

PRESERVED KNOWLEDGE OF SELF IN A CASE OF ALZHEIMER'S DEMENTIA

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We report the case of K.R., an individual with Alzheimer's dementia. Although K.R. has difficulty retrieving even mundane facts about the world, she has accurate knowledge of her own personality. But the self she knows is out-of-date. K.R.'s inability to update her trait self-knowledge stands in contrast to other neuropsychological cases in which individuals can acquire and update their fund of personality knowledge despite impairments to semantic and episodic memory. Results add to the growing body of literature suggesting that semantic memory contains a subsystem devoted to the acquisition and representation of trait self-knowledge.

Recent neuropsychological studies suggest that the unified self of everyday experience may actually be composed of at least five functionally (and neurally) isolable components (e.g., Klein, 2001; Klein, Rozendal, & Cosmides, 2002). These include: (a) episodic memories of one's own life (e.g., Levine, et al., 1998), (b) representations of one's own personality traits (e.g., Klein, Loftus, Trafton, & Fuhrman, 1992), (c) facts about one's personal history (semantic personal knowledge; e.g., Klein et al., 2002; Wheeler, Stuss, & Tulving, 1997), (d) experience of personal agency and continuity through time (e.g., Gallagher, 2000; Klein, Loftus, & Kihlstrom,

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2002), and (e) the ability to reflect on one's own thoughts and experiences (e.g., Gallagher, 2000; Stuss, 1991).

One component of the self—knowledge of one's personality traits—is surprisingly resilient in the face of brain damage and developmental disorders. It can be preserved without any retrievable episodic memory, as shown through case studies of patients D.B. (Klein, 2001; Klein, Rozendal, & Cosmides, 2002), K.C. (Tulving, 1993) and R.J. (Klein, Loftus, & Chan, 1999). Indeed, recent neuropsychological evidence demonstrates that individuals lacking access to episodic memory can, nevertheless, update their fund of personality knowledge (e.g., Klein, Cosmides, Costabile & Mei, 2002; Tulving, 1993).

Personality knowledge can also be preserved in the face of moderate impairments to other domains of knowledge (e.g., Klein, Rozendal, & Cosmides, 2002). For example, when R.J., an individual with autism, is asked to judge features of common objects (e.g., Is a lemon sour? Is a balloon round?), his answers do not correlate with those provided by others of the same mental age. Yet when asked about his own personality traits (e.g., Are you friendly? Are you messy?), R.J.'s answers are both reliable and accurate (Klein, Cosmides, Costabile & Mei, 2002). Because R.J.'s condition is caused by a developmental disorder, this pattern speaks not only to storage and retrieval but to acquisition as well: It raises the possibility that there may be mechanisms specialized for acquiring knowledge of personality, that can remain intact even when the mechanisms for acquiring knowledge of other domains are quite impaired.

Here we report the case of K.R., a patient with severe dementia brought on by Alzheimer's disease. Despite a striking inability to retrieve even mundane facts about the world and her surroundings, K.R. has intact, retrievable knowledge of her personality traits and those of her daughter. Interestingly, however, her knowledge is of her personality before the onset of Alzheimer's dementia. In contrast to other patients with memory impairments (Tulving, 1993), K.R. appears incapable of updating her database of trait self-knowledge.

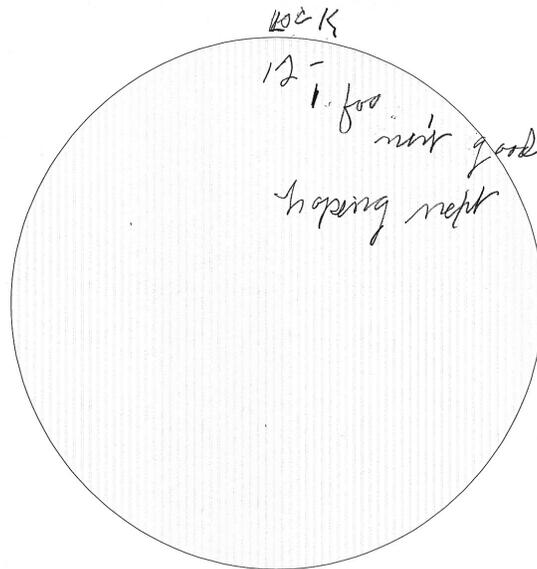


FIGURE 1. Drawing of clock by patient K.R.: Patient was presented with a printed circle and asked to mark in all the numbers to indicate the hours of a clock (GPCOG, Patient Examination subscale, item 3).

NEUROLOGICAL CASE

Patient K.R. is a 76-year-old right-handed college-educated female who was a high school guidance counselor for 35 years. In 2000, she was diagnosed with Alzheimer's dementia and moved into assisted living. K.R. is otherwise in good health and is being treated with the drug Aricept®.

K.R.'s cognitive functioning is typical of individuals with advanced dementia. She is disoriented for time and place and experiences difficulties with word finding and object naming. K.R. cannot, for example, name simple objects such as batteries and pencils or draw the face of a clock from memory (Fig 1). Her anterograde memory function is severely impaired, leaving her unable to recall events she had in mind only moments before. Knowledge of her personal past is at best sketchy: for example, she sometimes believes her late husband is alive, and her estimates of how long she has lived in her current facility range from 2 months to 14 years. To document the ex-

tent of her dementia, we administered a battery of tests of cognitive functioning, such as the Mini-Mental State Examination (MMSE); (Cockrell & Folstein, 1988) and the General Practitioner Assessment of Cognition (GPCOG); (Brodaty et al., 2002). On both, K.R.'s scores indicated severe dementia (See Table 1).

ASSESSMENT OF TRAIT SELF-KNOWLEDGE

Despite these profound cognitive deficits, K.R. has intact knowledge of her own personality traits. We asked K.R. on two occasions (separated by two weeks) to judge a list of personality traits for self-descriptiveness (e.g., "Does this describe you: *Stubborn*? Yes or No"). The traits were selected from norms provided by Kirby and Gardner (1972) and Anderson (1968). The traits were close to the norm means on the dimensions of meaningfulness and familiarity and spanned the range of social desirability. We also asked K.R.'s daughter and her caregiver at the assisted living facility to rate K.R. on the same traits.¹

The results showed that K.R.'s test-retest ratings were reliable ($r = .86, p < .001$). However, her ratings did not agree with the ratings provided by either her daughter or her caregiver ($r_s = .31, -.11$, for daughter and caregiver, respectively, $p_s > .10$). This lack of consistency was not because the daughter and caregiver were poor judges of character; when asked to rate other individuals, their judgments correlated strongly with those of others.²

How can K.R.'s ratings be so reliable, yet agree so little with those who know her best? It is common for patients suffering Alzheimer's dementia to undergo changes in personality and behavior (e.g., Mills, 1998; Siegler, Dawson, & Welsh, 1994). According to her fam-

1. Informed consent was obtained from all participants. In the case of patient K.R. we additionally obtained consent on her behalf both from her daughter and from the staff at the Gables Assisted Living Facility.

2. To see whether the caregiver was a good judge of character, he was asked to rate two neurologically healthy controls of similar age to K.R. (74, 85) and similar length of residence at the facility (2 and 3.5 years, respectively). His ratings strongly correlated with those of the controls ($r_s = .72, .53, p < .001, .01$, respectively). K.R.'s daughter was asked to rate her own personality, as was her husband: These, too, were strongly correlated ($r = .61, p < .001$).

TABLE 1. Assessment of Patient K.R.'s Cognitive Function

Measure	Maximum Score	Cut-Off Score*	K.R.
MMSE	30	< 23	9
GPCOG			
Patient Section	9	< 5	1
Informant Section	6	< 4	0

*The cut-off score refers to "definitely abnormal" values.

ily, K.R.'s personality changed dramatically as the disease progressed, but K.R. seems unaware of her transformation. This suggests that the disease may have impaired K.R.'s ability to update the mental records that store information about her personality. If her self-knowledge is intact but not being updated, then K.R.'s ratings should reflect her premorbid personality rather than her current one.

To test this hypothesis, we asked K.R.'s daughter to rate her mother on the same list of traits, only this time she was asked to base her ratings on her mother's personality prior to the onset of the disease. These ratings were strongly correlated with those provided by K.R. herself ($r = .59, p < .01$). So were pre-onset trait ratings of K.R. provided by her son-in-law ($r = .79, p < .001$). This indicates that K.R.'s ratings are accurate, but reflect her pre-Alzheimer's personality.

K.R. also knows her daughter's personality traits: When asked to rate her daughter on the same list of traits, her ratings correlated strongly with her daughter's self-ratings ($r = .65, p < .001$). This is expected if K.R.'s fund of personality knowledge was created premorbidly, and remains intact. But if, as hypothesized, K.R. has lost the ability to update her personality files, then her ratings should be inaccurate for people who she first met after the onset of her dementia.

This was the case. On two occasions (again, two weeks apart), K.R. was asked to rate her caregiver, whom she has known for 2.5 years. When the subject was her caregiver, K.R.'s test-retest reliability was low ($r = .34, p > .10$), in striking contrast to the reliability of her self-ratings ($r = .86$). Moreover, K.R.'s ratings of the caregiver

showed little overlap with the caregiver's ratings of his own personality ($r = .18, p > .20$). This is not due to the caregiver having a skewed view of himself: His self-ratings were strongly correlated with those provided by two neurologically healthy women living in the same facility, who are similar in age to K.R. and have known him for about the same length of time ($r_s = .73, .68, p < .001$; see footnote 2). This also shows that K.R.'s inability to acquire new personality information is not a simple manifestation of the normal aging process: Neurologically healthy age-matched controls were quite capable of acquiring accurate knowledge of the personality of someone they had recently met.

CONCLUSIONS

Despite profound cognitive deficits, K.R. has intact knowledge of her own premorbid personality and that of her daughter. That her trait knowledge has been preserved and remains retrievable is remarkable given the difficulties she has retrieving ordinary facts from semantic memory—the names of everyday objects, what a clock looks like, where she is. Like the cases of R.J. and D.B., K.R.'s preserved self-knowledge is a dissociation *within* semantic memory, suggesting the presence of a functionally specialized database for the storage and retrieval of information about personality.

It would appear, however, that the computational machinery responsible for updating personality knowledge has been impaired in K.R. by the Alzheimer's disease. K.R. does not know her own current, postmorbid personality, nor has she been able to learn the personality traits of her primary caregiver.

Neural dissociations in other patients suggest that personality knowledge is acquired via learning mechanisms that are specialized for that purpose (Klein, Rozendal, & Cosmides, 2002; Klein, Cosmides, Costabile, & Mei, 2002). Individuals with profound episodic amnesia can nevertheless update their trait self-knowledge (e.g., Tulving, 1993). Moreover, accurate personality knowledge can be acquired despite developmental disorders that impair one's ability to acquire general world knowledge (as well as episodic retrieval) (e.g., Klein, Cosmides, Costabile, & Mei, 2002;

Klein, Loftus, & Chan, 1999). In K.R., we see a case where trait knowledge of self and other remains intact, but the ability to update that knowledge based on new experiences is no longer functional.

Why should the mind contain a database specialized for storing and retrieving knowledge about personality traits? Klein, Cosmides, Tooby and Chance (2002) argue that the function of this database is to provide decision-making mechanisms with fast access to information that helps one navigate the social world. Because social life is so adaptively important for our species, it should not be surprising to find that this database is resilient in the face of trauma and developmental disruptions. Nor should it be surprising to find mechanisms specialized for creating and refreshing this database; people change with time and experience, and the database needs to be constantly updated so that it accurately captures what a person is like at the moment that relevant decisions are made.

These results add to a growing body of case studies demonstrating that some components of the self can be selectively spared while others are profoundly damaged (e.g., Klein, 2001; Klein, Cosmides, Costabile, & Mei, 2002; Klein, Loftus, & Kihlstrom, 1996; Klein, Rozendal, & Cosmides, 2002; Tulving, 1993; Wakabayshi, 2003; Wheeler et al., 1997). Across these cases, trait self-knowledge has been preserved in the face of impairments to episodic retrieval, personal temporality, general world knowledge, and the meta-representational skills that allow self-reflection. In contrast, there are no documented cases in which a person has lost trait self-knowledge while retaining other components of the self.

Clinicians and families often characterize late-stage Alzheimer's patients as lacking a sense of self (e.g., Cohen & Eisdorfer, 1986; Fontana & Smith, 1989; Orona, 1990; Ronch, 1996). Our findings suggest a more nuanced view. Alzheimer's patients may be operating from knowledge of a former self, which may not be congruent with their current behavior. Clinicians and family may need to be sensitive to the possibility that such individuals may see themselves as they were, not as they are.

REFERENCES

- Anderson, N.H. (1968). Likeableness ratings of 555 personality-trait words. *Journal of Personality and Social Psychology, 9*, 272-279.
- Brodsky, H., Pond, D., Kemp, N.M., Luscombe, G., Harding, L., Berman, K., & Huppert, F.A. (2002). The GPCOP: A new screening test for dementia designed for general practice. *Journal of the American Geriatric Society, 50*, 530-534.
- Cockrell, J.R., & Folstein, M.F. (1988). Mini-mental states examination (MMSE). *Psychopharmacological Bulletin, 24*, 689-692.
- Cohen, D., & Eisdorfer, C. (1986). *The Loss of self: A family resource for the care of Alzheimer's disease and related disorders*. W.W. Norton: New York.
- Fontana, A. & Smith, R.W. (1989). Alzheimer's disease victims: The "unbecoming" of self and the normalization of competence. *Sociological Perspectives, 32*, 35-46.
- Gallagher, S. (2000). Philosophical conceptions of the self: Implications for cognitive science. *Trends in Cognitive Sciences, 4*, 14-21.
- Kirby, D.M., & Gardner, R.C. (1972). Ethnic stereotypes: Norms on 208 words typically used in their assessment. *Canadian Journal of Psychology, 26*, 140-154.
- Klein, S.B. (2001). A self to remember: A cognitive neuropsychological perspective on how the self creates memory and memory creates self. In C. Sedikides & M.B. Brewer (Eds.), *Individual self, relational self, and collective self* (pp. 25-46). Philadelphia, PA: Psychology Press.
- Klein, S.B., Chan, R.L., & Loftus, J. (1999). Independence of episodic and semantic self-knowledge: The case from autism. *Social Cognition, 17*, 413-436
- Klein, S.B., Cosmides, L., Costabile, K.A., & Mei, L. (2002). Is there something special about the self? A neuropsychological case study. *Journal of Research in Personality, 36*, 490-506.
- Klein, S.B., Cosmides, L., Tooby, J., & Chance, S. (2002). Decisions and the evolution of memory: Multiple systems, multiple functions. *Psychological Review, 109*, 306-329.
- Klein, S.B., Loftus, J., & Kihlstrom, J.F. (1996). The self knowledge of an amnesic patient: Toward a neuropsychology of personality and social psychology. *Journal of Experimental Psychology: General, 125*, 250-260.
- Klein, S.B., Loftus, J., & Kihlstrom, J.F. (2002). Memory and temporal experience: The effects of episodic memory loss on an amnesic patient's ability to remember the past and imagine the future. *Social Cognition, 20*, 353-379.
- Klein, S.B., Loftus, J., Trafton, J.G., & Fuhrman, R.W. (1992). Use of exemplars and abstractions in trait judgments: A model of trait knowledge about the self and others. *Journal of Personality and Social Psychology, 63*, 739-753.
- Klein, S.B., Rozendal, K., & Cosmides, L. (2002). A social-cognitive neuroscience analysis of the self. *Social Cognition, 20*, 105-135.
- Levine, B., Black, S.E., Cabezza, R., Sinden, M., McIntosh, A.R., Toth, J.P., Tulving, E., & Stuss, D.T. (1998). Episodic memory and the self in a case of isolated retrograde amnesia. *Brain, 121*, 1951-1973.
- Mills, M.A. (1998). *Narrative identity and dementia*. Aldershot, UK: Ashgate Pub Ltd.
- Orona, C.J. (1990). Temporality and identity loss due to Alzheimer's disease. *Social Science & Medicine, 30*, 1247-1256.
- Ronch, J.L. (1996). Mourning and grief in late life Alzheimer's dementia: Revisiting the vanishing self. *American Journal of Alzheimer's Disease, 11*, 25-28.

- Siegler, I.C., Dawson, D.V., & Welsh, K.A. (1994). Caregiver Ratings of Personality Change in Alzheimer's Disease Patients: A Replication. *Psychology and Aging, 9*, 464–466.
- Stuss, D.T. (1991). Self, awareness and the frontal lobes: A neuropsychological perspective. In J. Strauss, & G.R. Goethals, (Eds.), *The self: Interdisciplinary approaches* (pp. 255–278). New York: Springer-Verlag.
- Tulving, E. (1993). Self-knowledge of an amnesic individual is represented abstractly. In T.K. Srull & R.S. Wyer (Eds.), *Advances in social cognition* (Vol 5, pp. 147–156). Lawrence Erlbaum: Hillsdale, NJ.
- Wakabayashi, A. (2003). *Is knowledge of personality episodic or semantic? Trait self-knowledge of an amnesic patient—another case in Japan*. Unpublished manuscript.
- Wheeler, M.A., Stuss, D.T., & Tulving, E. (1997). Toward a theory of episodic memory: The frontal lobes and autonoetic consciousness. *Psychological Bulletin, 121*, 331–354.