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Right hemispheric self-awareness: A critical assessment

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Abstract

In this commentary I evaluate the claim made by Keenan, Nelson, O'Connor, and Pascual-Leone (2001) that since self-recognition results from right hemispheric activity, self-awareness too is likely to be produced by the activity of the same hemisphere. This reasoning is based on the assumption that self-recognition represents a valid operationalization of self-awareness; I present two views that challenge this rationale. Keenan et al. also support their claim with published evidence relating brain activity and self-awareness; I closely examine their analysis of one specific review of literature and conclude that it appears to be biased. Finally, recent research suggests that inner speech (which is associated with left hemispheric activity) is linked to self-awareness—an observation that further casts doubt on the existence of a right hemispheric self-awareness.

In a widely publicized communication published in *Nature*, Keenan et al. (2001) report data suggesting that self-recognition would be the result of right hemispheric activity. The team of researchers first presented a series of pictures to a group of patients undergoing an intracarotid amobarbital (WADA) test. The pictures represented faces generated by morphing the image of a famous person with the

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patient's own face, and participants were asked to remember what picture was shown during selective anaesthesia of the right and the left hemispheres. Results indicate that most patients were unable to remember seeing their own face following an inactivation of the right hemisphere, whereas anaesthesia of the left hemisphere did not interfere with recall of the "self" face. In a second study normal participants exhibited significantly greater right hemispheric activity (as measured by evoked potentials induced by transcranial magnetic stimulation) while presented with pictures containing elements of their own face, as opposed to images of a famous person.

The fact that the right hemisphere seems to be involved in self-recognition is both intriguing and informative; but then the authors go on to suggest that "neural substrates of the right hemisphere may selectively participate in processes linked to self-awareness" (Keenan et al., 2001, p. 305)—a problematic claim I wish to closely examine here.[1]

Self-recognition has been repeatedly used to determine the presence or absence of self-awareness in primates (see Gallup, 1968, 1985, 1998) and young children (see Amsterdam, 1972). The basic hypothesis states that to recognize oneself one must first know who one is—one must possess a "self-concept," which presupposes self-observation; furthermore, exhibiting self-directed behaviors in front of a mirror would indicate that one is capable of becoming the object of one's attention, which is the very definition of self-awareness (Duval & Wicklund, 1972; Mead, 1934).

This reasoning has been challenged by Mitchell (1993) and more recently by Povinelli (1995, 1998). They both believe that self-recognition is actually associated with an unsophisticated self-concept and does not require introspection. Mitchell's argument essentially states that what the organism recognizes in front of a mirror is its body, by matching the image it sees in the mirror with a preexisting kinesthetic representation of it. Consequently, the only awareness the organism would have of itself before self-recognition is a kinesthetic sense of its body—not a "full-blown," mature awareness of its subjective experience. Povinelli's view is consistent with Mitchell's, except he thinks that what is recognized in front of a mirror is behavior emitted by the organism—the animal infers that what it sees in the mirror is the same as what it does. Povinelli also questions the presumed ability of animals that have been shown to be capable of self-recognition to make inferences about others' mental states. More precisely, Gallup (e.g., 1983) maintains that some primates are self-aware not only because they show self-recognition, but also because they emit behaviors in their natural environment (deception, altruism, empathy, etc.) that strongly suggest an ability to ponder potential intentions and emotions in others—behaviors that presuppose an access to their own mental states. According to Povinelli (1995, 1998), the problem is that in *rigorous experiments* primates are ac-

[1] It is very difficult to determine the exact meaning of "self-awareness" in the Keenan et al. (2001) article since the authors do not explicitly define this notion. Arguably, self-awareness is likely to be made up of distinct processes and self-representations scattered throughout the brain—and not just restricted to the right hemisphere. In the absence of a clear definition, however, and since Keenan et al. seem to treat self-awareness as a unitary entity with presumably unitary neurological substrates, I embrace this view in the present commentary.

tually incapable of inferring mental states in others. In one study, for example, chimpanzees (previously tested for self-recognition) were first blindfolded in order to experience how it feels not to be able to see. Then they were allowed to ask for food from two experimenters—one who could see the animals and another one who was blindfolded. If these primates were truly self-aware (i.e., if they really knew through introspection what it is like not to see), we would expect them to infer that a blindfolded experimenter cannot see them and to gesture only to the person who could see them. However, all subjects were just as likely to gesture to the person who could not see them as to the person who could.

Even if one assumes that self-recognition does indicate the presence of at least a simple form of self-awareness in animals and humans, I would suggest that these two operations are independent and should certainly not be equated. Self-awareness represents an *ability*—again, the capacity to become the object of one's own attention; self-recognition would rather be a (fairly primitive) *manifestation* or *expression* of self-awareness—the *consequence* of being able to look at oneself objectively. Thus because self-recognition takes place in the right hemisphere hardly means that self-awareness itself is located in that hemisphere.

If we take Keenan et al. (2001) rationale and stretch it to its logical limits, then it would mean that the right hemisphere should be *more* self-aware than the left hemisphere because it actually is *superior* to the left hemisphere at self-recognition (Keenan et al., 2001; Puccetti, 1976). This is highly unlikely. It is a well-known fact that the left disconnected hemisphere is fully self-aware because we can ask verbal questions to this part of the patient's brain and it will provide answers that clearly indicate that it has a full sense of self, e.g., the name it collectively shares with the right hemisphere, its current feelings, future goals, aspirations, and so on (Sperry, Zaidel, & Zaidel, 1979). I seriously doubt that anyone would argue that the left hemisphere is less self-aware that the right hemisphere even if it is poor at self-recognition.

In support to this notion that the right hemisphere would be at least partially responsible for self-awareness, Keenan et al. refer to an article published by Wheeler, Stuss, and Tulving (1997) and state that "patients with lesions to the right fronto-temporal cortex may experience a cognitive detachment from self" (p. 305). However, a closer analysis of this source actually reveals that Wheeler et al. do not specifically mention the right hemisphere—they link *both* frontal lobes to self-awareness (what they call "autonoetic consciousness"). On one instance they do report a case study of a patient suffering from right prefrontal cortex damage who displays "a dissociation between knowledge and the realization of personal relevance of that knowledge" (p. 348), but then comment on *another* case of disturbed self-awareness, this time involving *bilateral* orbital and lower mesial frontal pathology. Moreover, Wheeler et al. examine other brain pathologies leading to various forms of lack of self-awareness that would be produced by damage to sections of the *left* hemisphere. The overall conclusion of Wheeler et al.'s review is that "the prefrontal cortex, in conjunction with its reciprocal connections with other cortical and subcortical structures, empowers healthy human adults with the capacity to consider the self's extended existence throughout time" (p. 350); there is

no specific reference here to the *right* frontal lobe being exclusively involved in self-awareness.

If one wishes to localize self-awareness somewhere in the brain, then I would propose that the available evidence is rather pointing toward the left hemisphere (Morin, 2001), in conjunction with other bilateral cerebral structures, as Wheeler et al. (1997) suggest. In a recent study, Craik et al. (1999) assessed brain activity in normal subjects who were working on a self-referential encoding task. Participants were asked to evaluate how well trait adjectives described themselves by pressing response keys while relative regional cerebral blood flow was being measured. Such a task obviously requires self-awareness because it involves thinking about oneself. Control tasks included non-self-referential assignments—judging how well trait adjectives described a public figure, how socially desirable the trait adjectives were, or how many syllables there were in each adjective. In this experiment the self-referential encoding task produced significantly more activity in the left medial region of the superior frontal gyrus and in the left inferior frontal gyrus.

Interestingly enough, these brain areas of the left hemisphere have also been shown to be involved in inner speech (see Morin, 1999). For example, silently reading single words produces an increased activity in the left inferior frontal region (McGuire et al., 1996). Inner speech itself has also been associated with self-awareness (see Morin, 2001). Disruption of self-talk following aphasia for instance, negatively affects self-awareness (e.g., Moss, 1972); empirical evidence supports the notion of a relation between inner speech and self-awareness (Morin, 1995a, Morin, Everett, Turcotte, & Tardif, 1993; Rivest & Khawaja, unpublished observations, 1995; Siegrist, 1995). For example, Siegrist (1996) found that highly self-aware individuals use inner speech more frequently in comparison to less self-aware individuals. And theoretical analyses concerning the specific nature of a causal link between self-talk and self-awareness have been proposed (see Morin, 1993, 1995b). To illustrate, inner speech can reproduce social mechanisms contributing to self-awareness, i.e., self-talk allows for the incorporation of other persons' potential views of oneself ("What did he/she think of my conference?"), which then leads to a more objective awareness of oneself ("He/she seemed to appreciate my sense of humor...").

All this challenges the hypothesis according to which "a right-hemisphere network (would give) rise to self-awareness" (Keenan et al., 2001, p. 305): Again, the fact that self-recognition (which is likely to represent a partial and poor operationalization of self-awareness) is the result of right hemispheric activity certainly does not imply that the same hemisphere is responsible for self-awareness; in addition, one must not neglect the role of language (i.e., inner speech) in self-awareness—an activity deeply associated with normal functioning of the *left* hemisphere.

References

Amsterdam, B. (1972). Mirror self-image reactions before age two. *Development Psychobiology, 5*, 297–305.

Craik, F., Moroz, T., Moscovitch, M., Stuss, D., Winocur, G., Tulving, E., & Kapur, S. (1999). In search of the self: A positron emission tomography study. *Psychological Science, 10*, 26–34.

Duval, S., & Wicklund, R. A. (1972). *A theory of objective self awareness*. New York: Academic Press.

Gallup, G. G., Jr. (1968). Mirror-images stimulation. *Psychological Bulletin, 70*, 782–793.

Gallup, G. G., Jr. (1983). Toward a comparative psychology of mind. In R. L. Mellgren (Ed.), *Animal cognition and behavior* (pp. 473–510). New York: North-Holland.

Gallup, G. G., Jr. (1985). Do mind exist in species other than our own? *Neuroscience and Biobehavioral Reviews, 9*, 631–641.

Gallup, G. G., Jr. (1998, November). Can animals emphathize? Yes [29 paragraphs]. *Scientific American (Feature article: Animal self-awareness: A debate)*. Available: http://www.sciam.-com/1998/1198intelligence/1198debate.html.

Keenan, J. P., Nelson, A., O'Connor, M., & Pascual-Leone, A. (2001). Self-recognition and the right hemisphere. *Nature, 409*, 305.

McGuire, P. K., Silbersweig, D. A., Wright, I., Murray, R. M., Frackowiak, R. S. J., & Frith, C. D. (1996). The neural correlates of inner speech and auditory verbal imagery in schizophrenia: Relationship to auditory verbal hallucinations. *British Journal of Psychiatry, 169*(2), 148–159.

Mead, G. H. (1934). *Mind, self, and society*. Chicago: Univ. of Chicago Press.

Mitchell, R. W. (1993). Mental models of mirror-self-recognition: Two theories. *New Ideas in Psychology, 11*, 295–325.

Morin, A. (2001). The Split-Brain debate revisited: On the importance of language and self-recognition for right hemispheric consciousness. *Journal of Mind and Behavior, 22*(2), 107–118.

Morin, A. (1999, December). On a relation between inner speech and self-awareness: Additional evidence from brain studies. *Dynamical Psychology: An International, Interdisciplinary Journal of Complex Mental Processes* [on-line journal]. Available: http://goertzel.org/dynapsyc/.

Morin, A. (1995a). Preliminary data on a relation between self-talk and complexity of the self-concept. *Psychological Reports, 76*, 267–272.

Morin, A. (1995b). Characteristics of an effective internal dialogue in the acquisition of self-information. *Imagination, Cognition and Personality, 15*(1), 45–58.

Morin, A. (1993). Self-talk and self-awareness: On the nature of the relation. *The Journal of Mind and Behavior, 14*, 223–234.

Morin, A., Everett, J., Turcotte, I., & Tardif, G. (1993). Le dialogue intérieur comme médiateur cognitif de la conscience de soi privée: Une mesure de l'activité consistant à se parler à soi-même à propos de soi et une étude corrélationnelle [Self-talk as a mediator of private self-consciousness: A measure of the activity to talk to oneself about oneself and a correlational study]. *La Revue Québécoise de Psychologie, 14*, 3–19.

Moss, V. V. (1972). *Recovery with aphasia*. Champaign: Univ. of Illinois Press.

Povinelli, D. J. (1995). The unduplicated self. In P. Rochat (Ed.), *The self in early infancy* (pp. 161–192). Amsterdam: North-Holland/Elsevier.

Povinelli, D.J. (1998, November). Can animals emphathize? Maybe not [30 paragraphs]. *Scientific American (Feature article: Animal self-awareness: A debate)*. Available: http://www.sciam.com/1998/1198intelligence/1198debate.html.

Puccetti, R. (1976). The mute self: A reaction to DeWitt's alternative account of the split-brain data. *British Journal of the Philosophy of Sciences, 27*, 66–73.

Siegrist, M. (1995). Inner speech as a cognitive process mediating self-consciouness and inhibiting self-deception. *Psychological Reports, 76*, 259–265.

Siegrist, M. (1996). The influence of self-consciousness on the internal consistency of different scales. *Personality and Individual Differences, 20*, 115–117.

Sperry, R., Zaidel, E., & Zaidel, D. (1979). Self-recognition and social awareness in the disconnected minor hemisphere. *Neuropsychologia, 17*, 153–166.

Wheeler, M. A., Stuss, D. T., & Tulving, E. (1997). Toward a theory of episodic memory: The frontal lobe and autonoetic consciousness. *Psychological Bulletin, 121*, 331–354.