas, and the trait task activated the left superior parietal area, anterior cingulate, and putamen. A subsequent study (Kircher et al., 2001) of facial self-perception also implicated the right limbic system and left prefrontal cortex, as well as the left superior temporal cortex.

#### The Self in Mind and Brain

Although these pioneering studies are provocative and interesting, it is probably too early to conclude that the self is located in the right cerebral hemisphere. Although cognitive neuroscience has generally embraced a doctrine of modularity, the neural representation of individual items of declarative knowledge is distributed widely across the cerebral cortex. Accordingly, whereas self-referent processing may be performed by a specialized brain module or system, declarative knowledge of the self—whether episodic or semantic—is likely to be widely distributed over the same neural structures that represent knowledge of other people, as well as objects in the nonsocial domain.

Brain imaging is not the royal road to the self, not least because interpretation of images of the functioning brain requires that we already have an adequate psychological theory of the task the subject is performing—a theory that can only be based on

studies of human performance. Nevertheless, neuropsychological and brain-imaging research has offered cognitive psychologists new perspectives on enduring problems. This should be no less true for social and personality psychologists seeking to understand the structure of self-knowledge in memory and other problems of social cognition.

### Acknowledgments

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### Notes

1. A software system, known as PERSPACE, has been designed to elicit such information idiosyncratically and (by means of cluster analysis) produce a graphical portrayal of the relations among an individual's context-specific selves (Kihlstrom & Cunningham, 1991; Kihlstrom & Olsen, 1992). For example, a subject known as Adele (Kihlstrom, Marchese-Foster, & Klein, 1997) evinced no less than seven different situationally specific self-concepts. Adele's self-with-her husband was closely related to her "ideal self" (as defined by Higgins, 1987), and as far, psychometrically, from her self-with-former-significant-other as it was possible to be. Interestingly, however, this latter self-concept was closely related to both Adele's "actual self" and her "ought self" (Higgins, 1987).
2. One exception is Epstein (1973).
3. For an early anticipation of this approach, see Mancuso and Ceely (1980).
4. For the record, our proposal (Klein & Kihlstrom, 1998; Klein et al., 1996) was inspired, in part, by Jackendoff's proposal that certain aspects of social cognition might be regulated by dedicated brain modules (Jackendoff, 1992; Jackendoff, 1994). Proper reference to Jackendoff's work was unaccountably omitted from our paper, and we wish to correct that error now. In the meantime, our proposal has been echoed by a call for the development of a social-cognitive neuroscience (e.g., Adolphs, 1999; Ochsner & Lieberman, 2001). Although the term "neuroscience" has a certain appealing cachet, our use of the term "neuropsychology" was intended to firmly focus attention on the experiences, thoughts, and actions of the individual person rather than on the structures and functions of neural systems.
5. The American physician (and signer of the Declaration of Independence) Benjamin Rush referred to amnesia in 1786, and Korsakoff first described his eponymous syndrome in 1889.
6. K.C. is also sometimes referred to as patient N.N. (Tulving, 1985).

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