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ON THE ACQUISITION OF KNOWLEDGE ABOUT PERSONALITY TRAITS: DOES LEARNING ABOUT THE SELF ENGAGE DIFFERENT MECHANISMS THAN LEARNING ABOUT OTHERS?

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We report the case of R. J., an individual with autism. R. J.'s developmental disorder has impaired his ability to retrieve episodic memories as well as his ability to acquire consensually shared knowledge of animals, foods, and objects (Klein, Cosmides, Costabile, & Mei, 2002). Nevertheless, R. J. has developed normal, consensually accurate knowledge of his own personality traits (Klein, Chan, & Loftus, 1999). Moreover, his self–ratings show that he sees his own personality as distinct from the personalities of others. But R. J.'s facility in learning about his own personality does not translate into a facility in learning about the personality traits of others: He fails to differentiate between the personalities of his various family members, and his ratings of them appear to be less nuanced and less situationally specific than his ratings of his own personality. This pattern is radically at variance from that shown by cognitively normal individuals. Because R. J.'s dissociation is developmental in origin, it can illuminate the nature of the learning mechanisms by which knowledge of personality traits is acquired. It suggests that learning about one's own personality traits may engage a different set of mechanisms than learning about the personality traits of others.

How do we come to know our own personality traits? The cognitive architecture of an individual is able to learn the personality traits of

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the individual in which it is situated—of the self —as well as those of others. To acquire, store, and retrieve knowledge about personality traits, that architecture must have learning mechanisms for acquisition, databases for storage, and search engines for retrieval (for discussion, see Klein, Cosmides, Tooby, & Chance, 2002). A cognitive account of these mechanisms, databases, and search engines is beginning to emerge from a set of interlocking results that triangulate the performance of individuals with normal cognitive function with that of five individuals with neuropsychological disorders: K. C. (Tulving, 1993), W. J. (Klein, Loftus, & Kihlstrom, 1996), D. B. (Klein, Rozendal, & Cosmides, 2002), K. R. (Klein, Cosmides, & Costabile, 2003), and R. J. (Klein, Chan, & Loftus, 1999; Klein, Cosmides, Costabile, & Mei, 2002). Taken together, the cognitive and neuropsychological evidence suggests that knowledge of personality traits may be acquired through domain–specific learning mechanisms, stored in proprietary databases, and retrieved via functionally specialized search engines (e.g., Klein, in press; Klein, Cosmides, Tooby et al., 2002).

Here we report new evidence from patient R. J. suggesting a dissociation of acquisition *within* the domain of personality traits. R. J., who is autistic, seems to have accurate, nuanced, and perhaps situation–specific knowledge of his own personality traits, but highly stereotyped knowledge of the personality traits of his family members. Because R. J.'s dissociations are developmental in origin, these results suggest that the mechanisms deployed in acquiring personality self–knowledge may differ from those used in acquiring knowledge of other people's personality traits.

Before presenting the results, we briefly describe the picture that is emerging of how personality trait information is acquired, stored, and retrieved (for a fuller review, see Klein, in press; Klein, Cosmides, Tooby et al., 2002).

TRAIT SUMMARIES: SEMANTIC VERSUS EPISODIC MEMORY SYSTEMS

TRAIT SUMMARIES EXIST

Episodic memories of a personal past clearly are one source of information about the self (and others), but they are not the only source. Research over the past ten years has provided evidence that the cog-

nitive architecture computes and stores information about personality traits in the form of trait generalizations (e.g., *Self: usually stubborn*; *Mom: rarely rude*; *Dad: somewhat generous*). Information about one's personality traits is abstracted from specific behaviors, either as they happen or on the basis of episodic memories of these behaviors. These abstractions are stored in the form of pre–computed trait summaries (e.g., Budesheim & Bonnelle, 1998; Buss & Craik, 1984; Hirshman & Lanning, 1999; Klein, 2001; Klein & Loftus, 1993; Klein, Loftus, Trafton, & Fuhrman, 1992; Lord, 1993; Wakabayashi, 2003).

Consequently, when asked what we are like—whether we are kind, stubborn, talkative, rude, artistic, and so on—we do not have to compute the answer online based on information retrieved from episodic memory. Instead, trait judgments are made by direct retrieval from the trait summary database (e.g., Klein & Loftus, 1993; Klein, Babey, & Sherman, 1997; Klein et al., 1992; Klein, Sherman, & Loftus, 1996; Schell, Klein, & Babey, 1996).

This database is usually conceptualized as a form of semantic memory because the information it contains is generalized, context–free, and lacks a source tag—that is, it is experienced as knowledge without regard to where and when that knowledge was obtained (e.g., Perner & Ruffman, 1994; Tulving 1983, 1995; Wheeler, Stuss, & Tulving, 1997).

FAST-ACCESS DATABASE

These trait summaries form a fast-access database, which provides quick answers to decision processes that require trait judgments. Answers are available, on average, five to six seconds faster when a trait summary can be retrieved compared to when an answer must be computed from the retrieval of relevant episodic memories (e.g., Klein & Loftus, 1993).

RETRIEVAL OF TRAIT SUMMARIES IS FUNCTIONALLY INDEPENDENT OF EPISODIC MEMORY RETRIEVAL

If semantic memory contains a database of personality trait summaries, then an amnesic patient should be able to know what he or she is like despite being unable to recall the particular experiences from

which that knowledge was derived. There now is neuropsychological data from three such patients that supports this hypothesis: K. C. (Tulving, 1993), W. J. (Klein, Loftus et al., 1996), and D. B. (Klein, Rozendal et al., 2002). The cases of K. C. and D. B. are particularly dramatic: each suffered brain damage that resulted in a permanent inability to retrieve episodic memories. Nevertheless, each had accurate knowledge of his own personality traits and could report that knowledge. (Here, as in other studies, accuracy was measured by comparing each individual's ratings of his own personality traits with ratings made by people who know that individual well [e.g., a mother or daughter]).

SUMMARIES CAN BE UPDATED WITHOUT ACCESS TO EPISODIC MEMORIES

K. C. suffered from complete retrograde and anterograde amnesia—he could not recollect anything that had ever happened to him. Moreover, he underwent a personality change after his motorcycle accident. Interestingly, K. C.'s personality knowledge reflected his current, postmorbid personality, not his personality prior to the accident (Tulving, 1993). This suggests that updating of summaries can occur online, as behavioral episodes are unfolding in the present. It does not depend entirely on later retrieval of episodic memories of those events.

TRAIT JUDGMENT ACTIVATES SPECIALIZED RETRIEVAL MECHANISMS

Priming paradigms reveal that retrieval of trait information follows a functional logic that provides a good combination of speed and accuracy. When asked to make a trait judgment, search engines first search the fast–access database for a trait summary. If a summary is retrieved, there is no activation of trait–consistent behavioral episodes (i.e., memories of events in which one manifested the trait in question). But retrieval of a trait summary does activate trait–inconsistent episodes—for example, retrieval of the summary "*Self: Usually friendly*" will co–activate memories of situations in which one behaved in an unfriendly manner (e.g., Babey, Queller, & Klein, 1998; Klein, Cosmides, Tooby, & Chance, 2001). This pattern makes functional sense. Generalizations are more helpful if one knows their boundary conditions because trait–in-

consistent episodes contain information about situations in which the trait summary does not apply (i.e., they place boundary conditions on the scope of a trait summary). In contrast, the information a trait–consistent episode provides would be redundant with the summary (Klein, Cosmides, Tooby et al., 2002).

The pattern of priming for trait judgment is not only functional, it differs from that for other domains (Klein, Cosmides, Tooby et al., 2002). In many domains, activation of a memory trace speeds retrieval of that and related memory traces on subsequent trials (e.g., perceptual priming; Anderson, 1976; McNamara, 1992). If this pattern applied to trait judgment, activation of a trait summary would speed retrieval of trait–*consistent* episodes, whose semantic content is highly related to the summary. This, however, does not happen. Trait–consistent episodes are retrieved when the search engine fails to retrieve a trait summary (e.g., when a summary does not exist yet for a particular trait). Judgments are then made on the basis of the memories of these trait–consistent events (e.g., Klein et al., 2001; Klein & Loftus, 1993).

TRAIT SUMMARIES ARE STORED IN A PROPRIETARY DATABASE

Patients K. R., D. B. and R. J. have intact knowledge of their own personality traits but impairments in their knowledge of other domains. That is, they manifest content–specific dissociations within semantic memory. These dissociations suggest that the personality trait database is a functionally and neurally distinct subsystem of semantic memory.

K. R. is a woman with severe dementia brought on by Alzheimer's disease. Despite a striking inability to retrieve certain mundane facts about the world and her surroundings (e.g., what a clock looks like, what a pencil is called), K. R. had intact, retrievable knowledge of her own personality traits and those of her daughter (Klein et al., 2003). Interestingly, her knowledge was of her personality before the onset of Alzheimer's dementia. In contrast to K. C. (see above), K. R. appears incapable of updating her database of trait self–knowledge.

D. B. also showed preserved trait self–knowledge with impaired knowledge of other domains. The heart attack-induced anoxia that caused D. B. to lose access to his episodic memory also affected his se-

mantic memory, although less severely (Klein et al., 2002). For example, although he was able to accurately recount a number of details about certain historical events (e.g., the Civil War), his knowledge of other historical facts was seriously compromised (e.g., he claimed that America was discovered by the British in 1812). Despite these impairments in D. B.'s general semantic knowledge, his knowledge of his own personality was intact.

Additional testing revealed a dissociation between D. B.'s knowledge of his own personality traits and the traits of others. D. B. could not retrieve accurate knowledge of his daughter's personality traits: The correlation between D. B.'s ratings of his daughter and her self–ratings was not reliable, and was less than half that found between control parents' ratings of their child and the child's self–ratings. Thus, although D. B.'s ability to retrieve accurate knowledge of his own personality was intact—no different from that of age–matched controls—he had lost the ability to retrieve accurate personality information about his adult daughter.

In short, D. B.'s case goes beyond the usual episodic/semantic distinction. It suggests category–specific dissociations within semantic memory. His ability to retrieve trait self–knowledge is intact; his ability to retrieve his daughter's traits is impaired; and his knowledge about the world at large is impaired. This pattern raises the possibility that the human cognitive architecture includes a subsystem of semantic memory that is functionally specialized for the storage and retrieval of trait self–knowledge.

R. J., the subject of this report, also manifests category–specific dissociations within semantic memory. But because of the special circumstances of his case, his dissociations speak not only to storage and retrieval, but to acquisition as well. We discuss some of his case history in the next section.

THE ACQUISITION OF KNOWLEDGE ABOUT PERSONALITY TRAITS

The human cognitive architecture is capable of acquiring knowledge about many domains of life—language, foods, animals, tools, and so on. But there is no single learning mechanism that causes knowledge acquisition across all domains (e.g., Gallistel, 2000). Language (especially grammar) is acquired via learning mechanisms that are spe-

cialized for that purpose (e.g., Pinker, 1994). Phobias are also acquired via functionally specialized learning mechanisms, ones that respond strongly to stimuli that were dangerous in ancestral environments (e.g., spiders, snakes, felids), whether or not these pose a threat in the modern world (e.g., Marks, 1987; Ohman & Mineka, 2003). But what about knowledge of personality traits? Is this acquired by a domain–general default learning mechanism of some as yet unspecified kind, or is there an acquisition system specialized for this function?

Dissociations that arise from developmental disorders can reveal the presence of functionally distinct learning mechanisms. For example, SLI (specific language impairment), a disorder caused by a point mutation of the FOXP2 gene (Enard et al., 2002), can impair the ability to acquire syntactical inflections without affecting learning in other domains (such as mathematics). The converse dissociation is found in children with Williams's syndrome, who can become fluent speakers despite pervasive difficulties in acquiring general world knowledge (e.g., Johnson & Carey, 1998; Pinker, 1994). These dissociations would be impossible if the same learning mechanism caused the acquisition of both grammatical knowledge and knowledge about other domains; functionally distinct mechanisms must be involved.

The same logic can be applied to understand the acquisition of personality trait information. Preliminary evidence from R. J., whose dissociations are developmental in origin, suggests that personality traits may be acquired by means of learning mechanisms that are specialized for that function.

ACQUISITION OF TRAIT SUMMARIES DOES NOT DEPEND ON EPISODIC MEMORY

K.C's ability to update already formed trait summaries suggests that summary acquisition does not depend on the ability to consciously retrieve memories of behavioral episodes. However, stronger evidence comes from the case of R. J., who is also the subject of the present study.

Patients K. C., W. J., and D. B. lost access to episodic memory as a result of brain trauma. There are, however, cases of individuals for whom episodic memory failed to develop in the first place (e.g.,

Ahern, Wood, & McBrien, 1998; Klein et al., 1999; Vargha–Khadem et al., 1997). Such developmental dissociations are interesting because they permit inferences about the acquisition of trait knowledge that are not licensed by the discovery of dissociations caused by brain trauma in adults.

Consider, for example, two alternative hypotheses about how personality trait summaries are initially constructed. The abstraction process could occur online, as behavioral events unfold in the present. Alternatively, abstraction could occur offline, by accessing a database of episodic memories. This second hypothesis cannot be ruled out by cases like K. C., W. J. and D. B.: Their intact semantic self–knowledge could have been derived from episodic memories during the years prior to the brain trauma that caused their episodic loss as adults. But consider the implications of finding an individual who never has developed the ability to access episodic memories, yet has intact semantic knowledge of his or her own personality traits. This developmental dissociation would suggest that building a semantic database of trait self–knowledge does not require access to a database of episodic memories.

Autism is a developmental disorder, which has been hypothesized to impair the cognitive machinery that supports metarepresentations from developing normally (Baron–Cohen, 1995; Baron–Cohen, Leslie, & Frith, 1985; Leslie, 1987). It has been proposed that episodic memories are stored in and retrieved via metarepresentations (e.g., Cosmides & Tooby, 2000; Perner, 1991). If so, then autism should disrupt the normal development of episodic memory. To test this prediction, Klein et al. (1999) assessed the episodic memory of R. J., a 21-year-old male with autism.

Compared with I.Q.-matched, neurologically healthy controls, R. J. was found to be severely impaired on a variety of tests of recall, especially when memory for personally experienced events was tested (e.g., the Galton–Crovitz task). Although his impairment was developmental in origin, his episodic performance was similar to that found in classic amnesia caused by brain trauma (similar findings have been reported by Boucher, 1981, Boucher & Warrington, 1976, Millward, Powell, Messer, & Jordan, 2000; but see Minshew & Goldstein, 1993).

Despite this deficit in episodic retrieval, R. J. demonstrated reliable and accurate knowledge of his personality traits. His test–retest correlations were high (r = .86) and comparable to that of matched controls

(r = .78). Moreover, the correlation between R. J.'s trait self–ratings and his mother's ratings of him was significant (r = .56) and did not differ reliably from that obtained from control mother–son pairs (r = .50). R. J.'s self–ratings also were compared with ratings of R. J. obtained from one of his teachers; the correlation again was reliable and comparable to those obtained between control mother–son pairs. These findings show that R. J.'s knowledge of what he is like accurately reflects how he is perceived by people with whom he interacts.

But how did R. J. acquire knowledge of his own personality traits? His case suggests that conscious access to a database of episodic memories is unnecessary. R. J. has great difficulty retrieving episodic memories now and, because his impairment is developmental in origin, he probably never developed a normal ability to do so in the first place. This means it is unlikely that the abstraction process occurred offline on the basis of consciously accessed episodic memories.

Such offline processing might occur in cognitively normal individuals, but R. J.'s case shows that it is not the only way whereby trait knowledge is acquired. R. J.'s case is consistent with two (nonexclusive) possibilities: (a) acquisition mechanisms can abstract personality traits online from personal experiences as they unfold in the present, or (b) abstraction can operate offline—after the fact—on memory traces of episodes without them having been consciously retrieved.[1] These would seem to be the only sources of data available to R. J. from which abstraction could proceed.

All five cases—K. C., W. J., D. B., K. R. and R. J.—show that trait self–knowledge can *exist* independently of episodic access. But R. J.'s developmental dissociation indicates that the *acquisition* of trait self–knowledge does not require episodic access.

LEARNING ABOUT THE WORLD: ACQUISITION OF TRAIT KNOWLEDGE CAN DISSOCIATE FROM ACQUISITION OF KNOWLEDGE IN OTHER DOMAINS

The case of R. J. suggests something further: Personality knowledge may be acquired via learning mechanisms that are functionally dis-

1. It can, however, be argued that the notion of "unconscious episodic access" constitutes an oxymoron under current definitions of episodic memory (e.g., Tulving, 1985, 1995, 2002; Wheeler et al., 1997).

tinct from those that cause the acquisition of knowledge about other domains.

Further tests of R. J. revealed content–specific dissociations within his semantic memory (Klein, Cosmides, & Costabile, 2002). When R. J. was asked to judge features of common objects (e.g., Is a lemon sour? Is a balloon round? Is a peacock colorful?), his answers were reliable across sessions. However, they did not correlate with those provided by I.Q.-matched, neurologically healthy controls. There was high agreement among controls, with correlations among their answers ranging from .78 to .81. In contrast, correlations between R. J.'s answers and controls ranged from .18 to .33. R. J.'s results join those reported for patients D. B. and K. R. in suggesting a dissociation *within* semantic memory between general semantic knowledge and semantic knowledge of one's own personality traits.

Because R. J.'s dissociation is developmental in origin, it also speaks to the specificity of the learning process. R. J.'s atypical semantic knowledge is not due to a general inability to understand or answer questions—his ability to answer personality questions about himself is fine. This pattern—consensually accurate personality knowledge co–existing with odd, nonconsensual knowledge of foods, animals, and objects—is surprising. One would think the evidence of one's senses would allow the easy acquisition of knowledge about tastes, shapes, and colors. Indeed, words like sweet, tall, and large are more concrete and have more obvious referents than personality terms such as "*kind*," "*friendly*," and "*ungrateful*." Nevertheless an individual with autism was able to learn his own personality traits, but was unable to acquire consensually–held knowledge of foods, animals, and objects. Because R. J.'s condition is caused by a developmental disorder, this pattern raises the possibility that there may be mechanisms specialized for acquiring knowledge of one's own personality, which can develop normally even when the mechanisms for acquiring knowledge of other domains do not.

R. J.'s ability to acquire knowledge of his own personality traits appears to be intact, but can he acquire knowledge of other people's personality traits? That is, does acquisition of knowledge about one's own personality traits differ in any way from the acquisition of knowledge about other people's traits? The present study examined

this question by testing R. J.'s knowledge about the personalities of well–known others—his mother, father and, brother.

METHOD

PARTICIPANTS

R. J., a male, was 21 at the time the study was conducted. Psychiatric evaluation resulted in a diagnosis of autism and pervasive developmental disorder (for details, see Klein et al., 1999). R. J. had a history of symptoms consistent with these dual diagnoses, dating back to approximately eight months of age. The symptoms that led to his diagnoses included disturbances in socialization, communication, and imagination as well as self–injurious behaviors.

In contrast to his social and interpersonal deficits, R. J. was competent in a variety of academic domains, including reading, spelling, and math. In conversation, he showed good vocabulary and grammar, and answered questions willingly. On the Wechsler Intelligence Scale for Children, Revised (Wechsler, 1981), he achieved a verbal IQ of 67, a performance IQ of 64, and a full-scale IQ of 63, which placed him in the mildly retarded range of intellectual function. These scores indicate that R. J. is a high–functioning autistic person with moderate intellectual impairment.

R. J.'s mother, father, and brother also were participants; they are highly educated, and the father and brother both hold professional degrees. The members of another family served as a comparison group (see below).

PROCEDURE

To investigate R. J.'s access to semantic trait knowledge about others, he was provided with a questionnaire containing 26 trait words (see Klein et al., 1999 for selection criteria). Beside each trait word were three choices: "*not at all*," "*somewhat*," and "*definitely*." R. J. was instructed to indicate, by circling the appropriate choice, the extent to which each trait described how he viewed a designated target person. The targets selected were his mother, father, and brother. R. J.'s parents and brother also completed the questionnaire, indicating for each trait how well it described them. The brother also rated R. J., his mother, and his father. Finally R. J.'s mother provided trait ratings of

R. J. (due to a logistics problem, we were unable to acquire the father's ratings of R.J).

R. J.'s ratings were collected in several sessions spanning a two-month period. In the first session, R. J. rated both his mother and father. In a second session, conducted two months later, he was asked to rate his brother. R. J.'s parents and brother completed their ratings in individual sessions conducted during approximately the same two-month period.

RESULTS AND DISCUSSION

We first compared R. J.'s ratings of his family members with his family members' self–ratings. The Pearson product–moment correlation coefficient between R. J.'s ratings of his mother and her self–ratings was significant ($r = .59$). The correlation between his ratings of his father and his father's self–ratings was also significant ($r = .52$), as were his ratings of his brother (four years his senior) and his brother's self–ratings ($r = .48$). These figures are similar to those for a cognitively normal individual of the same mental age (see below).

At first blush, these robust correlations would seem to indicate that the process whereby R. J. learns about other people's personality traits is entirely normal. It turns out, however, that R. J.'s ratings of family members were highly correlated with one another. The correlation between R. J.'s ratings of his mother and ratings of his father was $r = .89$; the correlation between his ratings of his mother and his ratings of his brother was $r = .75$; and the correlation between his ratings of his father and his ratings of his brother was $r = .87$. Indeed, R. J. gave *identical* ratings to his mother, father, and brother on 17 out of 26 personality traits—almost 2/3 of the traits assessed.

DOES R. J. RATE OTHERS IN A STEREOTYPED WAY OR ARE HIS FAMILY MEMBERS REALLY VERY SIMILAR?

The high correlations among R. J.'s ratings of family members could still reflect accurate perceptions if R. J.'s mother, father, and brother indeed have almost the same personality profile. This seems unlikely, based on the ratings of the other family members. First, the mother, father, and brother clearly did not see themselves overlapping to this degree. The correlation between the mother's self–ratings and the father's self–ratings was $r = .41$; the correlation between

the mother's self–ratings and the brother's self–ratings was $r = .46$: and the correlation between the father's self–ratings and the brother's self–ratings was $r = .43$. These correlations—ranging from .41 to .46—are significantly lower than those generated by R. J., which ranged from .75 to .89. This is true whether one compares the average correlations (.84 for R. J. vs. .43 for the others; $p < .01$, or individual correlations ($.001 < p < .053$).

Perhaps individuals are more aware of the ways in which they differ from one another than are other observers. If this were true, there would be nothing unusual about the fact that R. J. sees his family members as more similar than they see themselves. This explanation would imply that cognitively normal observers would show the same pattern as R. J., but they do not. R. J.'s brother is a cognitively normal, well–educated professional. The brother's ratings of his mother are highly correlated with her rating of herself ($r = .73$), and his ratings of his father are highly correlated with the father's ratings of himself ($r = .64$), showing that his view of his parents overlaps highly with their views of themselves. Yet, the brother did not see the mother and father as highly similar: the correlation between the brother's ratings of his mother and his ratings of his father was only $r = .37$. Recall that the correlation between R. J.'s ratings for his mother and father was $r = .89$, significantly higher than the correlation generated by his brother ($p < .001$).

Whereas R. J.'s ratings suggest that his family members have almost identical personality profiles, the brother's ratings of his parents and the self–ratings of the mother, father, and brother converge on a view of these individuals as rather different from one another in personality.

Another potential explanation for the substantial overlap in R. J.'s ratings of others is that R. J.'s mother and father behave similarly in the presence of their children, but rate themselves on the basis of their interactions with people outside the family. If this were true, then R. J.'s brother would also see the parents as more similar to one another than they see themselves. But he did not: the fact that the brother's ratings of his parents were not highly correlated ($r = .37$), but did correlate highly with parental self-ratings, is at odds with the suggestion that the parents' behavior is more similar in the presence of their children than their self–ratings indicate.

It remains possible, of course, that R. J.'s parents exhibit a more unified behavioral profile in his presence than in the presence of his brother. However, the finding that R. J.'s ratings of his brother are *also* highly correlated with his ratings of both his mother and father suggest that the uniformity expressed in R. J.'s ratings of family members is due more to his perceptions and beliefs about others than to their actual behavior. For them to reflect an accurate perception, one would have to assume that his brother's behavior toward R. J. very closely mirrors that of the parents.

DOES R. J.'S PATTERN REFLECT NOTHING MORE THAN HIS MENTAL AGE?

It is instructive to see how a nonautistic individual, whose chronological age (M = 11 years 10 months) is closely matched to R. J.'s mental age (12 years, 1 month), performs the same trait rating tasks. To this end, T. M., one of the control participants from the Klein et al. (1999) study, along with his parents, were run through the same procedures administered to R. J. and his parents. The correlation between T. M.'s ratings of his parents and his parents' self–ratings fell in the range established by R. J. and his parents (rs = .52 and .47 for mother and father, respectively). And, similar to our findings for R. J.'s parents, T. M.'s mother's self–ratings showed a moderate correlation with his father's self–ratings (r = .47). However, in contrast to R. J., T. M. showed considerably greater discrimination with respect to parental characteristics: The correlation between his ratings of his mother and his ratings of his father was r = .52. This correlation is considerably below the r = .89 parental correlation generated by R. J. (p <.01), and is similar to the correlation generated by R. J.'s brother (r = .37) when he rated his parents (p >.20).

This means that R. J.'s failure to differentiate between his parents and brother is not a side effect of his mental age alone. T. M., who has a similar mental age, does see his parents has having distinct personalities.

DOES R. J. DIFFERENTIATE HIS OWN PERSONALITY FROM THAT OF OTHERS?

It might be argued that R. J.'s apparent difficulties in discriminating between family members' personality traits reflects a tendency to re-

spond to all people—including himself—in a stereotyped way. If this were true, then it would call into question R. J.'s ratings of his own personality.

There is, however, evidence that R. J. can make trait ratings in a more discriminating manner, at least when the person being judged is himself. As noted in the introduction, R. J. showed both reliable and accurate personality self–ratings (with parents and teachers serving as the criterion) when describing himself (Klein et al., 1999). Moreover, the correlations between his self–ratings and his ratings of his mother (r = .41), his father (r = .38) and his brother (r = .42) show that R. J. does see his own personality as different from those of his family members.

The brother's ratings of himself and his parents serve as a point of comparison. When the brother rated himself and his mother, the ratings correlated at r = .46; the correlation between the brother's self-ratings and his ratings of his father was r = .63; and the correlation between his ratings of his parents was r = .37. This means R. J. differentiates himself from others to the same extent—or more—than his cognitively normal brother does. (Indeed, the brother sees his own personality as rather similar to the father's (r = .64), whereas the correlation between R. J.'s view of himself and his father is only r = .38.)

The extent to which R. J. differentiated himself from his family was also similar to the same comparisons for T. M. The correlation between T. M.'s self-ratings and his ratings of his mother was r = .34; the correlation between T. M.'s self-ratings and his ratings of his father were r = .56.

IN RATING OTHER PEOPLE, IN WHAT WAYS DOES R. J. DIFFER?

In rating family members, does R. J. merely tick off positive traits? If R. J. knows nothing about the personality traits of his family members, and merely attributes positive traits to all of them, regardless of their actual characteristics, then this could result in high correlations between his ratings of family members. But this does not appear to be the case. This can be seen by examining how R. J.'s ratings differ from those made by others, and by examining their polarity.

R. J. and his brother were in high agreement about their mother: Their ratings of the mother were correlated at r = .72, and the

brother's ratings of their mother correlated with her self–ratings at $r = .73$. (The correlation between R. J.'s ratings of his mother and her self–ratings—.59—is not significantly different from the same measure for the brother; $p > .20$). All three individuals—R. J., his mother, and his brother—produced identical ratings of the mother on 50% of the traits, and R. J. and his brother produced identical ratings of their mother on 65% of the traits (17/26). Moreover, when R. J.'s ratings differed from his brother's, they were not always biased in the direction of social desirability: R. J. rated his mother more positively than his brother did on three traits, and more negatively on six traits. Indeed, for eight traits, R. J.'s ratings for his mother did not track social desirability. (He responded "not at all" for four positively valenced traits and "somewhat" for one; "somewhat" was his response for three negatively valenced traits.)

These facts suggest several things. First, R. J. seems to have an accurate view of his mother's personality traits. Second, when he differs from his brother, it is not because he is automatically attributing positive traits to his mother—where they differ, R. J.'s attributions are somewhat less positive than his brother's. That is, social desirability does not provide an easy account of R. J.'s ratings of his mother.

There is far less consensus about the father's personality traits. R. J., his brother, and his father give identical ratings of the father on nine of the traits (compared to 13 for the mother), and the correlation between R. J.'s and his brother's ratings of his father is only $r = .43$ (compared to $r = .72$ for their mother). When R.J's ratings of the father differ from those provided by the brother, ten were more positive, two were more negative, and one was difficult to categorize as positive or negative (less "talkative"). However, there is reason to think the brother's ratings of the father are more accurate. The brother sees the father much as the father sees himself ($r = .64$), and he sees himself as similar to his father ($r = .63$). That is, when the brother makes less positive attributions (e.g., "somewhat" rather than "definitely" on a socially desirable trait), he makes them not just about the father, but about himself as well.

"Somewhat": Is R. J.'s view of others less nuanced than normal? What does it mean to say that someone possesses a trait "somewhat?" Assume that you rated your mother as "somewhat talkative." This could mean that she is moderately talkative all the time, regardless of the situation. More likely, it means she is talkative with some people

but not others, or in some situations but not others. Human behavior shows a great deal of situation–specificity (Mischel, 1968). The more you know about how a person's behavior varies with the situation—assuming it does vary—the more likely you should be to choose "somewhat" in rating a trait, at least when the alternatives are "definitely" and "not at all."

Cognitively normal individuals might be more aware of the ways in which other people's behavior varies with the situation than is R. J., an individual with autism. If this were true, then normal subjects will use "*somewhat*" more than R. J. does in judging other people's traits.

That is what one sees in this data. When rating other people, every other person in this study used "*somewhat*" significantly more often than R. J. did. R. J. rated his mother, father, and brother on 26 traits; he used "somewhat" only four times for his mother, three times for his father, and three times for his brother ($M = 12.7\%$). In contrast, R. J.'s brother used "*somewhat*" 32.7% of the time (father: 42.3%; mother: 23.1%), his mother used it 38.5% of the time (in rating R. J.),[2] and T. M. used it 48.1% of the time in rating his parents (father: 50%; mother: 46.2%). In each case, other people's average use of "*somewhat*" in rating others was significantly higher than R. J.'s average of 12.7%. (brother vs. R. J.: $p < .05$, phi = .24; mother vs. R. J.: $p < .05$, phi = .30; T. M. vs. R.J $p < .01$, phi = .38; *P* values one–tailed).[3]

In other words, R. J. was far more likely to answer "definitely" or "not at all" when rating other people's traits. If the use of "*somewhat*" indicates a more nuanced view of other people's personalities—one that takes into account the situation–specificity of their behavior—then R. J.'s perceptions of others are less nuanced than the perceptions of others generated by cognitively normal individuals.

Does R. J. Have a Nuanced View of Himself? "Somewhat" Revisited. The answer is "yes." Although R. J. rarely uses "*somewhat*" in rating the personality traits of his family members, he uses it often in de-

2. The father was not asked to provide trait ratings for R. J.

3. The difference between R. J. and others is even more apparent if one excludes ratings of the mother—the single case in which there is consensus about the inappropriateness of the "somewhat" rating (in describing the mother, "somewhat" was used five times by the mother herself, six times by the brother, and four times by R. J.). Excluding ratings of the mother, R. J. used "somewhat" only 11.5% of the time (3/26 on father, 3/26 on brother), his brother used it 42.3% of the time (11/26 on father; brother vs. R. J.: $p < .01$, phi = .35), and the mother used it 38.5% of the time (10/11 on R. J.).

scribing himself. For 11 out of 26 traits—42.3%—he judged that he possessed the trait only "*somewhat*" rather than "*definitely*" or "*not at all*."

When it comes to self–ratings, R. J. and his family members do not differ reliably in the frequency with which they use the "*somewhat*" category: (R. J.: 11/26 = 42.3%; brother: 8/26 = 30.8%; father: 10/26 = 38.5%; mother: 5/28 = 19.2%). Indeed, R. J. used "*somewhat*" in describing himself slightly more often than other members of his family did in describing themselves, although not significantly so (two–tailed tests: $.07 < p < .78$). R. J. also did not differ from T. M., who used somewhat 9/26 times (34.6%) in his self–ratings ($p > .50$). Indeed, the only individuals whose self–ratings showed a higher "*somewhat*" frequency than R. J.'s were T. M.'s parents (TM's mother: 18/28 = 69.2%; T. M.'s father: 16/26 = 61.5%), and this difference was significant only in the case of T. M.'s mother ($p = .051$, two–tailed). Finally, R. J. used "*somewhat*" in rating himself significantly more often than he did in rating others (42.3% v. 12.7%: $p < .01$ one-tailed, phi = .33).

CONCLUSIONS

R. J. has accurate knowledge of his own personality traits: his self–ratings are reliable across sessions, they correlate highly with other people's ratings of him, and they indicate that he sees himself as different from other people. The same cannot be said for his knowledge of other people's personality traits.

Although his ratings of other people's traits correlate well with their self–ratings, his ratings indicate a failure to distinguish between the personalities of his mother, father, and brother. This is not because his family members all share the same personality profile; they view themselves as different. Moreover, R. J.'s brother views the mother and father as quite different, even though his ratings of each parent appear to be accurate (as judged by their significant correlation with the parent's self–ratings). R. J.'s ratings of his parents might correlate highly because they present a uniform personality when interacting with R. J.—but this hypothesis fails to explain why R. J. sees his brother as so similar to his parents ($r = .87$ for his brother and his father; $r = .75$ for brother and mother). R. J. gave his mother, father,

and brother identical ratings on almost two–thirds of all the traits he rated—17 out of 26 traits.[4]

R. J.'s failure to distinguish among his family members is not a side effect of his mental age. T. M., a cognitively normal male of approximately the same mental age distinguishes between his mother and father, yet R. J. does not. R. J.'s correlations also were not the result of a tendency to assign a socially desirable rating to everyone.

R. J. was much more likely to produce extreme trait judgments—"*definitely*" or "*not at all*"—for other people than were cognitively normal individuals. In rating other people, R. J.'s brother, R. J.'s mother, and T. M. all used the intermediate category—"*somewhat*"—more often than did R. J..

Is R. J.'s response repertoire restricted to the use of extreme categories? Certainly not. In rating his own personality traits, R. J. often used the intermediate category, "*somewhat*." Indeed, in this respect his self–ratings did not differ from the self–ratings of cognitively normal individuals. Moreover, R. J. used "*somewhat*" far more often in rating himself than in rating others.

SITUATION–SPECIFICITY

A "*somewhat*" generous (or friendly or stubborn) person might be someone who is "*moderately*" generous (or friendly or stubborn) in every situation. However, given that most human behavior shows considerable sensitivity to context, a more likely interpretation is that "*somewhat*" reflects the perception of situational contingencies—the perception that the individual being rated is (say) generous in some situations but not in others. In this view, use of "*somewhat*" indexes the extent to which a rater perceives that an individual's behavior as varying with the situation.

If this line of reasoning is valid, then R. J. understands that his own behavior varies with the situation, but he is failing to see that the same is true of his mother, father, and brother. This interpretation of R. J.'s responses fits well with what is known about autism, his developmental disorder.

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4 We have no ratings of the brother other than his self–ratings and those provided by R. J., so there is no basis for providing a cross–check of R. J.'s accuracy in judging his brother.

Autism is thought to result from the faulty development of the computational machinery that supports metarepresentation (Leslie, 1987; Baron–Cohen, 1995). As a result, people with autism have difficulty inferring other people's mental states, especially what other people believe, think, and know (the epistemic mental states). An individual with autism can act on his or her *own* knowledge, whether he or she is meta–aware of that knowledge or not. As a result, an autistic individual could well be aware of the ways in which his or her own behavior varies with the situation—the situation as he or she construes it. However, the inability to correctly infer what *other* people believe, think, and know would be a barrier to understanding how other people construe their own situations. Consider how difficult it would be to compute the ways in which another person's behavior is contingent upon the situations in which they find themselves if you cannot see that situation from that individual's point of view.

To see situational contingency in the behavior of his brother, father, and mother, R. J. would have to be able to infer what each of these individuals thinks is happening as situations unfold, even when what they think differs from what R. J. thinks. Yet most individuals with autism are notoriously bad at such "false belief" tasks (Baron–Cohen et al., 1985; Baron–Cohen, 1995). In false belief tasks, the subject can correctly predict what a character will do or think *only* if the subject understands that the character's beliefs about the world are different from what the subject knows to be true of the world.

WHY ARE R. J.'S RATINGS OF OTHERS SO HIGHLY CORRELATED

The fact that R. J.'s ratings of his brother, mother, and father are so highly correlated is strange; we do not see these correlations in his brother's ratings of parents, or in T. M.'s ratings of his parents. Note, however, that the inability to model the mental states of others, as postulated above, does not necessarily entail that R. J.'s ratings of others will be correlated. They could, instead, be random.

One possibility is that every individual has default personality ratings that they apply to others, which are then updated on the basis of experience (we thank David Funder for this suggestion). If so, then R.

J. may simply be applying his default template to all his family members, which would cause his ratings of others to be highly correlated.

A different possibility is suggested by a close examination of R. J.'s ratings of his mother and father. When one examines the personality profiles that R. J. provided, attempts to cross–check his ratings against those of other individuals suggest that his ratings of his mother were accurate: the brother, mother, and R. J. all share a highly similar view of the mother's personality. R. J.'s ratings of his father seem to be less accurate: they do not correlate highly with the brother's ratings of the father, yet the brother's ratings of the father correlate well with the father's ratings of himself.

This pattern suggests a possibility: R. J. may be applying his (accurate?) knowledge of his mother's personality traits across the board to his father and brother. This, too, would explain the correlations.

IMPLICATIONS FOR ACQUISITION

Previous results showed that R. J. did not acquire consensually shared semantic knowledge about animals, foods, and objects, yet he did acquire consensually shared knowledge of his own personality traits (Klein et al., 1999; Klein, Cosmides, & Costabile, 2002). This dissociation was not caused by a memory store or search engine being knocked out by brain trauma; it resulted from a developmental disorder and therefore speaks to acquisition. It suggests that acquiring knowledge about personality traits is governed by learning mechanisms that are functionally distinct from those that cause knowledge acquisition in other domains.

The results reported herein show a second dissociation in R. J.'s acquisition of semantic knowledge: between knowledge of his own personality traits and knowledge of other people's personality traits. R. J.'s developmental disorder did not interfere with his ability to learn about himself: he developed normal, consensually accurate knowledge of his own personality traits. However, his disorder did disrupt his ability to learn about other people's personality traits. This suggests that the process of learning about others involves at least one mechanism or system that is not required for learning about oneself. Too little is known to identify what that mechanism(s) might be. However, the data suggest that R. J. sees his own behavior as more situationally contingent than that of other people. This is con-

sistent with the hypothesis that the ability to model other people's mental states—an ability impaired in autism—is necessary for developing nuanced, situation–specific knowledge of other people's personality traits.

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