

# A Neurocognitive and Socioecological Model of Self-Awareness

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**ABSTRACT.** In the past, researchers have focused mainly on the effects and consequences of self-awareness; however, they have neglected a more basic issue pertaining to the specific mechanisms that initiate and sustain self-perception. The author presents a model of self-awareness that proposes the existence of 3 sources of self-information. First, the social milieu includes early face-to-face interactions, self-relevant feedback, a social comparison mechanism that leads to perspective taking, and audiences. Second, contacts with objects and structures in the physical environment foster self–world differentiation in infants; this environment also contains self-focusing and reflecting stimuli, such as mirrors and video cameras. Third, the self can develop bodily awareness through proprioception and can reflect on itself using imagery and inner speech. Furthermore, self-awareness is mainly mediated by the prefrontal lobes. The author establishes various links among these different neurological, social, ecological, and cognitive elements of the model.

Key words: inner speech, prefrontal lobes, self-focusing stimuli, self-information, self-perception, social environment

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RESEARCH ON SELF-AWARENESS is stronger than ever, as exemplified by the recent creation of numerous scientific journals and international associations specifically dedicated to the study of consciousness.<sup>1</sup> Currently, researchers in this area are investigating brain mechanisms and areas that mediate self-awareness (e.g., Keenan, 2003; Kjaer, Nowak, & Lou, 2002), mental health issues in relation to excessive self-focus (e.g., Ingram, 1990; Mor & Winquist, 2002), animal self-recognition and self-awareness (e.g., Gallup, 1998; Mitchell, 2002), autobi-

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<sup>1</sup>Examples of journals include *Self and Identity*, *Journal of Consciousness Studies*, *Consciousness and Cognition*, *The Journal of Mind and Behavior*, *Dynamical Psychology: An International, Interdisciplinary Journal of Complex Mental Processes*, *Science and Consciousness Review*, and *Psyche*. Examples of associations include The Center for Consciousness Studies, Association for the Scientific Study of Consciousness, International Society for Self and Identity, and Canadian Research Network on Human Consciousness.

ographical memory (e.g., Klein, Rozendal, & Cosmides, 2002; Teasdale & Green, 2004), and measurement techniques (e.g., Eichstaedt & Silvia, 2003; Govern & Marsch, 2001). Past assumptions about self-awareness, self-consciousness, and self-evaluation in social experimental psychology are being qualified with recent empirical studies (e.g., Silvia & Duval, 2001; Trapnell & Campbell, 1999). Psychologists are examining related abilities, such as modeling others' minds ("theory-of-mind" development—e.g., Astington & Jenkins, 1999; Frith & Happe, 1999). And philosophers are carefully describing different types of higher conscious states and uncovering the thought processes that make them possible (e.g., Carruthers, 1996; Rosenthal, 2002).

Although most of these researchers have been trying to identify short-term effects and long-term consequences of self-awareness, as well as its biological foundations, they have largely neglected a more fundamental question pertaining to the precise mechanisms and processes underlying self-awareness. How, exactly, does a person become self-aware and acquire self-information to form a self-concept? Furthermore, in past investigations, researchers have examined mainly isolated neurological or social factors involved in self-awareness (see Burns & Engdahl, 1998a, 1998b; Mischel & Morf, 2002; Stuss, Picton, & Alexander, 2001). In this article, I attempt to integrate most known variables into one coherent view and, thus, present a neurocognitive and socioecological model that takes into account brain regions, environmental and social influences, and cognitive processes that lead to self-awareness.

First, the notion of self-awareness has to be defined carefully because the model I propose mainly concerns this advanced form of consciousness. *Self-awareness* in this article refers to the capacity to become the object of one's own attention (Duval & Wicklund, 1972), in which the person actively identifies, processes, and stores information about the self. It is an awareness of one's own mental states (e.g., perceptions, sensations, attitudes, intentions, emotions) and public self-aspects (e.g., behaviors [including actions—Knoblich & Flach, 2003] and general physical appearance). This potential focus on private and public self-aspects (a distinction introduced by Fenigstein, Scheier, & Buss, 1975) can extend to a host of other self-related dimensions for example, professional work, intimate relationships, financial situation, health, and sexuality (Ben-Artzi, Mikulincer, & Glaubman, 1995).

Legerstee (1999) discussed a popular distinction in philosophy and developmental psychology between two forms of self-information. *Perceptual* (or *sensory*) *information* refers to products of one's direct experience with oneself (e.g., the body) or environmental stimuli (e.g., other persons, mirrors) that identify the self; *conceptual self-information* designates data about the self that is not available to immediate perceptual experience and that somehow has to be mentally

represented to be accessible to the self. It is tempting to propose that most private self-aspects represent perceptual self-information, and public self-aspects represent more conceptual self-information.

Self-awareness also involves knowing that one remains the same person across time, that one is the author of one's thoughts and actions, and that one is distinct from the environment (Kircher & David, 2003). Thus, self-awareness leads to the realization that one exists as an independent and unique entity in the world and that this existence will eventually cease. Psychologists argue that self-awareness is important because it enables the development of uniquely human qualities, including self-regulation. One's ability to self-monitor and to change one's current behaviors and thought processes largely depends on one's capacity to objectively examine the self (Carver & Scheier, 1981; Silvia & O'Brien, 2004). Various authors use different terms to designate slightly different forms of self-awareness (see Gallagher, 2000; Newen & Vogeley, 2003; Schooler, 2002; Zelazo, 2004). Higher types of self-awareness have been called private and public self-consciousness, meta-consciousness, meta-cognition, higher-order thought, auto-noetic or extended consciousness, second-order consciousness, reflective awareness, access consciousness, conceptual self-consciousness, iterative meta-representational self-consciousness, and narrative self. Lower forms of self-awareness, which I address only superficially in the present model, are immediate self-awareness, visceral, first-order, recursive, and phenomenal consciousness (or self-acquaintance), and the ecological or minimal self (or consciousness).

In the sections that follow, I examine various social, environmental, and personal variables that produce self-attention and self-knowledge. I also present an analysis of the numerous possible interactions between these sources of self-information. Although all factors are seen as important contributors to self-awareness, my model emphasizes the importance of the self and, more specifically, inner speech (cognitive dimension) for self-reflecting activities (see Morin, 2004, for a more detailed discussion about possible links between inner speech and self-awareness).

### The Model

Figure 1 depicts three main sources of self-awareness: (a) the social environment (1), (b) the physical (ecological) world (2), and (c) the self (3). Italic numbers and capital letters in the text refer to elements of the model in Figure 1. Solid lines connect the two first sources of self-awareness to the self, as well as the self to itself. The social milieu comprises (a) early face-to-face communication (1.1), (b) self-relevant feedback that the individual receives from other persons (reflected appraisals [1.2]), (c) a social comparison mechanism that leads to perspective taking (1.3), and (d) the presence of other persons observing the self (audiences [1.4]). The physical environment contains (a) objects and structures

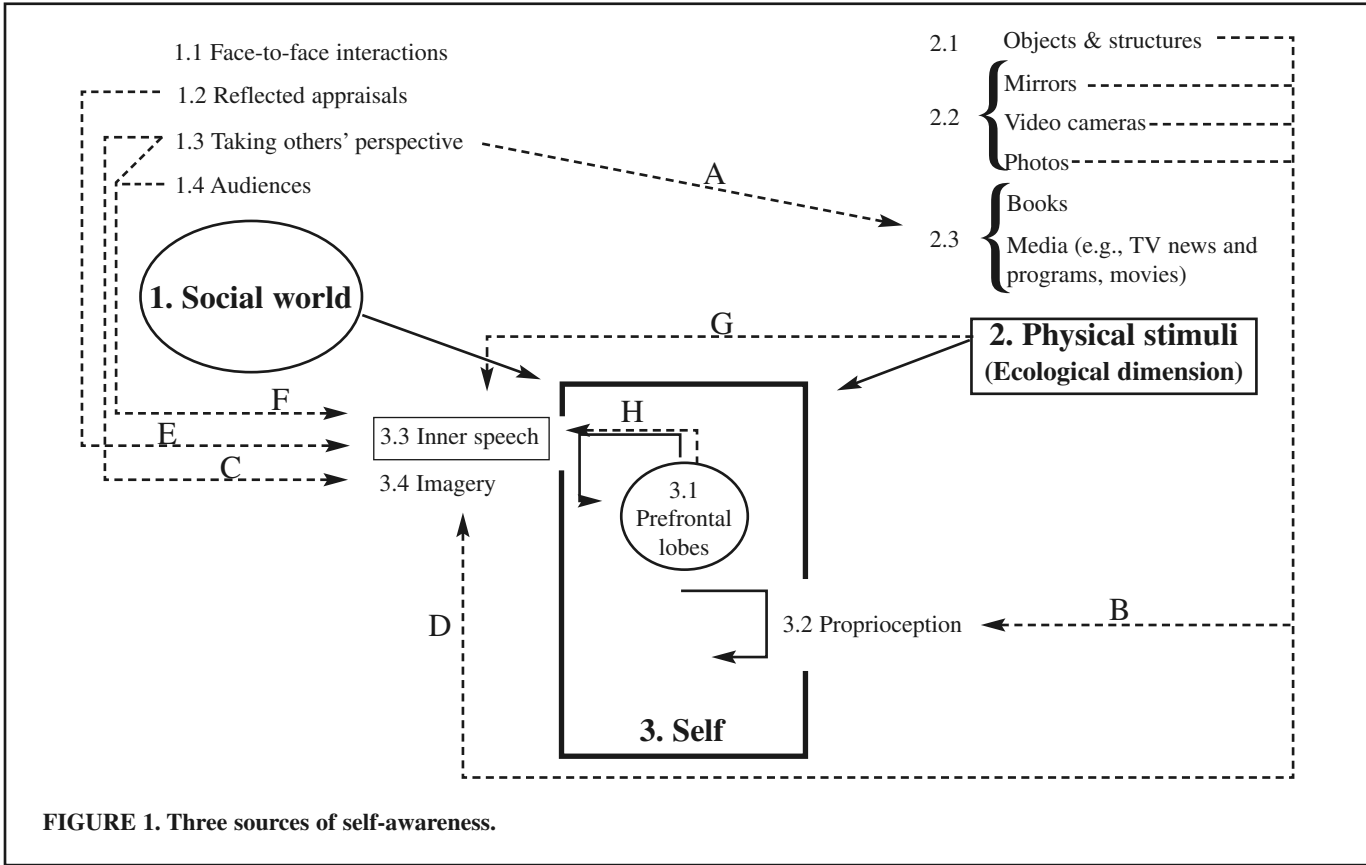


FIGURE 1. Three sources of self-awareness.

that lead to bodily awareness and self–world differentiation in infants (2.1); (b) self-focusing and reflecting stimuli (such as mirrors, video cameras, and photographs of the self [2.2]); and (c) written material printed in books, articles, and various media sources ([2.3], e.g., television programs and news, the Internet, and movies). And finally, the self can further develop bodily awareness with proprioception (3.2) and can reflect on itself by using cognitive processes, such as inner speech (3.3) and imagery (3.4). In addition, self-awareness requires the participation of specific brain structures, mainly the prefrontal lobes (3.1). Broken lines in Figure 1 correspond to different links (e.g., *A, B, C . . .*) that can be established between all these various sources of self-information.

### *Social Environment*

The social environment (1) represents a powerful source of self-information and can produce self-focus in various ways. Note that at this point in its formulation, the model does not systematically deal with the question of evolutionary and cultural influences on self-awareness, which would be beyond the scope of the present article. However, the model does acknowledge that these forces play a crucial role. For instance, Gallup (1997) suggested that our arboreal ancestors were so busy monitoring their movements through the trees that they had little time to develop a self-concept; self-awareness mainly emerged when these ancestors came down onto the savannah. Sedikides and Skowronski (2002) described ecological and social pressures (e.g., finding food and communicating with others) that led to the evolution of the self. Cross and Gore (2003) presented cross-cultural evidence indicating that people's self-concepts are deeply shaped by values, beliefs, and practices of the social institutions to which they belong. For example, when a particular cultural identity is made salient, individuals are more likely to think of themselves as having characteristics that are representative of that culture (Brewer, 2003). Oyserman and Markus (1993; also see Ross, 2003) showed that different social contexts shape the individual self to become either *conjoint* (focus on others, as in Chinese, Korean, and Japanese societies) or *disjoint* (self-focused and independent, as in American society). Studies examining cultural differences in self-focus generally have supported this last point (e.g., Chan, 1996; Gudykunst, Yang, & Nishisa, 1987).

### *Early Nonverbal Social Interactions*

A fairly large body of literature addresses the role of early nonverbal social interactions (1.1) between the infant and the caregiver in self–other differentiation (see Butterworth, 1992, 1995; Legerstee, 1999; Neisser, 1997; Rochat, 2003). Infants and caregivers constantly engage in face-to-face communication during which both participants react to one another by smiling and vocalizing. The in-

fant's behavior initiates responses from the caregiver, which motivate the baby to respond in turn, and so forth. This allows for a gradual understanding that the self can produce effects in the (social) environment and that the self represents a unique and independent entity in the world. Imitation plays a central role in this process. The infant imitates tongue protrusion, mouth opening, lip pursing, sequential finger movements, blinking, vocalization, gestures, and emotional expressions. Perceiving the correspondence between self and other people informs the self about itself (Butterworth, 1995). With the information that such interactions provide, infants also learn to anticipate intentional behavior in other people. This, in turn, leads to the development of self as a social agent. Frequent physical contact between infant and caregiver also promotes the emergence of bodily awareness (discussed in greater length in the sections on physical stimuli and proprioception).

### *Reflected Appraisal*

Another approach to the social environment as a source of self-information is provided by symbolic interactionism. Two theorists in particular explored this theoretical orientation in detail: Charles Horton Cooley and George Herbert Mead. Cooley (1902; also see McCall, 1977) basically suggested that people regularly comment on (verbal feedback—e.g., “You are good looking”) or react to (nonverbal feedback) one's personal characteristics and behaviors. Such reflected appraisals (*I.2*) allow a person to learn about oneself and can also induce self-focus. One can also engage in complex conversations with significant others and talk about one's personality characteristics and typical behavioral patterns. This feedback can also be nonverbal: People smile at, look angry at, or ignore one another; one uses this information to develop a self-view. Felson (1993) noted that reflected appraisals also include standards for evaluation that people come to internalize and then use in self-appraisal.

Some key factors determine the extent to which people accept or reject others' feedback as being self-relevant and incorporate it—or not—into their self-image. People have a tendency to readily accept rather unimportant and positive feedback and to reject important and negative self-information (Eichstaedt, Leippe, & Rivers, 2002). Individuals with low self-esteem and low tolerance for ambiguity tend to acknowledge others' appraisals more easily (Fletcher & Baldry, 2000). Although social feedback can sometimes be very clear and valid (e.g., when employers make annual personnel reports), it is important to observe that reflected appraisals are not always accurate and that, even when social feedback is truthful, people can misinterpret the information (Schrauger & Schoeneman, 1979). For instance, the “interaction ritual” causes people to avoid communicating negative information to others, thereby limiting the availability of evaluative data (Felson, 1993). In addition, Schafer and Keith (1985) suggested that people not only construct their self-image using direct feedback from others,

but they are also influenced by how they think others view them. Despite such qualifications, the fact remains that reflected appraisals represent a potentially important source of self-information that can be used to extend one's existing self-schemas. Social feedback can also trigger self-observation, especially when the information does not fit one's current self-concept. For example, a person might be told that he or she seems to be depressed, yet, by focusing on the self and analyzing his or her feelings, the person could question that comment and discard it. Also note that being asked directly how one is currently feeling or thinking will induce self-focus (Buss, 1980).

### *Perspective Taking*

Mead (1934, 1964, 1982; also see MacKay, 1979; Marlova, 1990; Natsoulas, 1985) proposed a different social mechanism for self-awareness (*I.3*). Confrontations with others motivate individuals to take others' perspectives to gain an objective point of view of themselves. Once in this stance, individuals become self-aware and can acquire information about the self. That is, in the social world, one is constantly exposed to different ways of thinking, feeling, or behaving; one notices discrepancies between these elements and what one characteristically does, thinks, or feels. This prompts one to take others' views and develop an objective outlook of oneself and to scrutinize one's own intellectual, emotional, and behavioral patterns. Essentially, this perspective-taking process represents a form of social comparison (Festinger, 1954). To illustrate, drivers could deduce that they are usually patient and calm (perspective-taking and acquisition of self-information) after observing someone else driving aggressively (confrontation), concluding that they never behave that way on the road.

Festinger (1954) originally assumed that people prefer objective comparison when available (e.g., comparing oneself to oneself) and that social comparison, in fact, represents the least preferred means of gaining self-information. Although there is evidence to this effect (possibly because "temporal-self" comparisons are more gratifying; see Wilson & Ross, 2000), subsequent work in this area has suggested that, in some situations, individuals do value social comparison more. For instance, Miller (1976) showed that perceiving the group used for self-evaluation as attractive and having an interpersonal, as opposed to task, orientation increase the likelihood of engaging in social comparison.

The social process of perspective taking, social comparison, and self-awareness can apply to most self-aspects—some more public (e.g., behavior, appearance), others more private (e.g., personal opinions and views, emotions, thought processes, values, motives). Like reflected appraisals, the process can sometimes be biased (Sedikides & Gregg, 2004). Indeed, "self-enhancement motives frequently overwhelm the drive for accurate self-knowledge and dominate the social comparison process" (Gardner, Gabriel, & Hochschild, 2002, p. 239). Thus, self-awareness produced by perspective taking and social compari-

son can initiate self-presentation strategies with the goal of making a positive impression on others (Fiske & Taylor, 1991). This can sometimes involve self-inflation attempts to manage challenges or threats to the self. For instance, people tend to prefer comparing themselves to large groups (i.e., statistical average) as opposed to specific individuals because the information resulting from the comparison is likely to be less threatening (Buckingham & Alicke, 2002). Others' performances affect one's own view of the self; outperformance is likely to lead to feelings of pride in an area that one finds self-irrelevant and to comparison and working at enhancing one's self-esteem in an area that one considers self-relevant ("self-evaluation maintenance"; e.g., Tesser, 2003). However, when the self is expanded to include others as a part of self (such as in close interpersonal relationships—see Aron, 2003), this tendency is significantly reduced: Successes of close others in self-relevant domains become less threatening (Gardner et al.; also see Kimmelmeier & Oyserman, 2001).

Still, in close relationships, self-conception is partially shaped by the partner's expectations. This "behavioral confirmation" tendency indicates that people are inclined to view themselves the way the partner perceives them (Aron, 2003). In addition, people are constantly motivated to seek out information that verifies their self-concept, even when this information is negative ("self-verification"; e.g., Swann, Rentfrow, & Guinn, 2003). Furthermore, people have a tendency to overestimate how variable their performance appears in the eyes of others ("Spotlight Effect"; e.g., Gilovich, Kruger, & Medvec, 2002). The preceding clearly suggests that perspective taking and social comparison are not free of potential pitfalls as far as accurate acquisition of self-information is concerned; at the same time, it does not invalidate this social mechanism altogether.

Being exposed to very different cultural customs and practices, as when one travels to foreign countries, is likely to enhance the perspective-taking process. By the same token, being part of a distinctive group—being different and unique—will also intensify the phenomenon of social comparison. This refers to *individuation*—the amplification of one's sense of identity and self-awareness because one is distinct from others (Diener & Wallbom, 1976). For instance, famous individuals have been shown to be more self-aware than ordinary people (Schaller, 1997). To illustrate, Nobel Prize winner Ernest Hemingway started using significantly more first-person singular pronouns (indicating high self-focus) in his stories and personal letters following fame (Morin & Craig, 2000). Celebrity, or being handicapped, would represent fairly salient personal characteristics. Differences can be more common and still lead to increased self-focus; for example, being the only woman in a group of men (or vice-versa) or having an accent.

### *Audiences*

Again, one way to explain the effects of individuation is by proposing that outstanding differences between the self and its social surroundings more often



trigger the perspective-taking process described earlier. Another possible account is that being different attracts attention to the self, which in turn increases self-attention and thus self-awareness. In other words, attention to the self caused by distinctiveness reminds persons of their object status for others and induces self-observation (Duval & Wicklund, 1972). This second view allows the introduction of yet another important component of the social world: audiences (1.4). Research has shown that being in front of people who are actively observing the self promotes self-focus (Diener, 1979; Diener, Lush, DeFour, & Flax, 1980). For instance, volunteers scored significantly higher on a measure of egocentrism when in front of an audience than when alone in an empty room (Carver & Scheier, 1978). Being observed by only one person is enough to foster self-awareness (Buss, 1980). Representative examples include giving a speech in front of a class, being the target of attention as one enters a room full of people, or being observed by one's boss at work. Note here that both social comparison (1.3) and audiences (1.4) involve a form of perspective taking; however, these two components of the model differ in that social comparison leads to developing one's own perspective on how one compares to others, whereas audiences implicate taking the perspective of others to observe oneself.

### *Physical Stimuli*

A second main source of self-awareness is the physical world (2). Many philosophers and developmental psychologists have argued that visual perception and physical interactions with objects lead to self-world differentiation (2.1; e.g., Bermudez, 1998; Butterworth, 1992, 1995; Legerstee, 1999; Neisser, 1997). Following J. J. Gibson, Bermudez (1999) indicated that visual kinesthesia involves self-perception as well as world perception. For instance, the self appears in vision as the boundary of the visual field; also, the patterns of flow in the optic display and the relationships between the variant and invariant qualities of the physical environment make available information about the movement of the perceiver. Likewise, lateral displacement, rotation, and movement against a background, as well as contacts with objects and people (e.g., touching, squeezing, rubbing, sucking, throwing, kicking), allow the infant to acquire self-specifying information. An empirical indication that infants do indeed possess basic information about their body has been suggested by studies in which 4-month-old infants were observed reaching for objects they saw by deliberately bringing their hands in contact with objects (Rochat, 2003). Such eye-hand coordination requires that infants be aware of the situation of their own body in relation to the object for which they are reaching.

The physical environment also constitutes a source of self-information because it includes stimuli that can, like audiences, remind people of their object status (2.2). Physical objects such as mirrors, video cameras, recordings of one's voice, and pictures of the self are labeled *self-focusing stimuli* because they produce self-awareness

(Carver & Scheier, 1981) and thus have been used extensively in research to experimentally manipulate self-focus. To illustrate, participants exposed to a mirror or a video camera significantly use more first-person singular pronouns while working on a verbal task compared with volunteers who were not placed in front of these self-focusing stimuli (Davis & Brock, 1975). Small mirrors seem to induce a state of private self-awareness, whereas large mirrors or video cameras lead to public self-awareness (Buss, 1980; Davies, *in press*).

These stimuli can also be conceived of as self-reflecting devices. Observing oneself in the mirror or seeing oneself on video provides one with key information about the public self, such as facial features and expressions, mannerisms (e.g., way of walking, talking, smiling), tone of voice, body height and weight, skin tone and complexion, hairstyle, and so forth. Such characteristics are important because, to some degree, they define one's personal identity (see Cole, 1999). Without self-reflecting stimuli, one could not gain access to that public self-information. Olowu (1984) suggested that some tribal groups in Nigeria actually impede self-awareness development in children by preventing them from manipulating mirrors for superstitious reasons. Note that mirrors have been used extensively to test self-recognition in primates, infants, and mentally ill people (e.g., Gallup, 1985).

An additional group of physical stimuli that can generate self-awareness is written material found in books and articles, the media (newspapers and television news and programs), the Internet, radio, CDs, and movies, including videotapes and DVDs (2.3). Here, a connection between the social environment and the physical world can be established (see Link A in Figure 1). The aforementioned stimuli convey a host of views and behaviors (and, indirectly, underlying motives, values, attitudes, emotions, etc.) that are possibly different from one's own present beliefs and actions. Obviously, when exposed to that type of information, one might simply engage in modeling and absorb it. But, as suggested by Mead, such confrontations are also likely to elicit perspective taking and self-awareness. Thus, physical objects (i.e., their content) could expand a phenomenon that originally is solely social. For example, one might feel motivated to better define one's view on any given topic (perspective taking and acquisition of self-information) after being exposed to a radical opinion (confrontation) presented on a TV program. The same process is most likely active in various situations and for many physical stimuli: observing real people or actors on the news and in movies engaging in what one believes are odd behaviors, being exposed to strange information on the Internet, or even listening to song lyrics that make one contemplate one's own feelings. Provided that what one perceives is different enough from what one believes one is, the result will be the same: increased self-awareness.

### **The Self**

A third main source of self-awareness I propose in the model is the self (3). The self can become the object of its own attention and reflect on itself; it thus

becomes a precious source of self-information to which it has privileged access. As mentioned earlier, within the self, one can identify a noncognitive, fairly primitive mechanism participating in the acquisition of kinesthetic information and in the development of a body image (proprioception—3.2). In addition, the self can engage in more elaborate cognitive operations (self-talk [3.3] and imagery [3.4]), making it possible for it to communicate with itself. Neuropsychological processes (especially the prefrontal lobes—3.1) are also postulated to mediate self-awareness. I start with the latter.

### *The Prefrontal Lobes*

New brain-imaging techniques have significantly increased knowledge of the neural correlates of consciousness. Although structures within the reticular formation have been linked to levels of wakefulness for quite some time (Moruzzi & Magoun, 1949), more recent proposals are being put forward concerning the exact nature and location of neural processes associated with various states of consciousness: 40-Hz oscillations in the cortex, intralaminar nuclei in the thalamus, reciprocal signaling in thalamocortical systems, certain neurochemical levels of activation, and much more (see Atkinson, Thomas, & Cleeremans, 2000). A recent hypothesis suggests that (visual) consciousness (in primates) is supported by the activity of single neurons or small groups of neurons; that is, shifting coalitions of neurons (Crick & Koch, 2003; also see Mutalik, 2003).

That diverse brain areas would participate in consciousness can, of course, be explained by the fact that different types of consciousness are possible. Also, considering the complex nature of the phenomenon at hand, it would be naïve to expect to find one single brain area associated with conscious and self processes (Feinberg, 2001; Kircher & David, 2003). Another potential account is that studies employ a great variety of measurement techniques, participants, and tasks, leading to inconsistent results in the neurocognitive literature. These observations apply very well to the search for the neural correlates of self-awareness. Different types of self-awareness and related abilities exist, and experimental tasks used to induce self-awareness vary greatly. Participants can be healthy volunteers, patients suffering from many possible forms of brain injury that can be difficult to circumscribe with accuracy, or psychiatric populations (e.g., autism, schizophrenia). And at least three functional brain-imaging techniques are available to researchers (Kolb & Wishaw, 2003), making it highly problematic to establish comparisons between studies and to isolate common brain areas involved.

Despite these obstacles, neuropsychological assessments of patients suffering from brain damage, together with studies of psychiatric conditions and brain-imaging experiments, all strongly support the notion of an important involvement of the prefrontal cortex in self-awareness (3.1; e.g., Vogeley, Kurthen, Falkai, & Maier, 1999), especially more anterior areas (Stuss, Picton, & Alexander, 2001).

To illustrate, Frith (1987) proposed that schizophrenia leads to a disturbance of self-monitoring, which includes impairment of the experience of ownership (e.g., thought insertion), the loss of the experience of being the agent of one's own actions, and depersonalization. Vogeley et al. indicated that schizophrenic patients suffer from a decrease in metabolic rate in the prefrontal regions bilaterally. Stuss and Alexander (2000) and Stuss et al. reported numerous examples of bilateral frontal damage leading to self-awareness disturbance; for example, lack of awareness of the implications of the disorder, cognitive detachment from self, dissociations between knowledge and the realization of personal relevance of that knowledge, and capacity to consider the self's extended existence throughout time. Assessment of patients with Alzheimer's disease, a condition known to involve neurological deterioration of the frontal lobes, has shown self-awareness loss (Gil et al., 2001).

The overall neuroanatomic picture gets more complex when one considers the many possible components or dimensions of self-awareness. It is still unclear up to what point the involvement of the prefrontal cortex is bilateral or unilateral (Morin, 2003). Furthermore, nonprefrontal areas (e.g., subcortical structures) also seem to participate in self-information processing (Wheeler, Stuss, & Tulving, 1997).

Self-recognition appears to be associated mainly with right hemispheric activity (Keenan, 2003; Keenan, Nelson, O'Connor, & Pascual-Leone, 2001; but see Turk et al., 2002, and Turk, Heatherton, Macrae, Kelley, & Gazzaniga, 2003). The left prefrontal lobe is engaged in encoding of autobiographical memory, whereas the right prefrontal lobe plays a role in retrieval of that same self-information (Wheeler et al., 1997). Use of the body image involves activation of the right parietal region and the prefrontal cortex, especially the ventromedial parts (Vogeley et al., 1999). Patients' lack of awareness of their deficits frequently implicates bilateral (primarily right-sided) prefrontal damage (Ownsworth, McFarland, & Young, 2002). Neural mechanisms underlying first-person perspective (the subjective experiential multidimensional space centered around one's own person; e.g., spatial self-navigation and perspective taking) comprise medial parietal and posterior cingulate cortical structures, including anterior medial prefrontal, medial parietal, and posterior cingulate cortex (Vogeley & Fink, 2003). Activity within the parietal cortex has been associated with awareness of action (e.g., predicting sensory consequences of action; Blackmore & Frith, 2003).

Another ability closely related to self-awareness is modeling the mental states of others; that is, developing a theory of mind (TOM). The exact nature of the relationship between self-awareness (thinking about the self) and TOM (thinking about what others might be thinking or feeling) is currently debated in the literature (see Vogeley et al., 2001). One central view states that TOM requires self-awareness but is relatively independent of it. That is, one cannot possibly conceive of others experiencing mental events (TOM) if one cannot self-reflect; in other words, self-awareness is a prerequisite for TOM. However, being actively engaged

in TOM does not mean that the person will simultaneously be self-aware. In this perspective, it is unlikely that the brain areas functioning during TOM are identical to those mediating self-awareness. However, an overlap is expected: Studies in which patients were asked to infer visual experience and deception in others revealed impaired performance for focal frontal lesions, especially on the right side (Stuss, Gallup, & Alexander, 2001). Results obtained by Vogeley et al. with comparable tasks but using functional magnetic resonance imaging (fMRI) are more specific and point toward activation of the anterior cingulate cortex, also with a right hemispheric dominance. Yet, in their review of neuroimaging and lesion studies of TOM, Gallagher and Frith (2003) concluded that the anterior paracinate cortex, bilaterally, is consistently associated with “mentalizing.”

Brain-imaging studies explicitly designed to identify regions involved in genuine self-awareness have reported discrepant results, again indicating that the (prefrontal) bilateral neurological nature of self-awareness is uncertain. Craik et al. (1999) measured brain activity with position emission tomography (PET) scans in eight normal subjects working on a self-referential encoding task. Participants were asked to judge how well personality traits described them by pressing response keys while relative regional cerebral blood flow was being measured. Control tasks consisted of three non-self-referential exercises: judging how well trait adjectives described a public figure, how socially desirable the trait adjectives were, and how many syllables there were in each adjective. Results showed that the self-awareness task led to increased activity in the left medial aspect of the superior frontal gyrus and the left inferior frontal gyrus, as well as in either medial or right frontal locations.

In another study using fMRI (Johnson et al., 2002), 11 healthy volunteers evaluated the self-relevance of personality traits in addition to abilities and attitudes by pressing “yes” or “no” buttons. In the control condition, participants were asked to do the same for non-self-relevant questions. An activation of the right anterior medial prefrontal lobe was observed in 6 participants; 3 exhibited more activity in the left anterior medial prefrontal lobe and 3 in the right anterior medial prefrontal lobe. And finally, Kjaer et al. (2002) asked 7 normal participants to describe orally their personality traits and physical attributes while PET scans were being performed. Control tasks included orally reflecting on the personality and appearance of a public figure. Results revealed precuneus, bilateral temporoparietal, and left orbitofrontal activation; in this experiment, no right hemispheric bias was noted. (For related studies, see Conway et al., 1999; Decety & Sommerville, 2003; Gusnard, Akbudak, Shulman, & Raichle, 2001; Kelley et al., 2002; Kircher et al., 2000; Kircher, Brammer, Simmons, Bartels, & David, 2002.)

### *Proprioception*

One significant aspect of self-awareness is body awareness, which most likely develops not only through early social interactions (*I.1*) and contacts with the

physical environment (2.1), but also through somatic proprioception (3.2). Eilan, Marcel, and Bermudez (1995) listed a host of information sources involved in proprioception: pressure, temperature, and friction from skin receptors, and balance and posture from joints, muscles, and the vestibular system. Patients who lose their sense of proprioception cannot feel their body (Meijnsing, 2000). Double sensory stimulation also provides information about the body: When infants touch themselves, they simultaneously feel that they touch and are being touched. Proprioception represents a nonconceptual mechanism (i.e., it does not require cognition) and is already present from birth or shortly after in human infants and animals. It allows for an awareness of the distinction between self and nonself. This awareness contributes to the construction of a kinesthetic self-representation ("body image"), which gradually becomes part of the self-concept (O'Shaughnessy, 1995).

It can be postulated here (see Link *B* in Figure 1) that self-reflecting objects present in one's environment (2.2) also participate in the formation of body awareness. Repeatedly seeing oneself in the mirror, on video camera, or in pictures most likely offers additional information about one's body that could be combined with somatic information previously acquired through proprioception.

### *Imagery*

Still within the self, more sophisticated (cognitive) processes are likely to participate in self-awareness. Imagery (3.4) is a case in point. *Imagery* represents the phenomenon of visual experiences in the absence of any visual stimulus from the outside world. Mental images play a significant role in numerous basic psychological activities, such as memory, learning, initiating action, reverie, perception, motivation, creative imagination, and emotion (Morris & Hampson, 1983). The fact that one can have *autoscopic imagery* (i.e., images of the self) suggests that this cognitive process could lead to self-awareness. Empirical evidence is sketchy at best, yet Turner, Scheier, Carver, and Ickes (1978) noted that highly self-conscious people (individuals who frequently engage in self-reflection) report using imagery as a means of introspection.

A more specific proposal is that imagery can internally reproduce and expand social mechanisms responsible for self-awareness (Morin, 1998). This idea is schematically illustrated with Link *C* in Figure 1. One social mechanism is the opportunity to see oneself as one is seen by others (Mead's thesis of perspective taking [1.3]), which leads to an objective vision of oneself. Imagery internalizes this social mechanism because mental images empower one to literally see oneself acting (or having behaved) in given ways as others would see (or have seen) one acting. When one mentally sees oneself behaving in a given fashion, one is self-aware. Furthermore, when one reflects on past behaviors by using mental images, one can deduce aspects of one's past functioning from what is internal-

ly seen; that is, one can acquire self-information and build a self-concept. As Mead put it (cited in Meltzer, 1991, p. 24), "Individuals are able to view themselves as objects only by imaginatively taking the role, or standpoint, of others and viewing themselves 'through the eyes of others.'" Clearly, imagery can accomplish this. For example, as one is on the verge of emitting some inappropriate behavior, one can "see" oneself acting in a foolish fashion, thus becoming aware of the potential behavior. Or one can remember how one acted in a given situation by using mental images of the self; for example, "seeing" oneself behaving nervously after having been pulled over by the police for speeding. In both examples, one is reflecting on the self with imagery and acquiring self-information about current or past behaviors (and feelings).

Another social mechanism potentially reproducible by imagery is being confronted by an audience (*I.4*—again, see Link *C*). For example, after performing music at a concert, one could visualize members of the audience and "see" specific individuals paying attention to oneself. By looking at oneself now as these individuals did during the concert, one can observe oneself (in imagination) playing the instrument with dexterity or clumsiness, feeling at ease or anxious on stage, and so on. Baldwin and Holmes (1987) provided partial evidence for that type of phenomenon. In Study 1, participants were instructed to create a "private audience" by visualizing the faces of acquaintances or family members. Some internalized audiences (e.g., one's parents) were assumed to hold more conservative views toward sexuality, whereas others (e.g., one's friends) were assumed to hold more liberal attitudes. Participants' positive or negative reactions to a sexually permissive piece of fiction changed as a function of each audience's standards.

Imagery most certainly has limits as far as self-awareness is concerned. Although "one picture is worth a thousand words," it is logical to suppose that imagery is somewhat powerless in conveying more abstract self-aspects, such as emotions, values, beliefs, motivations, or sensations. That is, one cannot "see" an emotion or a sensation; words (inner speech—see the next section) would be ideal to capture conceptual self-information. Imagery is probably more adequate in making a person aware of public self-aspects (e.g., observable behaviors and visible physical characteristics), as opposed to more private ones (moods, motives, mental processes, desires, etc.).

For imagery to be functional as a self-representational process, it must have in its content a decisive ingredient, such as one's facial features and other physical characteristics. Without a clear mental picture of oneself to contemplate, there is no need to suggest the possibility of oneself internally seeing the self as acting or behaving in a particular fashion. Here, again, one's experience with self-reflecting devices (2.2) must be crucial in acquiring this critical ingredient. By repeatedly observing the physical self in mirrors or on videotapes, one can form a mental picture of oneself and then use that picture for introspection purposes. This idea is represented by Link *D* in Figure 1.

### *Inner Speech*

*Inner speech* (3.3) is typically defined as the activity of talking to oneself in silence (Zivin, 1979). Other comparable expressions found in the literature are self-talk, subvocal speech, internal dialogue or monologue, utterances, self-verbalizations, and self-statements. The term *private speech* means speech for the self verbalized out loud by adults (Flavell, 1966), whereas *egocentric speech* designates children's overt self-verbalizations emitted in social situations without any preoccupation of being understood by others (Piaget, 1923/1926; Vygotsky, 1962). Like imagery, inner speech operates many functions, such as verbal self-guidance and self-regulation, problem-solving, planning, memory, and mediation of anxiety and depression (see Kendall & Hollon, 1981).

One neglected function of inner speech is its role in self-awareness (Morin, 2004; also see Briscoe, 2002; Burns & Engdahl, 1998b; McCrone, 1994; Stamenov, 2003; Steels, 2003). Self-talk allows one to verbally identify, process, and store both private and public self-information. Recent evidence, although mainly of a correlational nature, supports this proposal. Independent studies using diverse measures of inner speech and self-awareness have found robust and significant positive correlations between these two mental activities (e.g., Morin, Everett, Turcotte, & Tardif, 1993; Schneider, 2002; Schneider, Pospeschill, & Ranger, 2003; Siegrist, 1995). The "higher-order thought" view of consciousness (e.g., Carruthers, 1998) proposes that one becomes aware of a mental state when one forms a thought about that state. This hypothesis is consistent with the present analysis: One becomes self-aware when one engages in self-talk (higher-order thought) about one's current mental states and personal characteristics. It is important to note that, like any other source of self-information, inner speech can potentially lead to the acquisition of inaccurate self-information. People can engage in dysfunctional self-talk and distort or reject self-relevant information. Inner speech must contain some basic qualities to foster genuine self-awareness (see Morin, 1995).

Links *E* and *F* in the model indicate that inner speech can reproduce social mechanisms that produce self-awareness. More specifically, with inner speech, one can engage in verbal conversations with oneself and duplicate comments emitted by others (Cooley's [1902] mechanism—*I.2*, Link *E*). Observations and inferences about one's thoughts, feelings, and behaviors made by other persons might imprint such comments on one's own self-talk. A mode of communication of self-information that was originally *interpersonal* (verbal appraisals made by others about oneself; e.g., "You are lazy") would progressively become *intrapersonal* (verbal remarks about oneself that one addresses to oneself; e.g., "I am lazy").

Inner speech can also reproduce Mead's (1934) perspective-taking mechanism (*I.3*, Link *F*). Talking to oneself can instigate a fictional dialogue in which verbalizations of an objective and, thus, different point of view about oneself are achieved. People sometimes converse with themselves and express to real or



imaginary persons their reasons for behaving in a given way or for possessing some personal attributes. When, in response to the anticipated reactions of others, one explicates one's behaviors or describes oneself in self-talk, one takes others' perspectives into account and thus gains an objective vision of oneself. For example, one might say to oneself, "People will probably speculate as to why I changed my mind and decided to buy *this* house [perspective taking produced by the likely reaction of an imaginary group of individuals—the "generalized other" of Mead]. The fact is that I prefer the location; also, I love the house, and I will be able to move sooner." With inner speech, the person is capable of reflecting on three self-dimensions: (a) a preference (location), (b) an emotion (love), and (c) a behavior (moving sooner).

The model also suggests that another social factor leading to self-awareness is the presence of other persons observing the self (*I.4*). This social mechanism can also be reproduced and extended by self-talk (*Link F*). To illustrate, again, an individual has just performed music at a concert and engages in self-talk. "How did I perform at the concert? I remember seeing *X* [a friend] looking at me. I wonder what he/she thought about it [perspective taking and objective vision of oneself]. At first I was nervous, but I then became more at ease, and overall I played very well" [acquisition of self-information].

*Link G* connects inner speech to self-reflecting objects (2.2) and proposes that self-talk is likely to become active when people examine the public self in front of a mirror, on video, or in a picture (e.g., "I'm gaining weight"). One also produces self-verbalizations when one compares one's own behavior, values, attitudes, emotions, and so on with those presented in books, on TV, and in the news. For instance, one might state, "This character [in a TV series or movie] is lying to his wife. . . . I could never do that—I'm too honest."

*Link H* in the model suggests that inner speech is activated when some areas of the left prefrontal cortex are functioning. One such structure is the inferior frontal gyrus (Craik et al., 1999), and inner speech is precisely associated with activation of that area. For example, the inferior frontal gyrus is more active in participants who are asked to silently articulate sentences (McGuire, Silbersweig, Murray, et al., 1996) or single words (McGuire, Silbersweig, Wright, et al., 1996). Studies of brain-damaged patients support these findings: Destruction of Broca's area in the left hemisphere (Verstichel, Bourak, Font, & Crochet, 1997) or of the left posterior and anterior frontal regions (Levine, Calvanio, & Popovics, 1982) disrupts inner speech. Because portions of the left prefrontal lobe are associated with both self-reflective activities and inner speech, this supports the notion that the latter participates in self-awareness (Morin, 1999; Steels, 2003).

## Conclusion

In this article, I offered a multidimensional view of self-awareness. The model portrays self-attention and the resulting acquisition of self-information as

a complex, multifaceted phenomenon shaped by a host of neurological, social, ecological, and cognitive processes. The self can reflect on itself by communicating with itself through the use of inner speech and imagery; self-awareness requires functional prefrontal lobes. The self can also learn about its body with proprioception and by manipulating objects and being exposed to self-reflecting devices found in one's environment. These also inform one about more public dimensions of the self. People, the media, and self-focusing objects in one's surroundings can convey self-information or initiate self-observation.

Table 1 summarizes the different links proposed by the model. A basic phenomenon of replication can be repeatedly found throughout the model and attests to its highly dynamic nature. One source of self-information can be reproduced and expanded by another one, so that various factors are in constant interaction. For instance, imagery can internally replicate the presence of an audience that leads to self-focus in the first place, and physical stimuli, such as books, can extend perspective taking that produces self-awareness. The fundamental importance of inner speech can be appreciated by noting that half of the links pertain to it. Without inner speech, many parts of the model would be isolated, and its internal consistency would greatly suffer. But again, the model makes it clear that inner speech is not the whole story.

What I have proposed in this article is a preliminary version of a self-awareness model. Its main value, I hope, is synthetic and analytic and consists of bringing together various pieces of information that one does not typically view as related. Proposing a host of specific empirical predictions that could derive from the model is beyond the scope of the present article. Formulating

**TABLE 1. Links Among the Three Sources of Self-Awareness Proposed by the Model (Figure 1)**

Link	Description
A	Physical stimuli (2.2) extend perspective taking (1.2).
B	Self-reflecting devices (2.1) participate in the formation of body awareness (3.2).
C	Imagery (3.4) can internally reproduce social mechanisms (1.2, 1.3) responsible for self-awareness.
D	Experiences with self-reflecting devices (2.1) are crucial in acquiring autoscopic imagery (3.4).
E	Inner speech (3.3) can reproduce social feedback (1.1) and redirect it toward the self.
F	Inner speech (3.3) can internalize others' perspectives (1.3).
G	Self-talk (3.3) is activated when one is exposed to self-reflecting devices (2.1).
H	Inner speech (3.3) is activated when some areas of the left prefrontal cortex (3.1) are working.

testable hypotheses will undoubtedly increase the model's heuristical value. One example could be that increased use of self-talk (achieved through cognitive training—e.g., Meichenbaum & Goodman, 1971) should lead to heightened self-focus and self-concept complexity; alternatively, inner speech deficits following brain insult should negatively alter self-awareness (see Moss, 1972). Although it might ultimately prove difficult to empirically test the existence of some links put forward by the model (Link *B* for instance), evidence already (at least partially) supports Link *H* (see previous discussion), and Link *E*—what significant others say to children—seems to influence their self-talk (Burnett, 1996). Fairly straightforward experiments could be designed to test other links; for example, participants should significantly engage in more self-talk when exposed to a mirror or a video camera than when placed in a control situation (Link *G*).

As Leary and Tangney (2002) pointed out, self-attention is central to understanding of the self and related constructs (e.g., self-efficacy, self-schema, self-presentation, self-adaptation) because all these involve thinking reflectively about oneself. One can get a comprehensive—and thus more realistic—picture of this experience only by simultaneously considering all the possible mechanisms and processes leading to it and by looking at their multiple and complex interactions. This, in turn, will increase researchers' knowledge of what makes us uniquely human.

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