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The Getting of Wisdom: Theory of Mind in Old Age

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Theory of mind, the ability to attribute mental states, has been little explored beyond the early school years. Yet, later development, including possible patterns of breakdown, has important implications for current debate concerning the modularity/domain-specificity of the cognitive and neurological systems underlying theory of mind. This article reports a first study of theory of mind in normal aging. The results suggest that although performance on tasks with nonmental content may decrease with age, performance on theory of mind tasks remains intact and may even improve over the later adult years. The implications of these findings for the cognitive processes underlying theory of mind are discussed.

Theory of mind—the ability to attribute independent mental states to self and others to predict and explain behavior—has become a major research focus in developmental psychology over the last decade (e.g., Astington, Harris, & Olson, 1988; Fodor, 1992; Leslie, 1987). The litmus test for this ability has been the attribution of false beliefs, which most children achieve in their 4th year (Wimmer & Perner, 1983). Before this time, the young child shows a number of socially insightful behaviors (e.g., mental state talk, naturalistic deception, teasing, understanding of desires; for a review, see Wellman, 1990), which may or may not reflect an ability to represent mental states (Perner, 1991). There has been a great deal of debate concerning the underpinnings of this early social ability, the cause of false belief task failure before age 4 years, and the mode of acquisition of a mature “adult-like” belief-desire psychology (see, e.g., Carruthers & Smith, 1996, for discussion).

Considering the mass of studies conducted in this field, it is perhaps surprising that, with a few notable exceptions (e.g., Chandler & Helm, 1984), we know little about how theory of mind develops beyond the age of approximately 7 years, when understanding of second-order false beliefs (e.g., Mary doesn't know John knows X) reliably emerges (Perner & Wimmer,

1985; Sullivan, Zaitchik, & Tager-Flusberg, 1994). Does the 7-year-old, then, have all the “mind-reading” apparatus of an adult? Is further development of social sophistication merely a matter of acquiring general knowledge or the maturing of domain-general cognitive components (e.g., executive functions)? The present article reports a first study of theory of mind ability in normal old age and explores possible differences between social insight in young and in old adults.

A second motivation for the present study comes from a current debate in the theory of mind literature concerning whether attribution of mental states relies on a dedicated, domain-specific cognitive system (Leslie, 1994; see Baron-Cohen, 1994, and commentaries for debate). This appears to be a possibility on the basis of several lines of evidence. First, theory of mind is of clear evolutionary advantage (Byrne & Whiten, 1988), and there has been the suggestion that our cognitive systems have been particularly shaped by selective pressure for social intelligence (reflected in superior reasoning in the social domain; Cosmides, 1989). Second, it has been suggested that there are relatively few individual and cultural differences in the timing of false belief understanding (e.g., Avis & Harris, 1991). This claim is currently debated, with some reports suggesting important cultural influences on the age at which children demonstrate competence with, for example, false beliefs (Chen & Lin, 1994) or the mental-real distinction (Wahi & Johri, 1994). Recent studies have underlined the important role of the environment, highlighting the importance of interaction with siblings and conversation with caregivers in explaining individual differences in social understanding (e.g., Dunn, Brown, Slomkowski, Tesla, & Youngblade, 1991; Perner, Ruffman, & Leekam, 1994).

Those in favor of a dedicated cognitive mechanism, or module, underlying the child's development of theory of mind (e.g., Fodor, 1992; Leslie, 1994; Premack, 1990) have pointed, in particular, to evidence of dissociation in developmental disorders. Theory of mind ability may be dissociable from cognitive ability in other domains; children with autism may be “mind blind” yet intelligent in other respects (Baron-Cohen, Tager-

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Flusberg, & Cohen, 1993), and children with William's syndrome have been suggested to show intact theory of mind despite delayed theorizing in other domains (Karmiloff-Smith, Klima, Bellugi, Grant, & Baron-Cohen, 1995). Although the argument from double dissociation to separable cognitive systems is controversial (see, e.g., Dunn & Kirsner, 1988; Goldberg, 1995; Plaut, 1995; Shallice, 1988), findings of uneven cognitive profiles may at least provide constraints on proposed models of functional architecture.

The dissolution of cognitive abilities, like the development of those abilities, has the potential to reveal distinct and dedicated modular systems — although, in this case, dissociation can only suggest differentiation in the mature cognitive architecture (perhaps an emergent property) and is silent on the question of intrinsic or innate modularity (Goldberg, 1995). The pattern of intact and impaired abilities in normal aging may tell us something about the relative independence (or otherwise) of the cognitive processes underlying mental state attribution. As domain-general processes, such as short-term memory, worsen in old age (e.g., Lavigne & Finley, 1990; Lindenberger, Mayr, & Kliegl, 1993) — is social understanding proportionately affected or spared relative to reasoning in other areas?

Method

Participants

Nineteen healthy elderly individuals were recruited from a participant pool maintained by the Research Center of the Department of Neurology, Boston University School of Medicine. Ten women and 9 men, ranging in age from 61 to 80 years (m age = 73 years), took part in the study and were reimbursed for their time. All were free of past or present psychiatric diagnosis, developmental or learning disabilities, medical illness, and drug or alcohol abuse. For all participants, English was the first or joint first language. Years of education ranged from 12 to 18 years (m = 14 years 7 months).

The elderly group was compared with two samples of young normal participants. The larger sample was collected in the United Kingdom through students at London University (and their friends and families). The 25 men and 27 women in this group ranged in age from 16 to 30 years (m = 21 years 0 months). To control for any possible cultural or national differences, a small sample of U.S. participants was also tested. This young group was collected in Boston and comprised friends of students at Boston College. This sample of 8 men and 7 women was aged 21 to 30 years (m = 22 years 6 months). Information on years of education was available for the U.S. participants only and averaged 14 years 7 months (range 13–16 years).

Materials

The materials comprised 24 short passages of text, followed in each case by a test question. The passages were of three types: theory of mind stories, control stories, and jumbled text. The theory of mind stories (adapted from Happé, 1994) concerned double bluffs, mistakes, persuasions, and white lies (two examples of each of these four story types). These stories were followed by questions requiring an inference about the characters' thoughts and feelings — in most cases, an inference about the speaker's or actor's intentions. The control stories also involved people and the subsequent test questions also required inferences to be made, but, in this case, the mental states of the characters were not relevant and the inference concerned, for example, physical causation. The topics of the eight control stories can be summarized as fol-

lows: setting off a burglar alarm, paying for a car by installment versus lump sum, x-raying an elderly lady following a fall, the filing system of a library, making meringues from egg whites left over after making mayonnaise, the role of weather conditions in determining the outcome of air and land battles, identifying the most likely location for reading glasses to have been mislaid, and buying multipacks rather than single items while shopping. The jumbled passages consisted of meaningful but disconnected sentences, with no unifying or coherent story, and were followed by test questions concerning the information presented in one of the sentences. No inference was required for these questions, but there was a demand on literal or verbatim memory. Examples of the three types of materials can be seen in the Appendix (see also Fletcher et al., 1995).

Procedure

All participants were tested individually, following the same procedure. Participants were told that they would be shown a number of short passages and that they were to read each passage silently until they felt they had understood it, at which point they should turn the page for the test question, the answer to which they should tell the examiner. Participants were instructed that once they had turned the page for the test question, they were not to turn back to the passage, and so they were encouraged to spend as long as necessary studying the passage before turning over. The order of the theory of mind and control stories was counterbalanced, but participants always received these stories before the jumbled passages. Before the first story, a practice story was given, and before the first jumbled passage, a practice passage of this type was given, along with an explanation that the following passages were not stories and did not make sense. Time to read each story or passage before turning the page was recorded, as were participants' answers to the test questions. These answers were later rated according to a standardized scoring scheme, with good agreement (87%, with disagreements resolved on discussion) from a second rater who was blind to participant group and hypothesis. Answers were scored 0, 1, or 2, with 2 being credited for a *full and explicitly correct* answer and 1 for a *partial or implicit* answer. For the jumbled passages, test questions required simply yes or no answers and were scored 0 (*incorrect or don't know*) or 1 (*correct*). Examples of scoring criteria for the stories are given in the Appendix.

Results

Comparison of the young U.S. and young U.K. samples with independent sample *t* tests showed no significant differences in performance (scores or times). Data from these groups were therefore combined for comparison with the elderly sample, as shown in Table 1.

As can be seen in Table 1, the elderly group performed better than the young adults on the theory of mind stories but not on the control stories or jumbled passages. Analysis of variance (ANOVA) for scores on the two story conditions (theory of mind and control) by age and by sex showed a significant main effect of story type, $F(1, 82) = 23.71, p = .000$, and of age, $F(1, 82) = 5.00, p = .028$. The only significant interaction was between age and story type, $F(1, 82) = 14.59, p = .000$. The pattern of means within the interaction was explored with *t* tests (omitting the sex variable), which showed that the elderly group scored more highly than did the young group on theory of mind stories, $t(84) = 4.18, p = .000$, but not on control stories, $t(84) = .20, p = .838$. In addition, scores on the two story types did not differ in the young group, $t(66) = 1.13, p = .26$, whereas

Table 1
Results for Elderly and Young Groups by Story Condition

Group	Performance variable	ToM stories (max = 16)		Control stories (max = 16)		Jumbled passages (max = 16) ^a	
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Elderly (<i>n</i> = 19)	Score	14.9**	1.2	12.4	2.2	11.3	1.8
	Time (s)	27.2	5.9	33.9	8.3	33.3	9.9
Young (<i>n</i> = 67)	Score	12.8	2.0	12.5	2.2	12.9*	2.5
	Time (s)	23.9	7.2	29.7	9.3	27.5	9.6

Note. Max = maximum; ToM = Theory of mind.

^aScores out of 8 are doubled here for comparison with other conditions.

Group differences: * $p < .01$, ** $p < .001$.

in the elderly group, performance on theory of mind stories significantly exceeded that on control stories, $t(18) = 4.97$, $p < .000$.

Because the jumbled passages involved yes or no questions, with a maximum total score of 8, performance on this measure was not included in the repeated measures ANOVA. Direct comparison of the two groups showed that the elderly group scored less well on this condition than did the young participants, $t(84) = 2.61$, $p = .011$.

Time data from the two groups revealed a significant main effect of age, $F(1, 82) = 4.82$, $p = .031$, but no significant interactions between task type and age or sex. The greater time taken by the elderly participants across the conditions raises concerns about a possible speed-accuracy trade-off.¹ To check for this, the analysis of scores was repeated at covarying times. This did not alter either the main effects or the interaction, and time was not significant as a covariate, $F(1, 81) = 0.98$, $p = .32$. Examination of correlations between scores and times also failed to reveal any significant relation between time and score in either the elderly or the young adult group (r values ranging from $-.26$ to $.18$, all p 's $> .14$).

Discussion

The results suggest that theory of mind ability, as tapped by the stories used here, is preserved and even superior in healthy elderly individuals compared with younger participants. The elderly group showed worse performance on the jumbled passages, which is in line with findings of reduced performance on certain memory tasks in old age (e.g., Olofsson & Backman, 1993). Performance on all tasks was slower, but superior theory of mind performance by the elderly group cannot be explained by allocation of greater effort or time because performance on control stories (which was also slow) was not superior. In addition, covarying time did not effect the pattern of results. For young participants, the theory of mind and control stories were of equal difficulty, as has been reported in Fletcher et al.'s (1995) brain imaging study using the same materials.

Although the present results suggest a dedicated processing mechanism for theory of mind, other possible explanations exist. For example, it might be that the elderly group tested here happen to be of higher general intelligence than the younger

sample and that this underlies their superior theory of mind performance. If this is the case, an additional explanation must be found for their failure to surpass the young group on the control stories. One suggestion is that these stories were in some way of less relevance to the elderly than to the young group. However, this seems unlikely; several of the topics would appear, if anything, more salient to the elderly (e.g., having an x-ray after a fall on an icy doorstep or finding misplaced reading glasses). Nothing in the time data suggests that these stories were either less interesting (so read faster) or more unfamiliar (so read slower) for the elderly than for the young participants. However, to rule out these other explanations, a study including IQ measures would be necessary. Even if the present data are accepted as demonstrating intact and superior social reasoning in the elderly, the notion of a dedicated mechanism for theory of mind is not the only possible explanation. It might be said that the elderly are more interested in, or motivated by, the social stories, although this would in turn beg the question, why?

The findings fit well with the folk notion of increasing wisdom in old age, but, to our knowledge, this is the first study to date documenting superior social insight in the elderly. The notion of wisdom, as discussed in the literature on aging, is a complex one; definitions include "expert knowledge in the pragmatics of life" (Smith, Staudinger, & Baltes, 1994, p. 989), "recognition and response to human limitation" (Taranto, 1989, p. 1), or "the ability to understand human nature" (Clayton, 1982, p. 315). A key element of wisdom so conceived appears to be social skill; wisdom is found to have a "psychological bias" (Baltes, Staudinger, Maercker, & Smith, 1995) and is superior in human service professionals versus those in other professions (Staudinger, Smith, & Baltes, 1992); it is found to be high in clinical psychologists (Smith et al., 1994) and is improved (especially in older adults) by conditions that involve the interaction of minds (Staudinger & Baltes, 1996). Superior theory of mind ability may be one way of conceptualizing this increasing social sensitivity in old age, although the notion of wisdom is clearly intended to extend beyond reasoning about thoughts and feelings (Baltes, 1993).

Intact or superior theory of mind may be reflected in findings

¹ We are grateful to an anonymous reviewer for this suggestion.

from a number of previous studies focusing on other cognitive abilities in the elderly. For example, Hashtroudi, Johnson, and Chrosniak (1990), studying memory impairments in old age, reported that elderly participants were better than younger participants at recalling and reporting their thoughts and feelings regarding imagined and actual events. This, Hashtroudi et al. suggested, may actually impair memory performance, if elderly participants focus on internal states rather than taking in the spatial and perceptual information favored by younger participants.

If reasoning in the social domain is preserved while some other cognitive functions deteriorate in old age, this may suggest a separate cognitive system underlying social versus nonsocial reasoning. Previous functional imaging work with the materials used here found activation specifically associated with theory of mind story performance in the medial, prefrontal areas of the left hemisphere. Although different functional imaging studies of theory of mind have isolated rather different frontal regions (Baron-Cohen et al., 1994; Goel, Grafman, Sadato, & Hallett, 1995), it has proved possible to find a distinct pattern of brain activation associated with theory of mind tasks that is not seen during carefully matched control tasks. A final line of evidence in support of dissociable neural and cognitive underpinnings for theory of mind comes from studies of acquired lesions. For example, previously normal adults who suffer right-hemisphere damage appear to show specific impairments on theory of mind tasks such as those described here (Happé, Winner, & Brownell, 1997a, 1997b). These studies suggest a dedicated mechanism for understanding other minds but cannot speak to the issue of whether there is an innately specified module. Specialization at the cognitive and neural levels may be the product of experience and expertise, perhaps a process of "modularisation" (Karmiloff-Smith, 1993), throughout the life span.

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Appendix

Example Stories and Scoring

Example Theory of Mind Story

A burglar who has just robbed a shop is making his getaway. As he is running home, a policeman on his beat sees him drop his glove. He doesn't know the man is a burglar, he just wants to tell him he dropped his glove. But when the policeman shouts out to the burglar, "Hey, you! Stop!", the burglar turns round, sees the policeman and gives himself up. He puts his hands up and admits that he did the break-in at the local shop.

Question: "Why did the burglar do that?"

Example responses scored:

2. "Because he thought the policeman knew he had robbed the shop."
1. "Because he thought he was caught."

Example Control Story

A burglar is about to break into a jewelers' shop. He skillfully picks the lock on the shop door. Carefully he crawls under the electronic detector beam. If he breaks this beam it will set off the alarm. Quietly he opens the door of the store-room and sees the gems glittering. As he reaches out, however, he steps on something soft. He hears a screech

and something small and furry runs out past him, towards the shop door. Immediately the alarm sounds.

Question: "Why did the alarm go off?"

Example responses scored:

2. "Because the burglar disturbed a cat, which ran through the detector beam."
1. "Because something broke the beam."

Example Jumbled Passage

Young Simon is very tall and strong. She sees that Fred cannot play. Jeremy is always laughing and smiling. Ruth sees her uncle very often, but today he has gone to Brazil. Richard is packing up to go away. Today, at college, it is Jim's worst class—mathematics. She has only one dollar left, which she must keep for her bus fare. He buys a bright tie, to go with his new shirt.

Question: "Does she have two dollars left?"

Example responses scored:

1. "No."
0. "Yes" or "Don't know."

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