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STEREOTYPE RELIANCE IN SOURCE MONITORING: AGE DIFFERENCES AND NEUROPSYCHOLOGICAL TEST CORRELATES

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This study provides evidence that when source-specifying features are less available, people will rely more on their general knowledge to attribute memories to sources. Two factors (ageing and emotional self-focus) that, in general, are associated with poorer source identification performance both led to a greater reliance on stereotypes when participants attempted to remember who had said statements in a video they had watched earlier. In addition, correlations between older adults' ability to attribute statements correctly and their scores on a battery of neuropsychological tests suggests that both frontally based processes and medial temporally based processes affect accuracy of source identification, but do so to different degrees depending upon the nature of the source identification tasks.

INTRODUCTION

Our general knowledge about the world is invaluable in guiding us through our daily lives, helping us perceive, structure, and remember what we encounter. However, sometimes our knowledge can lead us astray. For example, when trying to remember which student in a seminar made a particularly interesting comment, you may misattribute the comment to the student who you know often says interesting things, rather than to the usually quiet student who actually made the remark. According to the Source Monitoring Framework (SMF) outlined by Johnson and her colleagues (e.g. Johnson, Hashtroudi, & Lindsay, 1993; Johnson & Raye, 1981, in press; Mitchell & Johnson, in press), general knowledge about how particular sources may relate to a remembered event is a critical part of attributing a source to the event.

The purpose of the present study was to investigate two factors that are likely to affect how much people rely on general knowledge (in this case, stereotypes) when making source judgements: (1) age; and (2) whether participants focus their attention inwardly or outwardly at encoding. In addition, this study investigates how two neuropsychological test batteries (comprised of tests often used to assess medial-temporal and frontal brain region functioning) correlate with the use of stereotypes in source monitoring.

Types of Information Used to Make Source Attributions

As outlined by the SMF, two main classes of information can be used to make source attributions for remembered information. The first consists of the

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qualitative characteristics of the information that come to mind, such as associated emotional reactions, associated cognitive operations, and semantic, perceptual, temporal, and spatial detail. The quality and quantity of particular types of characteristics can be used to distinguish one source from another. For example, because memories for perceived events tend to include more perceptual and contextual detail than memories for imagined events (e.g. Hashtroudi, Johnson, & Chrosniak, 1990; Henkel, Johnson, & De Leonardis, 1998; Johnson, Foley, Suengas, & Raye, 1988; Johnson, Raye, Foley, & Kim, 1982; Mather, Henkel, & Johnson, 1997; Norman & Schacter, 1997; Schooler, Gerhard, & Loftus, 1986; Suengas & Johnson, 1988), the amount of perceptual and contextual detail associated with a particular memory can help one determine whether the event was perceived or imagined. Even in situations in which imagined events seem indistinguishable from perceived events, inducing participants to focus on perceptual and contextual memorial characteristics can increase their source monitoring accuracy (Lane & Villa, 1997; Mather et al., 1997).

The second class of information that can be used to make memory source attributions includes beliefs, supporting memories, plausibility, schemas, stereotypes, and category information. We know from many different lines of research that our general knowledge and beliefs about the world can have a powerful effect on the way we perceive and remember the world, helping us to organise information (so that we do not have to remember all the details to retain the meaning), but sometimes leading to systematic errors (e.g. Bartlett, 1932; Bransford & Johnson, 1973; Devine, 1989; Fiske & Neuberg, 1990; Owens, Bower, & Black, 1979; Ross, 1989; Taylor & Crocker, 1981).

To date, most studies investigating source monitoring processes have focused on the use of more specific attributes such as perceptual detail and cognitive operations and not on the role of more general, abstract knowledge in determining the source of information. Conversely, most studies investigating the effects of stereotypes and schemas on memory have focused on the fact that schema-consistent errors occur, rather than on the source attribution processes that account for why the errors occur.

However, in daily life specific attributes and general knowledge often act in concert to help determine how we remember events. Both types of information are continuously activated, weighted, and used in ongoing source attributions that are integral parts of all remembering. For example, in trying to remember who gave you permission to do something, in which store you purchased a particular item, or when you last had a tetanus shot, both specific qualities of the memory and general knowledge guide attribution of information to sources (e.g. who, where, when, etc.). One question is how these two types of information interact. Do people change how much they weight one type of information depending upon how much access they have to the other type of information? The present study uses an explicit source identification task to explore the interplay between specific feature information and general knowledge in remembering.

Using Category or Stereotype Knowledge to Make Memory Attributions

Using our knowledge about typical members of a category to attribute information to a member of that category can be quite a useful strategy. For example, if one were trying to remember who was talking about a great new fitness centre, one might be more likely to attribute the information to an athletic friend than to a nonathletic friend. However, if it happened to be a nonathletic friend who made the remark, relying only on stereotype knowledge would lead to an incorrect attribution. Such misattributions could have a much more serious impact than just making it difficult to find the phone number of the new fitness centre. For example, an eyewitness might misattribute a crime to someone other than the actual perpetrator because it seems more consistent with their race or gender.

One type of study that has examined the effects of general categorical knowledge on source attributions has been concerned with distinguishing category-based and person-based memory (Brewer, Weber, & Carini, 1995; Taylor & Falcone, 1982; Taylor, Fiske, Etcoff, & Ruderman, 1978; see also

Stangor, Lynch, Duan, & Glass, 1992). In these studies, participants were presented with a video (or slides and tape-recording) of a group of people talking. The composition of the groups was varied, such that discussants could be split into groups based on some feature such as race, gender, or the colour of their sweatshirt. In general, when later asked to attribute the statements that had been made to their speaker, participants made more misattributions within a category (e.g. misattributing something one female said to another female) than between categories (e.g. misattributing something a female said to a male). This difference in error rates was interpreted as suggesting that participants relied on the categories to some extent when attributing the source of the statements. Similar findings have been used to argue that source information is not an all-or-none proposition—instead, memories represent different amounts of partial source information (Dodson, Holland, & Shimamura, 1998). We may remember that a female said a statement, but not know which female said it. These studies (e.g. Dodson et al., 1998; Taylor et al., 1978) provide evidence consistent with the idea that category knowledge can play a role in making source attributions. However, they do not distinguish between two factors—both assumed to be important within the SMF—attributions based on abstract category information and attributions based on partial item-specific information (e.g. remembering a voice was high-pitched, but not more discriminating perceptual information). In addition, the stereotypicality of the content of the information to be attributed was not manipulated in those studies.

Studies that have manipulated how well the content of items corresponds with stereotypes about target sources have found that content can play an important role in source attributions. For example, unfriendly behaviours were more likely to be misattributed to a skinhead than were friendly behaviours (Sherman & Bessenoff, in press). Another study (Stangor, 1988) had participants read about actors performing actions (e.g. "Pam met a friend for coffee") and then had them recognise which statements they had previously read. Participants were instructed to reject statements if the actors had been switched (e.g. "Don met a friend for coffee"). Participants were more likely to falsely recognise gender-consistent pairings of actors and behaviours than gender-inconsistent pairings. Gender stereotypes also played a role for participants presented with a recently read name and asked to decide whether or not it belonged to a famous person (Banaji & Greenwald, 1995). Participants were more likely to categorise the name incorrectly as being famous if it was a male name than if it was a female name. In a related vein, in a study of conversation memory (Holtgraves, Srull, & Socall, 1989), participants who believed the speaker was of higher status than his conversational partner were more likely to falsely recognise assertive paraphrases of the speaker's remarks than participants who believed the two speakers were of equal status (e.g. "Tell them to hurry things up" when what had actually been said was "You could ask them to hurry things up"). Knowledge about a particular source also affected source attributions in a study in which participants were more likely to say they had heard a particular speaker say a word (that had actually not been spoken) if they had heard that speaker say a list of words semantically related to the new word than if they had heard the other speaker say the related words (Mather et al., 1997). Thus, knowledge or beliefs about what sort of things are typically associated with a particular source can sometimes lead to false source attributions.

The present study investigated two factors (age and emotional focus) that should affect how much people rely on stereotypes when trying to identify the source of remembered information. Participants watched a videotape of two women making statements. Each woman said some statements that matched her stereotyped description in the instructions (speaker-consistent statements; e.g. "We need to invest in rehabilitating criminals, rather than just punishing them" said by a woman previously described as a Democrat) and some statements that did not match the speaker's established stereotype but rather matched the description of the other speaker (speaker-inconsistent statements; e.g. "Illegal immigrants shouldn't receive public services" also said by the Democrat). This compari-

son between performance on items in which the actual source and the probable source (based on knowledge about the speaker) are the same (speaker-consistent) and items for which the actual source and the probable source are different (speaker-inconsistent) allowed us to separate the influence of categorical knowledge from that of more specific qualitative characteristics.

Ageing and Reliance on Stereotypes

The majority of studies investigating how stereotypes may affect memory for social information have involved only college students. However, as we age, the way we process and remember information changes (e.g. Light, 1996; Salthouse, 1992; Schacter, Koutstaal, & Norman, 1997). Older adults often show a deficit in making source identifications, even when they are as good as younger adults at recognising that items were previously presented (e.g. Brown, Jones, & Davis, 1995; Ferguson, Hashtroudi, & Johnson, 1992; Henkel et al., 1998; McIntyre & Craik, 1987; Spencer & Raz, 1995).

Of particular interest for this study is the possibility that older adults rely more than younger adults do on abstract, stereotypical (i.e. categorical) cues in making attributions about the source of a remembered item. For example, in studies in which younger and older adults heard words spoken by either two similar sources (two females) or two dissimilar sources (male and female) (Ferguson et al., 1992; Johnson, De Leonardis, Hashtroudi, & Ferguson, 1995), older adults were worse than younger adults at identifying the source of a word when both speakers had been female. Yet when the speakers were male and female, older adults were just as good as younger adults at identifying the source of words. In a related study (Bayen & Murnane, 1996) in which the distinctiveness of both gender (two males vs. one male and one female) and temporal context (speakers' statements alternated vs. were blocked) were varied, older adults performed as well as younger adults only in the condition in which both the speaker's gender and temporal context of the statement could discriminate between the sources.

These experiments, however, do not necessarily indicate that older adults rely more on categorical information to make source attributions than younger adults. The categories in these studies (i.e. male and female, temporal context) were associated with different qualitative characteristics of the memory for the items (i.e. voice qualities suggesting gender, distinctiveness of the memory trace, or particular associations suggesting when it was presented). It may be that the older adults generally have fewer (or less vivid) perceptual/contextual qualitative characteristics available to make source judgements (e.g. Hashtroudi et al., 1990), but that when these qualitative characteristics are different enough, older adults can make quite accurate source judgements in spite of an overall lower level of qualitative information (e.g. Dodson et al., 1998). In contrast, in the present study, the categorical information (e.g. political affiliation) does not arise from any physical qualities of the speaker or from the context in which the statement was said, allowing us to examine the influence of categorical knowledge separately from the influence of source similarity of physical or contextual features.

Some previous studies do provide direct evidence of increased reliance on general knowledge during source monitoring in older adults. For example, older adults are more likely to identify an object incorrectly as having been present in a visual scene if the object typically belongs in that context than if it does not (e.g. a sink vs. a television in a kitchen scene), and the difference between their false recognition of new but thematically associated items and new unassociated items is greater than it is for the young (Hess & Slaughter, 1990). In other studies, age differences in memory decrease as the relevance and typicality of the target information increases (Hess, Donley, & Vandermaas, 1989) and also as test stimuli are more meaningfully organised (Waddell & Rogoff, 1981), suggesting that older adults are able to take advantage of general knowledge during remembering. Thus, in the current study, we expected older adults to show less of a memory disadvantage relative to younger adults when attributing speaker-consistent statements than when attributing speaker-inconsistent statements.

We further expected that the ability to attribute the source of speaker-inconsistent statements correctly would be particularly difficult for older participants with low performance on measures of reflective or executive functions usually associated with frontal brain regions—activities such as planning, problem solving, metamemory, and evaluation and retrieval of information in memory (e.g. Johnson & Raye, 1998; Moscovitch & Winocur, 1995; Nolde, Johnson, & Raye, 1998b; Raz, Gunning-Dixon, Head, Dupuis, & Acker, 1998; Shimamura,1995; Stuss & Benson, 1986; West, 1996). In general, source identification decisions require more frontally based reflective activity than do old/new recognition decisions (Johnson, Kounios, & Nolde, 1996a). However, we expect that not all source identification tasks rely on frontal brain regions to the same extent. The level of reliance should depend upon the level of reflective activity demanded by the task (Nolde et al., 1998b). In the present context, processes supported by frontal regions should be essential (at both acquisition and test) to help resolve the contradictions between the schematic content of the statement that implies one source and the specific attribute details that imply another source.

In contrast, determining the source of the schema-consistent items should depend less upon frontal functioning. Correct attribution of these schema-consistent items should depend both on the ability to encode the general schema about each person and on the initial binding and subsequent reactivation of item-specific attributes (e.g. associating the speaker's emotional expression with the content of the statement). These processes are more likely to be supported by the medial-temporal regions (e.g. N.J. Cohen & Eichenbaum, 1993; Johnson & Chalfonte, 1994; Squire, 1992; Squire & Knowlton, 1995). In addition, we expected accurate old/new recognition of both types of statements to be supported by medial-temporal regions (e.g. Squire, 1992).

Normal ageing is likely to be accompanied by neuropathology in frontal (e.g. Haug & Eggers, 1991; Raz et al., 1998; West, 1996) and medial-temporal regions (e.g. Golomb et al., 1994; Jernigan et al., 1991). Thus, in order to investigate the brain mechanisms underlying source monitoring processes, we examined the older participants' memory performance in relation to their performance on two batteries of neuropsychological tests that have been used to assess frontal and medial-temporal brain region functioning (Glisky, Polster, & Routhieaux, 1995; Henkel et al., 1998). The frontal and medial-temporal test batteries are each composed of several tests for which performance has often been shown to be impaired in patients with lesions in frontal and medial-temporal brain regions, respectively. Any particular test may not specifically and uniquely assess functioning of frontal or medial-temporal brain regions (e.g. Reitan & Wolfson, 1994; Salthouse, Fristoe, & Rhee, 1996). Nonetheless, the frontal tasks generally tap more complex reflective or executive processes than the medial-temporal tasks, and thus differences in patterns of correlations between these batteries and other performance measures provide clues about processes and underlying brain regions.

Emotional Focus and Reliance on Stereotypes

Often when interacting with other people, we evaluate what was said by considering how we feel about it or how it relates to ourselves. Focusing on one's own emotional reactions to an event can result in a memorial trade-off. Because focusing on one's own feelings may distract one from the event itself, contextual and perceptual details are less likely to be bound to that event, making it more difficult later to identify the context in which the event was experienced. Instead, the external event may become linked with personal associations, possibly making it easier to recall or recognise the event itself later (but not its source). In general, distracted participants are more likely to base impressions on group knowledge than on individuating characteristics (Bargh & Thein, 1985; Kruglanski & Freund, 1983; Macrae, Hewstone, & Griffiths, 1993; Pratto & Bargh, 1991; Rothbart, Fulero, Jensen, Howard, & Birrell, 1978), suggesting that an emotional self-focus may have similar effects.

The simultaneous positive and negative memorial effects of self-focus were reflected in a study in which participants hearing statements thought about either how they felt or how the speakers felt about what was being said (Johnson, Nolde, & De Leonardis, 1996b). Participants who thought about their own feelings later recognised the content of the statements better than did participants who thought about the speakers' feelings. However, self-focus resulted in poorer identification of the source of the statement than did other-focus. In addition, in a subsequent study, older adults were affected by the direction of focus in the same way as younger adults (De Leonardis, Nolde, & Johnson, 1996). Emotional self-focus also increases the number of elaborations that later embellish an account of an event (Hashtroudi, Johnson, Vnek, & Ferguson, 1994). Interestingly, self-focus when reviewing an event can lead to a particular pattern of memory distortion, in which events are remembered as being more internally consistent (and thus more schematic) than they actually were (Mather & Johnson, 1998).

Therefore we manipulated the direction of emotional focus in this study. We predicted that participants in the present study who focused on how they felt about the statements they heard would be better at recognising the statements but worse at identifying the source of the statements than participants who focused on how the speakers felt about the statements. Of particular interest was the form of the source identification deficit in the self-focus condition. One possibility is that self-focus participants will show a uniform source memory deficit for both consistent and inconsistent items. However, the tendency for emotional self-focus to lead to more schematic recall in Mather and Johnson (1998) and previous studies, which found that distracted participants were more likely to form impressions based on stereotypes or general knowledge about a group, suggest that self-focus may lead to a greater reliance on stereotypes in source identification. If so, emotional self-focus would lead to a source memory deficit that is greatest for the inconsistent items.

There is some evidence that older adults may focus more on affective information when experiencing events. For example, they report greater memory for thoughts and feelings experienced at the time of a remembered event than do younger adults (Hashtroudi et al., 1990). Focusing on thoughts and feelings when thinking about an event can reduce the salience of the event's contextual and sensory characteristics (Suengas & Johnson, 1988). Thus, age differences in remembering information may sometimes be related to the type of focus preferred by each age group. In addition, even when both older and younger adults engage in an emotional focus, it can have more of an effect (relative to a more factual focus) on older adults' performance (Hashtroudi et al., 1994). Consequently, we were interested in whether the direction of emotional focus may affect one's reliance upon stereotypes any differently for older adults than for younger adults.

Another question addressed is how the direction of focus affects the forming of a stereotype on-line. In this study, participants were given a stereotype label for each speaker before watching the videotape; thus they did not have to form an impression on-line in order to be able to tell that certain statements were consistent or inconsistent with the speaker's label. To see how the direction of focus may affect the use of stereotypes when the stereotype must be formed as the video is watched, we also had each speaker say a set of statements that were from a second, unrelated schema set (secondary-schema statements). These statements were irrelevant to the speaker's dominant schema, but were internally consistent for each speaker. Thus if a speaker was described as a Republican, she might also make some statements consistent with being athletic. We were also interested in whether age (in particular, medial-temporal functioning) might be related to the likelihood of forming stereotypes on-line.

Experiment Overview

In summary, in this study we investigated how age and emotional self-focus affect participants' reliance on stereotypes when making source judgements from memory. For this purpose, we gave participants a source identification test that

included both old and new statements that fit particular stereotypes. Some statements had been said by a speaker with a stereotype label consistent with the content of the statement and some had actually been said by the other speaker. By contrasting participants' ability to attribute the source of the speaker-consistent statements with their ability to attribute speaker-inconsistent statements, we derived a measure of stereotype reliance that could be compared across conditions. In addition, we included secondary-schema items (all of which were consistent with their speaker), for which the stereotype could be learned only by listening to the statements throughout the video, in order to compare how the different conditions affected the likelihood of acquiring and applying a schema on-line. For the older adults, we also administered batteries of neuropsychological tests associated with frontal and medial-temporal brain region functioning. We correlated source identification and recognition performance with scores on these test batteries to investigate neuropsychological correlates of stereotype reliance in this situation.

METHOD

Participants

Forty-eight older adults (ages 62–85 years; mean = 72) and 48 undergraduates (ages 17–21 years; mean = 19) participated. All of the older adults and some of the younger adults received financial compensation for their participation. The rest of the younger adults received credit toward a course requirement. Three additional older adults participated, but their data were discarded because they indicated that they had difficulty hearing 12 or more of the statements on the video. One other older adult participated but was replaced because she took notes while watching the video.

Materials

Two pairs of schemas were used. One pair included a Republican and a Democrat schema and the other pair included a writer and an athlete schema. One-paragraph descriptions (see Appendix A) and 24 related items corresponding to each schema were created (see Table 1 for some example statements from each schema).

The related items were designed such that they were associated with their corresponding schema, but could be said by someone not associated with that schema without undermining that other speaker's schema (e.g. although being a Democrat is more associated with being pro-choice for abortion, a Republican might happen to be pro-choice). In addition, there were four filler items for each schema that were unambiguously associated with the schema (e.g. "Writing is my passion in life" for the writer schema; "My parents were also

Table 1. *Examples of Statements Associated with Schemas*

Athlete
I work out almost every day.
It's hard to find good athletic clothing.
I enjoy competing in athletic events.
I think many of the Olympic athletes are such amazing role models.
A coach I once had told me not to worry about winning or losing, but just to have a great time doing it.
Writer
I was the editor of the paper in high school.
I can type faster than I write.
I don't have enough bookcases to hold my books.
In the evenings, I usually curl up on the couch with a good book.
My mother always said I shouldn't read in dim light.
Republican
Most college professors are liberal, so students get a distorted view of reality.
I think welfare creates a cycle of dependency.
Divorce laws should be tougher so that people take marriage seriously.
We need stricter measures to prevent illegal immigration.
Affirmative action discriminates against white males.
Democrat
I'm pro-choice.
I seriously considered serving in the Peace Corps.
There are many gross inequities in our society today.
The death penalty is a cruel and unusual punishment.
The federal government must do more to protect our environment.

Democrats" for the Democrat schema). For counterbalancing purposes, eight acquisition videotapes were created in which two middle-aged women randomly alternated reading statements (with the constraint that neither speaker said more than two statements in a row). After each statement, there was a 15-second pause, followed by a beep and the next statement. In each videotape, each of the women had a dominant schema that was explicitly described in the instructions (e.g. Democrat). Half (12) of the statements she read corresponded to that schema. Another six of the statements each woman read corresponded to the dominant schema of the other woman in the videotape (e.g. Republican). Each woman also had a secondary schema (e.g. athlete), and the six other statements she read were from that schema. This schema was not described for the subjects and there were no statements inconsistent with it. Thus, it could develop on-line as the video advanced. In addition to these 24 target items each woman also read the 4 filler items corresponding to her dominant schema (2 at the beginning of the videotape and 2 at the end). The materials were counterbalanced such that: (1) The dominant schemas were equally as often Republican/Democrat as they were writer/athlete; (2) there was every possible pairing of dominant schemas with secondary schemas (such that there were both Republican-athlete and Republican-writer characters); (3) the actors who read the statements played an athlete, a writer, a Republican and a Democrat equally often; and (4) each statement was presented as a consistent, inconsistent, and secondary schema item as often as was every other statement.

For the memory test, each participant read 72 statements, randomly ordered. All 48 critical statements that had been heard in the video were on the list (the filler items were not included). There were also 24 new statements. Six of these corresponded to each of the two speaker's secondary schemas and six corresponded to each speaker's dominant schema[1].

Procedure

Before participating in the experiment, participants were asked if they felt comfortable using a computer mouse. If they did not, they were given a computer-run tutorial to familiarise them with pointing and clicking the mouse. Subsequently, participants viewed the video either alone or in pairs. If there were two participants in the same session, one was randomly assigned to the self-focus condition and the other to the other-focus condition. The focus conditions and the video counterbalancing conditions were crossed such that three self-focus and three other-focus participants viewed each of the eight videotapes in each of the age groups.

Participants were given written instructions and a pen to fill out a rating form corresponding to their condition. In the self-focus condition, the first line of the instructions was "We are interested in how much people agree in the strength of their feelings to various types of statements." In the other-focus condition, the first line was "We are interested in people's ability to perceive other people's emotions." Then both instructions continued as follows:

> We have videotaped a number of people saying statements about different sorts of things and had them rate the strength of their feelings about what they said. In the videotape you will see, you will hear Sandy and Patricia saying statements. Before recording the videotape, they were asked to write down a number of statements that were opinions they hold or facts about themselves. During the videotape, they were cued by the experimenter to read the statements they had written.

Subsequently, self-focus participants were instructed to think about how strongly they felt about what was said after they heard each statement, and then rate how strongly they felt about it on the rating sheet provided. Other-focus participants were instructed to think about how strongly they thought the speaker felt about what she had said, and then to rate how strongly they thought the speaker felt on their rating sheet. Participants were given an example of how to rate a sentence. Then

[1] Note that new items were always consistent with one of the two speaker's schemas, either the dominant or secondary one.

participants were instructed that if they had difficulty understanding what was said for any particular statement they should draw a line through that item on their sheet, and not to discuss anything with the other participant if there was someone else watching the video at the same time.

Participants then turned the page and read descriptions of the two speakers. The descriptions they read corresponded with the dominant schema of each speaker in that counterbalancing condition (see Appendix A for descriptions). Participants were shown photographs of each speaker with their name so they would know which description corresponded with which speaker on the video. As they watched the video, participants rated each statement on a 5-point scale with the endpoints of either *the speaker does not feel strongly/the speaker feels strongly or I do not feel strongly/I do feel strongly*.

After watching the video, participants moved to another room, where they were seated at a computer (if there were two participants, they were seated with their backs to each other so they could not see what the other person was doing). They were given a computer-presented recognition test, with the photos and names of the women available to look at, in case they forgot which name corresponded with which speaker. Each statement in the test was displayed at the top of the screen. Participants first clicked on a button displayed on the screen to indicate that either "yes," the statement had been said in the video, or "no," the statement had not been said in the video. Then they rated each old/new judgement on a scale from 1 for not at all confident to 5 for very confident. If they said that the item was not said in the video, they were presented with the next statement. If, however, they had said the item was in the video, they were asked to make a source judgement by choosing either Sandy or Patricia as the speaker of the statement and then to make a confidence rating (using the same scale as for the old/new judgement) for the source judgement. They were then presented with the next statement.

When participants had completed the memory test, they were debriefed and paid or given course credit. Forty of the 48 (20 self-focus and 20 other-focus) older participants returned for a separate session to complete the neuropsychological tests (Glisky et al., 1995). Frontal lobe measures were: the modified Wisconsin Card Sorting Test (Hart, Kwentus, Wade, & Taylor, 1988), the Controlled Oral Word Association Test (Benton & Hamsher, 1976), the Mental Arithmetic Test from the Weschler Adult Intelligence Scale-Revised (Weschler, 1981), and the Mental Control Test and Backward Digit Span Test from the Weschler Memory Scale-Revised (Weschler, 1987). Medial-temporal lobe measures were: Logical Memory 1, Verbal Paired Associates 1, and Visual Paired Associates II (all from the Weschler Memory Scale-Revised), and the Long-Delay Cued Recall measure from the California Verbal Learning Test (Delis, Kramer, Kaplan, & Ober, 1987).

RESULTS

An alpha level of .05 was assumed for all of the following statistical tests. If a participant had marked that he or she had difficulty hearing or understanding a statement during the video, that item was excluded from the analysis of their memory test results (proportions reported included only the items they did hear).

Correct Recognition of Old Items

A 2 (Age: old, young) × 2 (Focus: self, other) × 3 (Item Type: consistent, inconsistent, secondary) ANOVA for old items that were correctly recognised as old (see Table 2) revealed main effects of Age [$F(1,92) = 29.29$, $MSe = 0.02$], and Focus [$F(1,92) = 13.38$, $MSe = 0.02$]. Younger adults were more likely to say correctly that a statement from the video had been in the video (mean = .94) than were older adults (mean = .85), and participants who had focused on their own feelings while watching the video were more accurate (mean = .93) than those who had focused on the speakers' feelings (mean = .86). There were no effects of item type and no interactions, indicating that whether the statement was consistent or

Table 2. *Correct Recognition and Source Identification for Younger and Older Participants*

	Younger		*Older*	
Item Type	*Self-focus*	*Other-focus*	*Self-focus*	*Other-focus*
Recognition of old items				
Consistent	.95	.91	.90	.80
Inconsistent	.97	.91	.89	.79
Secondary-schema	.97	.95	.89	.82
Source identification				
Consistent	.91	.93	.86	.90
Inconsistent	.75	.88	.40	.62
Secondary-schema	.84	.94	.78	.91

inconsistent with the speaker or whether it was from the speaker's primary or secondary schema did not affect whether it would be recognised later.

Source Identification

If participants relied solely on the stereotypes to make their source attributions, they should correctly attribute nearly all of the speaker-consistent statements and virtually none of the speaker-inconsistent statements. In contrast, if participants were not affected by the stereotypes at all in making their source attributions, they should have approximately the same proportion of correct attributions for the consistent and the inconsistent statements. Thus, the difference between each participant's proportion of correctly identified speaker-consistent statements and their proportion of correctly identified speaker-inconsistent statements (both shown in the bottom of Table 2) indicates the extent to which they relied on the stereotypes to make their attributions. We submitted these difference scores to a 2 (Age: younger, older) × 2 (Focus: self, other) ANOVA, which revealed main effects of both Age [$F(1,92) = 31.96$ $MSe = 0.05$] and Focus [$F(1,92) = 8.85$, $MSe = 0.05$] (see Fig. 1). Older adults were more likely than younger adults were to rely on the stereotypes (means = .37 and .11, respectively), and self-focus participants were more likely than other-focus participants to rely on the stereotypes (means = .31 and .17, respectively). There was no interaction of Age and Focus.

In addition, because we were interested in performance on each type of item, we conducted separate Age × Focus ANOVAs for correct source identification for each Item Type (consistent, inconsistent, and secondary; see Table 2 for means). For consistent items, there were no significant effects. Older adults and younger adults showed no difference in the probability they would identify the source of consistent old items and the focus at encoding also did not affect participants' ability to identify the source. For secondary items, there was a main effect of Focus [$F(1,92) = 12.55$, $MSe = 0.03$], with other-focus leading to better source accuracy (mean = .92) than self-focus (mean = .81). Thus, for both types of consistent items (secondary schema items were all consistent with their speaker), there were no age differences in source attributions. For inconsistent items, however, there was a main effect of Age, [$F(1,92) = 49.93$, $MSe = 0.05$], as predicted. When asked to identify the source of an item that was inconsistent with its speaker's dominant schema, older adults were much less accurate (mean = .51) than younger adults (mean = .81). There was also a main effect of Focus [$F(1,92) = 15.82$, $MSe = 0.05$], with self-focused participants less accurate (mean = .57) at attributing inconsistent statements than other-focused participants (mean = .75).

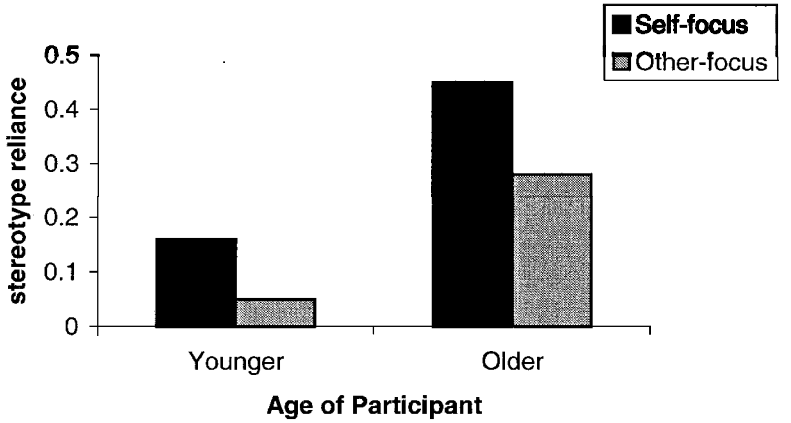

Fig. 1. *Reliance on stereotypes to make source attributions (reliance = proportion of speaker-consistent items correctly attributed – proportion of speaker-inconsistent items correctly attributed).*

False Alarms to New Items

Every new item was consistent with one of the two speakers, whether it was consistent with a speaker's primary (described in advance) or secondary (potentially picked up through watching the video) schema. Thus, every false alarm to a new item was attributed to a source that was either consistent or inconsistent with the content of the statement (see Table 3).

A 2 (Age: old, young) × 2 (Focus: self, other) × 2 (Schema Associated with Statement: primary, secondary) × 2 (False Alarm Attribution: consistent, inconsistent) ANOVA revealed a main effect of Age [$F(1,92) = 8.73$, $MSe = 0.004$]. Older adults were more likely to recognise new items falsely than were younger adults. In addition, participants were more likely to recognise a statement falsely from a speaker's primary schema than one from their secondary schema [$F(1,92) = 16.80$, $MSe = 0.002$]. A main effect of Type of False Alarm [$F(1,92) = 13.05$, $MSe = 0.003$], indicated that participants were more likely to attribute new items to the speaker with which the new items were consistent than to the other speaker. There were also several interactions[2] that were qualified by a four-way interaction of all the factors [$F(1,92) = 4.74$, $MSe = 0.003$]. This interaction was the result of the fact that, as can be seen in Table 3, older adults. were by far more likely to attribute primary schema new items to their consistent speaker than to make any other type of false alarm, a tendency which was even more likely when they had been self-focused (mean = .11) than when they had been other-focused (mean = .07). Thus, older adults were less likely than younger adults to screen out new items consistent with the primary schema of a speaker, especially if they had focused on their own feelings when hearing the statements.

Confidence Ratings

Recognition. We analysed confidence in correct and incorrect responses in a 2 (Age: younger, older) × 2 (Focus: self, other) × 2 (Response: correct, incorrect) ANOVA for each type of item[3]. There were main effects of Response for

[2] These other significant interactions were: Age by Focus, Age by Associated Schema, Age by False Alarm Attribution, Associated Schema by False Alarm Attribution, and a three-way interaction of Age, Associated Schema, and False Alarm Attribution.

[3] We analysed each type of item separately to minimise the impact of missing data points (some participants did not have any incorrect responses for a particular type of item and thus could not be included in the analysis for that type of item).

Table 3. *Proportion of False Alarms (FAs) to New Items for Younger and Older Participants*

	Self-focus		*Other-focus*	
	Cons. Attr.	*Incons. Attr.*	*Cons. Attr.*	*Incons. Attr.*
Younger participants				
Primary schema FAs	.02	.01	.05	.02
Secondary schema FAs	.01	.01	.01	.03
Older participants				
Primary schema FAs	.11	.01	.07	.01
Secondary schema FAs	.02	.03	.02	.01

Cons. Attr. = consistent attribution (e.g. Republican item attributed to a Republican speaker); Incons. Attr. = inconsistent attribution. The proportion of consistent and inconsistent attributions in each category (e.g. younger participants primary-schema self-focus condition), should be added (not averaged) to obtain the total proportion of false alarms in that condition for that type of item.

consistent [$F(1,73) = 190.99$, $MS\text{e} = 0.41$], inconsistent [$F(1,57) = 42.58$, $MS\text{e} = 0.67$], secondary [$F(1,48) = 66.44$, $MS\text{e} = 0.77$], and new items [$F(1,52) = 61.25$, $MS\text{e} = 0.44$], all indicating that participants were more confident in their correct responses than in their incorrect responses (see Table 4 for means). In addition, there were interactions of Age and Response for consistent [$F(1,73) = 4.64$, $MS\text{e} = 0.41$], secondary [$F(1,48) = 8.41$, $MS\text{e} = 0.77$], and new items [$F(1,52) = 5.36$, $MS\text{e} = 0.44$], such that older participants exhibited less difference between their confidence in their correct and incorrect responses than did younger adults. There were no other significant effects in the ANOVA analyses.

One possible explanation of the age deficit in confidence discriminability is that older adults used less of the scale when making their confidence ratings. However, in a *t*-test, there was not a significant difference between the standard deviations of older (mean = .88) and younger (mean = .93) adults' recognition confidence ratings. Thus, older adults use about as much of the scale as younger adults, but their ratings are less associated with their accuracy than those of younger adults.

Source Identification. As we did for recognition of old items, we analysed the average difference between confidence in correct and incorrect source attribution in a 2 (Age: younger, older) × 2 (Focus: self, other) × 2 (Response: correct, incorrect) ANOVA for consistent, inconsistent, and secondary items (it was not possible to make a correct attribution for new items). As found for recognition confidence, participants were more confident in their correct responses than in their incorrect responses for consistent [$F(1,64) = 76.69$, $MS\text{e} = 0.56$], inconsistent [$F(1,80) = 30.66$, $MS\text{e} = 0.46$], and secondary items [$F(1,49) = 25.42$, $MS\text{e} = 0.45$] (see Table 4 for means). In addition, older adults' confidence was less discriminating than younger adults' confidence, as indicated by the interactions of Age and Response for consistent [$F(1,64) = 6.61$, $MS\text{e} = 0.56$] and secondary items [$F(1,49) = 9.26$, $MS\text{e} = 0.45$][4]. For the source confidence ratings of the new items that were incorrectly recognised we conducted a 2 (Age: younger, older) × 2 (Focus: self, other) ANOVA. There was a main effect of Age [$F(1,52) = 6.70$, $MS\text{e} = 1.18$], indicating that older adults were more confident about their incorrectly attributed new items

[4] For both recognition and source identification, the interaction between Age and Response was not significant for inconsistent items, although it was in the same direction as for the other items.

Table 4. *Confidence Ratings for Younger and Older Participants for Correct and Incorrect Items*

	Correct	*Incorrect*
Old/New Recognition		
Younger Adults		
Consistent	4.77	3.09
Inconsistent	4.74	3.39
Secondary-schema	4.89	2.87
New	4.35	3.02
Older Adults		
Consistent	4.60	3.38
Inconsistent	4.56	3.71
Secondary-schema	4.55	3.59
New	4.35	3.63
Source Identification		
Younger Adults		
Consistent	4.47	3.01
Inconsistent	4.37	3.61
Secondary-schema	4.24	3.11
New		2.97
Older Adults		
Consistent	4.17	3.37
Inconsistent	4.07	3.66
Secondary-schema	4.06	3.78
New		3.76

For each type of item, the means are based on those subjects who made both correct and incorrect responses, corresponding with our analyses.

(mean = 3.76) than were younger adults (mean = 2.97).

As we did for the recognition confidence, we tested whether older adults were using a restricted range. Again, there was no significant difference between the average standard deviation of older (mean = .82) and younger (mean = .73) adults' confidence ratings.

Thus, across multiple types of confidence judgements, older adults' confidence ratings were less discriminating between correct and incorrect responses than younger adults' confidence ratings, although they selected just as large a variety of confidence scores as younger adults did. This difference was apparent even under circumstances in which older adults' memory responses were nearly as accurate as those of younger adults (source attributions of schema-consistent items).

Performance in Relation to Neuropsychological Test Scores

Scores on each test were converted to standardised z scores for each of the 40 older participants who completed the neuropsychological test batteries. For each participant, z scores were averaged across the five tests associated with a frontal factor and across the four tests associated with a medial-temporal factor (Glisky et al., 1995; Henkel et al., 1998). This yielded a frontal score and a medial-temporal score for each participant. Each participant was designated as a high frontal scorer if they scored above the mean and a low frontal scorer if they scored below the mean. The same was done for the medial-temporal scores. The distribution of high and low scorers across the two conditions was fairly evenly distributed (frequencies of high and low frontal and medial-temporal scores for the self-focus condition: HH = 4; HL = 6; LH = 4; LL = 6; for the other-focus condition: HH = 6; HL = 4; LH = 4; LL = 6), and the mean frontal and medial-temporal scores did not differ in the two conditions. Within the group of older participants, the oldest participants tended to have lower frontal ($r = -.27$) and medial-temporal scores ($r = -.22$), though neither correlation was significant.

Of particular interest is whether age-related neuropathology in medial-temporal and frontal brain regions may underlie the age deficits found in this study. Thus, to avoid confounding our analyses with other age-related factors, we used partial correlations to remove variance due to age for all of the following correlations. We correlated the frontal and medial-temporal scores with each participant's corrected recognition score (false alarms to new items subtracted from correct hits to old items) and correct source identification scores (we correlated the source identification scores for each type of item separately because we expected frontal processes to be more important for identifying the source of speaker-inconsistent than speaker-consistent items). In addition, we were interested in whether the age-related deficit in the difference in confidence scores between correct and incorrect responses (confidence discriminability) might be

correlated with the neuropsychological test scores. Thus, we also correlated each participant's average difference in confidence for their correct and incorrect responses (for both recognition and source identification) with the neuropsychological scores. All of the correlations were done separately for the self-focus and other-focus conditions (see Table 5).

As might be expected from studies linking content memory and medial-temporal regions, medial-temporal test performance was positively correlated with recognition accuracy in both the self-focus condition ($r = .40$, $P < .1$) and other-focus ($r = .65$, $P < .005$) conditions (although the correlation was only marginally significant in the self-focus condition). In the other-focus condition, medial-temporal functioning seemed to affect not only memory performance, but also ability to evaluate the accuracy of one's responses, as indicated by the correlation between the confidence discriminability for recognition responses and medial-temporal scores ($r = .50$, $P < .05$).

Medial-temporal performance was also related to source monitoring performance. Participants with higher medial-temporal scores correctly attributed more secondary-schema items[5] than those with low scores ($r = .48$, $P < .05$; $r = .49$, $P < .05$ for self- and other-focus conditions, respectively) and, in the other-focus condition, correctly attributed more consistent items than those with low scores ($r = .47$, $P < .05$). As with recognition, medial-temporal functioning seemed to be related to participants' metamemory ability as well as to their actual performance: Medial-temporal scores were correlated with confidence discriminability for source judgements for both self-focus ($r = .57$, $P < .01$) and other-focus conditions ($r = .52$, $P < .05$). Thus, accurate metamemory judgements seem to depend on the ability to encode specific memorial qualitative characteristics.

Table 5. *Partial Correlations (Partialling Out Age) between Frontal and Medial-temporal Battery and Older Adults' Recognition Performance, Source Identification, and Confidence Ratings*

	Frontal Battery	*Medial-temporal Battery*
Self-focus Condition		
Corrected recognition	.05	.40
Source identification		
Stereotype reliance (C − I)	.30	−.28
Consistent	.15	−.05
Inconsistent	−.30	.34
Secondary-schema	.31	.48*
Confidence discriminability		
Recognition judgement	.10	.20
Source judgement	.03	.57*
Other-focus Condition		
Corrected recognition	.21	.65*
Source identification		
Stereotype reliance (C − I)	−.59*	−.16
Consistent	.02	.47*
Inconsistent	.62*	.38
Secondary-schema	.40	.49*
Confidence discriminability		
Recognition judgement	.34	.50*
Source judgement	.32	.52*

Stereotype reliance = consistent source identification − inconsistent source identification; confidence discriminability = average confidence for correct responses − average confidence for incorrect responses.

* $P < .05$.

Participants' stereotype reliance (consistent–inconsistent source identification) was negatively correlated with their frontal scores in the other-focus condition ($r = .59$, $P < .01$); participants with high frontal scores were less likely to rely on the stereotypes when making source identifica-

[5] Note that the secondary-schema items were all consistent with the speaker's secondary schema, and as such can be considered to be a type of speaker-consistent statements.

[6] As can be seen in Table 5, in the self-focus condition the correlation between stereotype reliance and frontal scores was actually in the opposite direction, with a positive value (although nonsignificant). This suggests that high frontal scorers may use different strategies depending upon the type of information available to them. Participants in the self-focus condition presumably had little source-specific information available, such that even if they attempted to retrieve specific memorial details about the item, those details would not have helped identify the source of the item. Thus, in the self-focus condition, high frontal scorers may have resorted to the best available strategy to complete the source identification task without the assistance of source-specific memorial information—using the schemas to identify who said which item.

tions than were participants with low frontal scores. This correlation was not significant in the self-focus condition[6]. Looking at the two components of stereotype reliance in the other-focus condition, there was a correlation between frontal scores and the ability to correctly attribute speaker-inconsistent items ($r = .62$, $P < .005$), but not between frontal scores and the ability to attribute speaker-consistent items.

The overall pattern of correlations suggests that not all source identification tasks require the same cognitive processes for optimal performance. These data suggest that when general knowledge and item-specific information are contradictory, performance on that task will rely upon frontal region functioning. The fact that the frontal correlation with stereotype reliance appeared in the other-focus condition but not the self-focus condition, whereas the correlations found with medial-temporal performance were generally consistent in the two conditions, suggests that the nature of the relationship between frontal functioning and performance is more dependent upon the type of focus than is the relationship between medial-temporal functioning and performance. Strategic frontal processes may be more flexible and likely to shift according to task demands than medial-temporal binding processes.

DISCUSSION

The results of this study demonstrate both the utility and the pitfalls of using general knowledge to help remember information. When the actual speaker and the probable speaker for a given statement were the same, neither emotional focus nor age affected participants' ability to attribute the statement to the correct speaker. Thus, under some circumstances, factors that generally make source monitoring less accurate can be counteracted with the use of general knowledge. This type of cognitive strategy can be very useful. Quite often, our memories do not have qualitative characteristics that are distinctive enough to determine the source of the remembered information. As long as potential sources act in a consistent manner, educated inferences about who said what will lead to correct source attributions. However, as also demonstrated by this experiment, relying on general knowledge can lead to problems when specific qualitative information and the knowledge about the source do not match. Emotional self-focus and ageing, factors associated with decrements in source identification (both presumably due in part to poor feature information), both led to a greater reliance on stereotypes for making source attributions for statements that had been heard.

A great deal of research has focused on when expectancy-congruent information is remembered better than expectancy-incongruent information, and vice versa (for a review, see Stangor & McMillan, 1992). One reason this question is interesting is that what is remembered can help determine when stereotypes will be maintained and when they will not. Our study suggests that source misattributions may be a mechanism through which stereotypes about particular individuals or groups may be maintained even when memory for the content of the consistent and the inconsistent information is equivalent. In particular, older adults and people in situations that encourage focusing more on oneself than on the source of information may be more likely to maintain their stereotypes through false (but stereotype-consistent) memories about the behaviour of particular individuals or groups. In general, increasing cognitive load through distraction or stress should have similar effects.

Also potentially leading to the maintenance of stereotypes is the fact that general knowledge affected the rates of false recognition to new statements. Items corresponding to the primary schema were more likely to be falsely recognised than items from the secondary schema. Participants were significantly more likely to attribute the new statements they falsely recognised to the speaker they were consistent with than to the other speaker (see Mather et al., 1997, for similar findings). It is possible that being able to associate a new statement with a particular speaker increased participants' confidence that they had actually heard the statement. Because we did not have any new items that were

not associated with one of the two speakers, we cannot address this possibility with this study, but it would be an interesting question to pursue.

Neuropsychological Test Scores and Stereotype Reliance

The fact that older adults were more likely than younger adults to rely on schematic knowledge when making source attributions integrates two lines of research. First, in comparison to younger adults, older adults often show deficits in source identification tasks (e.g. Brown et al., 1995; G. Cohen & Faulkner, 1989; Ferguson et al., 1992; Henkel et al., 1998; McIntyre & Craik, 1987; Spencer & Raz, 1995), and second, older adults tend to rely more on schematic knowledge when trying to recall or recognise information (e.g. Hess et al., 1989; Hess & Slaughter, 1990; Hess & Tate, 1992). Thus, giving greater weight to schematic knowledge is one mechanism through which older adults can compensate for their decreased access to other types of source-specifying information (although we have also seen how schematic knowledge can lead them astray).

For older adults, source monitoring performance for different types of items was associated with scores on different neuropsychological test batteries. In the other-focus condition, correctly attributing statements that were not consistent with their speaker's schema (e.g. a Democratic statement spoken by a Republican) was correlated with performance on the frontal component of a neuropsychological test battery (Glisky et al., 1995). Frontal regions may contribute to this task through processes monitoring inconsistencies between a statement and the speaker at encoding or through systematic retrieval and evaluation processes engaged during the test. Because of the conflict at test between specific memorial information associated with who actually said the statement and the schematic knowledge about that person, it may be necessary to retrieve more information and evaluate it more closely. In contrast, correctly attributing speaker-consistent statements requires less reflection at encoding and a less complex retrieval/decision process (all one has to remember is the schema that was associated with that person). Indeed, speaker-consistent statements (and secondary-schema statements, which were also consistent with their speaker's schema) were not correlated with frontal scores, but instead with scores on the medial-temporal test battery. This finding suggests that the ability to remember the content of the schema and possibly to bind specific qualitative characteristics to the statement are important (whereas there is less of a need for strategic processes) in order to attribute the source of this type of item.

These findings help shed light on prior discrepancies in the literature regarding brain region functioning and performance. A number of researchers have suggested that memory for the content and the source of an event may be functionally dissociable (e.g. Craik, Morris, Morris, & Loewen, 1990; Glisky et al., 1995, Johnson & Raye, 1981; Schacter, Harbluk, & McLachlan, 1984) and neuropsychologically dissociable, with memory for content relying on medial-temporal lobe areas of the brain and memory for source relying on frontal areas of the brain (e.g. Glisky et al., 1995; Janowsky, Shimamura, & Squire, 1989; Schacter, 1987; Schacter et al., 1984; Shimamura, Janowsky, & Squire, 1990; Shimamura & Squire, 1987). For example, in one experiment, elderly participants' ability to remember sentences they had heard was correlated with their performance on a battery of tests often used clinically to measure medial-temporal lobe function but not with their performance on a battery used to measure frontal lobe function, whereas the reverse was true for their ability to remember the voice in which the sentence had been spoken (Glisky et al., 1995). However, although source memory is sometimes correlated with measures of frontal functioning in older adults, a reliable relationship is not always evident (e.g. Degl'Innocenti & Bäckman, 1996; Dywan, Segalowitz, & Williamson, 1994; Johnson et al., 1995; Schacter, Kaszniak, Kihlstrom, & Valdiserri, 1991; Spencer & Raz, 1995). In addition, source memory tasks are not necessarily exclusively associated with measures of frontal functioning. For example, determining whether an object was seen or imagined was found to be associated with mea-

sures of both frontal and medial-temporal region functioning in older adults (Henkel et al., 1998).

According to the SMF, accurate source monitoring requires both initial binding of multiple features of an event and later retrieval and evaluation of these features. Different types of source monitoring tasks depend to different degrees on these different processes. In particular, because frontal regions are critical for reflective activities such as strategic retrieval and evaluation (e.g., Burgess & Shallice, 1996; Gershberg & Shimamura, 1995; Johnson et al., 1993; Johnson & Raye, 1998, in press; Mangels, Gershberg, Shimamura, & Knight, 1996; Moscovitch, 1994; Schacter, Norman, & Koutstaal, 1998), the more reflective processing that is necessary to retrieve and evaluate the source of an event correctly, the more likely that source task is to be correlated with measures of frontal functioning. Democratic statements that were spoken by a Republican speaker require more systematic evaluation than speaker-consistent statements in order to be attributed correctly, and indeed, the likelihood of attributing speaker-inconsistent statements correctly was correlated with measures of frontal functioning, whereas speaker-consistent attributions were not. This differential relation to measures of frontal brain region functioning is consistent with recent brain-imaging studies suggesting that prefrontal region activity reflects the amount of reflective activity required at test (e.g. Johnson et al., 1996a; Nolde, Johnson, & D'Esposito, 1998a; Schacter, Alpert, Savage, Rauch & Albert, 1996). In addition, the fact that source identification for speaker-consistent statements was not correlated with frontal battery performance suggests that the degree to which a particular source task will rely on processes associated with medial-temporal or frontal brain regions will depend upon the demands of the particular task (Nolde et al., 1998b).

The finding of greater stereotype reliance among participants with low performance on the frontal test battery is also consistent with the argument that stereotypes are used as a means of simplifying complex judgement tasks (e.g. Bodenhausen & Lichtenstein, 1987; Fiske & Neuberg, 1990; Macrae, Milne, & Bodenhausen, 1994; Tajfel, 1981). Older participants whose low frontal battery scores suggest they have frontal brain region deterioration presumably have more difficulty engaging in reflectively demanding tasks and thus rely more on simpler, heuristic processes such as matching the statement to the speaker on the basis of the speaker's stereotype label.

Less Differentiated Confidence Ratings for Older Adults

Confidence ratings in this study indicate that, in general, participants had some information about the accuracy of their memory judgements. They tended to be less confident when they incorrectly recognised or attributed a statement than when they correctly remembered it. However, older adults' confidence ratings differentiated less well between correct and incorrect responses than did those of younger adults (see also Henkel et al., 1998). This was the case even when their accuracy was nearly as good as that of the younger adults (i.e. when attributing speaker-consistent statements). In addition, the average difference between older adults' confidence ratings for correct and incorrect items was correlated with their medial-temporal test performance, suggesting that the ability to make confidence judgements that reflect actual accuracy is aided by processes supported by medial-temporal brain regions. Presumably, these processes are critical for binding one qualitative characteristic (e.g. perceptual detail) to another (e.g. semantic detail) in memory.

Self-focus and Later Use of Stereotypes

Both older and younger participants who thought about how they felt about the statements (self-focus) rather than thinking about how the speakers felt (other-focus) were more likely to misattribute statements to the speaker for whom the statement would be more consistent. The higher reliance on schematic knowledge by self-focus participants was not due to poorer memory in general. Self-focus participants were actually more likely to recognise statements correctly from the video than were other-focus participants.

Instead, their schematic misattribution errors seem to be due to a lack of source-specifying memorial information, a result of their focus at encoding (Johnson et al., 1996b).

An interesting finding from this study is that self-focus increased the older adults' false recognition of new items but not that of the younger adults. Thinking about how strongly they felt about the statements led older adults to be particularly likely to say that they had heard new items that were consistent with a speaker's primary schema. These false alarms were almost always attributed to the speaker whose stereotype label was consistent with the content of the statement. This pattern suggests that after focusing on their own feelings when experiencing an event (and thus not encoding many source-specifying details for events) older adults may weight schema information more heavily when attributing related events to sources. Thus, older adults sometimes pay a greater cost for self-focus than do younger adults (e.g. Hashtroudi et al., 1994).

Conclusions

In summary, we found that the degree to which a person relies on stereotypes to determine the source of information depends both on the way they focused on the information when they first encountered it and also on age-related changes in processing. Thinking about our own feelings when listening to people talk might help us remember the content of the statements, but because it reduces the likelihood of binding source-specifying information to statements, it can also foster a greater reliance upon general knowledge when trying to remember who said the statement. In addition, the pattern of results with older adults was consistent with the hypothesis that frontal brain regions support the type of processes necessary to deal with possible contradictions between specific information and schematic knowledge.

Although we have investigated speaker as one type of source information, this general pattern of results would be expected to hold for conflicts between general knowledge and any type of source-specifying information (e.g. place, temporal information, colour, etc.). Similarly, although we used an explicit source identification task, the general pattern of findings are relevant to understanding performance in tasks that do not require explicit source identification but that require source monitoring nonetheless (exclusion tasks, e.g. Jacoby, Woloshyn, & Kelley, 1989; cryptomnesia paradigms, e.g. Marsh, Landau, & Hicks, 1997; free recall of stories, e.g. Mather & Johnson, 1998). In general, increased reliance on general knowledge as a result of a lack of source-specifying memorial qualitative characteristics can be dangerous. Assuming that the source that seems most consistent with an event was actually associated with the event can lead to errors that are difficult to detect because they seem so plausible.

REFERENCES

Banaji, M.R., & Greenwald, A.G. (1995). Implicit gender stereotyping in judgments of fame. *Journal of Personality and Social Psychology*, *68*, 181–198.

Bargh, J.A., & Thein, R.D. (1985). Individual construct accessibility, person memory, and the recall-judgment link: The case of information overload. *Journal of Personality and Social Psychology*, *49*, 1129–1146.

Bartlett, F.C. (1932). *Remembering: A study in experimental and social psychology*. Cambridge: Cambridge University Press.

Bayen, U.J., & Murnane, K. (1996). Aging and the use of perceptual and temporal information in source memory tasks. *Psychology and Aging*, *11*, 293–303.

Benton, K.L., & Hamsher, K. (1976). *Multilingual Aphasia Examination manual*. Iowa City: University of Iowa.

Bodenhausen, G.V., & Lichtenstein, M. (1987). Social stereotypes and information-processing strategies: The impact of task complexity. *Journal of Personality and Social Psychology*, *52*, 871–880.

Bransford, J.D., & Johnson, M.K. (1973). Considerations of some problems of comprehension. In W. Chase (Ed.), *Visual information processing* (pp. 383–438). New York: Academic Press.

Brewer, M.B., Weber, J. G., & Carini, B. (1995). Person memory in intergroup contexts: Categorization

vs. Individuation. *Journal of Personality and Social Psychology*, *69*, 29–40.

Brown, A.S., Jones, E.M., & Davis, T. L. (1995). Age differences in conversational source monitoring. *Psychology and Aging*, *10*, 111–122.

Burgess, P.W., & Shallice, T. (1996). Bizarre responses, rule detection and frontal lobe lesions. *Cortex*, *32*, 241–259.

Cohen, G., & Faulkner, D. (1989). Age differences in source forgetting: Effects on reality monitoring and on eyewitness testimony. *Psychology and Aging*, *4*, 10–17.

Cohen, N.J., & Eichenbaum, H. (1993). *Memory, amnesia, and the hippocampal system*. Cambridge, MA: MIT Press.

Craik, F.I.M., Morris, L.W., Morris, R.G., & Loewen, E.R. (1990). Relations between source amnesia and frontal lobe functioning in older adults. *Psychology and Aging*, *5*, 148–151.

Degl'Innocenti, A., & Bäckman, L. (1996). Aging and source memory: Influences of intention to remember and associations with frontal lobe tests. *Aging, Neuropsychology, and Cognition*, *3*, 307–319.

De Leonardis, D.M., Nolde, S.F., & Johnson, M.K. (1996). *Direction of emotional focus and source memory in older and younger adults*. Paper presented at the eighth annual APS convention, June, San Francisco, CA.

Delis, D.C., Kramer, J., Kaplan, E., & Ober, B.A. (1987). *The California Verbal Learning Test*. San Antonio, TX: Psychological Corporation.

Devine, P.G. (1989). Stereotypes and prejudice: Their automatic and controlled components. *Journal of Personality and Social Psychology*, *56*, 5–18.

Dodson, C.S., Holland, P.W., & Shimamura, A.P. (1998). On the recollection of specific and partial source information. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *24*, 1121–1136

Dywan, J., Segalowitz, S.J., & Williamson, L. (1994). Source monitoring during name recognition in older adults: Psychometric and electrophysiological correlates. *Psychology and Aging*, *9*, 568–577.

Ferguson, S., Hashtroudi, S., & Johnson, M.K. (1992). Age differences in using source-relevant cues. *Psychology and Aging*, *7*, 443–452.

Fiske, S.T., & Neuberg, S.L. (1990). A continuum of impression formation, from category-based to individuating processes: Influences of information and motivation on attention and interpretation. *Advances in Experimental Social Psychology*, *23*, 1–73.

Gershberg, F.B., & Shimamura, A.P. (1995). The role of the frontal lobes in the use of organizational strategies in free recall. *Neuropsychologia*, *13*, 1305–1333.

Glisky, E.L., Polster, M.R., & Routhieaux, B.C. (1995). Double dissociation between item and source memory. *Neuropsychology*, *9*, 229–235.

Golomb, J., Kluger, A., de Leon, M.J., Ferris, S.H., Convit, A., Mittelman, M., Cohen, J., Rusinek, H., De Santi, S., & George, A.E. (1994). Hippocampal formation size in normal human aging: A correlate of delayed secondary memory performance. *Learning and Memory*, *1*, 45–54.

Hart, R.P., Kwentus, J.A., Wade, J.B., & Taylor, J.R. (1988). Modified Wisconsin Card Sorting Test in elderly normal, depressed and demented patients. *Clinical Neuropsychologist*, *2*, 49–56.

Hashtroudi, S., Johnson, M.K., & Chrosniak, L. D. (1990). Aging and qualitative characteristics of memories for perceived and imagined complex events. *Psychology and Aging*, *5*, 119–126.

Hashtroudi, S., Johnson, M.K., Vnek, N., & Ferguson, S.A. (1994). Aging and the effects of affective and factual focus on source monitoring and recall. *Psychology and Aging*, *9*, 160–170.

Haug, H., & Eggers, R. (1991). Morphometry of the human cortex cerebri and corpus striatum. *Neurobiology of Aging*, *12*, 336–338.

Henkel, L.A., Johnson, M.K., & De Leonardis, D.M. (1998). Aging and source monitoring: Cognitive processes and neuropsychological correlates. *Journal of Experimental Psychology: General*, *127*, 251–268.

Hess, T.M., Donley, J., & Vandermaas, M.O. (1989). Aging-related changes in the processing and retention of script information. *Experimental Aging Research*, *15*, 89–96.

Hess, T.M., & Slaughter, S.J. (1990). Schematic knowledge influences on memory for scene information in young and older adults. *Developmental Psychology*, *26*, 855–865.

Hess, T.M., & Tate, C.S. (1992). Direct and indirect assessments of memory for script-based narratives in young and older adults. *Cognitive Development*, *7*, 467–484.

Holtgraves, T., Srull, T.K., & Socall, D. (1989). Conversation memory: The effects of speaker status on memory for the assertiveness of conversation remarks. *Journal of Personality and Social Psychology*, *56*, 149–160.

Jacoby, L.L., Woloshyn, V., & Kelley, C. (1989). Becoming famous without being recognized:

Unconscious influences of memory produced by dividing attention. *Journal of Experimental Psychology: General*, *118*, 115–125.

Janowsky, J.S., Shimamura, A.P., & Squire, L.R. (1989). Source memory impairment in patients with frontal lobe lesions. *Neuropsychologia*, *27*, 1043–1056.

Jernigan, T.L., Archibald, S.L., Berhow, M.T., Sowell, E.R., Foster, D.S., & Hesselink, J.R. (1991). Cerebral structure on MRI, Part 1: Localization of age-related changes. *Biological Psychiatry*, *29*, 55–67.

Johnson, M.K., & Chalfonte, B. L. (1994). Binding complex memories: The role of reactivation and the hippocampus. In D.L. Schacter & E. Tulving (Eds.), *Memory systems 1994* (pp. 311–350). Cambridge, MA: MIT Press.

Johnson, M.K., De Leonardis, D.M., Hashtroudi, S., & Ferguson, S.A. (1995). Aging and single versus multiple cues in source monitoring. *Psychology and Aging*, *10*, 507–517.

Johnson, M.K., Foley, M.A., Suengas, A.G., & Raye, C.L. (1988). Phenomenal characteristics of memories for perceived and imagined autobiographical events. *Journal of Experimental Psychology: General*, *117*, 371–376.

Johnson, M.K., Hashtroudi, S., & Lindsay, D.S. (1993). Source monitoring. *Psychological Bulletin*, *114*, 3–28.

Johnson, M.K., Kounios, J., & Nolde, S.F. (1996a). Electrophysiological brain activity and memory source monitoring. *NeuroReport*, *7*, 2929–2932.

Johnson, M.K., Nolde, S.F., & De Leonardis, D.M. (1996b). Emotional focus and source monitoring. *Journal of Memory and Language*, *35*, 135–156.

Johnson, M.K., & Raye, C.L. (1981). Reality monitoring. *Psychological Review*, *88*, 67–85.

Johnson, M.K., & Raye, C.L. (1998). False memories and confabulation. *Trends in Cognitive Science*, *2*, 137–145.

Johnson, M.K., & Raye, C.L. (in press). Cognitive and brain mechanisms of false memories and beliefs. In D.L. Schacter & E. Scarry (Eds.), *Memory, brain, and belief*. Cambridge, MA: Harvard University Press.

Johnson, M.K., Raye, C.L., Foley, M.A., & Kim, J.K. (1982). Pictures and images: Spatial and temporal information compared. *Bulletin of the Psychonomic Society*, *19*, 23–26.

Kruglanski, A.W., & Freund, T. (1983). The freezing and unfreezing of lay-inferences: Effects on impressional primacy, ethnic stereotyping, and numerical anchoring. *Journal of Experimental Social Psychology*, *19*, 448–468.

Lane, S.M., & Villa, D. (1997). *Focusing on the characteristics of accurate memories reduces false memories.* Paper presented at the annual meeting of the Psychonomics Society, Philadelphia, PA.

Light, L.L. (1996). Memory and aging. In E.L. Bjork & R.A. Bjork (Eds.), *Memory* (pp. 443–490). San Diego, CA: Academic Press.

Macrae, C.N., Hewstone, M., & Griffiths, R.J. (1993). Processing load and memory for stereotype-based information. *European Journal of Social Psychology*, *23*, 77–87.

Macrae, C.N., Milne, A.B., & Bodenhausen, G.V. (1994). Stereotypes as energy-saving devices: A peek inside the cognitive toolbox. *Journal of Personality and Social Psychology*, *66*, 37–47.

Mangels, J.A., Gershberg, F.B., Shimamura, A.P., & Knight, R.T. (1996). Impaired retrieval from remote memory in patients with frontal lobe damage. *Neuropsychology*, *10*, 32–41.

Marsh, R.L., Landau, J.D., & Hicks, J.L. (1997). Contributions of inadequate source monitoring to unconscious plagiarism during idea generation. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *23*, 886–897.

Mather, M., Henkel, L.A., & Johnson, M.K. (1997). Evaluating characteristics of false memories: Remember/know judgments and memory characteristics questionnaire compared. *Memory and Cognition*, *25*, 826–837.

Mather, M., & Johnson, M.K. (1998). *Emotional review and memory distortion*. Manuscript under review.

McIntyre, J.S., & Craik, F.I.M. (1987). Age differences in memory for item and source information. *Canadian Journal of Psychology*, *41*, 175–192.

Mitchell, K.J., & Johnson, M.K. (in press). Source monitoring: Attributing (and misattributing) memories to sources. In E. Tulving & F.I.M. Craik (Eds.), *Oxford handbook of memory*. New York: Oxford University Press.

Moscovitch, M. (1994). Cognitive resources and dual-task interference effects at retrieval in normal people: The role of the frontal lobes and medial-temporal cortex. *Neuropsychology*, *8*, 523–534.

Moscovitch, M., & Winocur, G. (1995). Frontal lobes, memory, and aging. *Annals of the New York Academy of Sciences*, *769*,119–150.

Nolde, S.F., Johnson, M.K., & D'Esposito, M. (1998a). Prefrontal activation during episodic remembering: An event-related MRI study. *NeuroReport, 9,* 3509–3514.

Nolde, S.F., Johnson, M.K., & Raye, C.L. (1998b). The role of the prefrontal cortex during tests of episodic memory. *Trends in Cognitive Sciences*, *2*, 399–406.

Norman, K.A., & Schacter, D.L. (1997). False recognition in younger and older adults: Exploring the characteristics of illusory memories. *Memory and Cognition*, *25*, 838–848.

Owens, J., Bower, G.H., & Black, J.B. (1979). The soap opera effect in story recall. *Memory and Cognition*, *7*, 185–191.

Pratto, F., & Bargh, J.A. (1991). Stereotyping based on apparently individuating information: Trait and global components of sex stereotypes under attention overload. *Journal of Experimental Social Psychology*, *27*, 26–47.

Raz, N., Gunning-Dixon, F.M., Head, D., Dupuis, J.H., & Acker, J.D. (1998). Neuroanatomical correlates of cognitive aging: Evidence from structural magnetic resonance imaging. *Neuropsychology*, *12*, 95–114.

Reitan, R.M., & Wolfson, D. (1994). A selective and critical review of neuropsychological deficits and the frontal lobes. *Neuropsychology Review*, *4*, 161–198.

Ross, M. (1989). Relation of implicit theories to the construction of personal histories. *Psychological Review*, *96*, 341–357.

Rothbart, M., Fulero, S., Jensen, C, Howard, J., & Birrell, P. (1978). Recall for confirming events: Memory processing and the maintenance of social stereotypes. *Journal of Experimental Social Psychology*, *14*, 237–255.

Salthouse, T.A. (1992). Why do adult age differences increase with task complexity? *Developmental Psychology*, *28*, 905–918.

Salthouse, T.A., Fristoe, N., & Rhee, S.H. (1996). How localized are age-related effects on neuropsychological measures? *Neuropsychology*, *10*, 272–285.

Schacter, D.L. (1987). Memory, amnesia, and frontal lobe dysfunction. *Psychobiology*, *15*, 21–36.

Schacter, D.L., Alpert, N.M., Savage, C.R., Rauch, S.L., & Albert, M.S. (1996). Conscious recollection and the human hippocampal formation: Evidence from positron emission tomography. *Proceedings of the National Academy of Sciences of the United States of America*, *93*, 321–325.

Schacter, D.L., Harbluk, J.L., & McLachlan, D.R. (1984). Retrieval without recollection: An experimental analysis of source amnesia. *Journal of Verbal Learning and Verbal Behavior*, *23*, 593–611.

Schacter, D.L., Kaszniak, A.W., Kihlstrom, J.F., & Valdiserri, M. (1991). The relation between source memory and aging. *Psychology and Aging*, *6*, 559–568.

Schacter, D.L., Koutstaal, W., & Norman, K.A. (1997). False memories and aging. *Trends in Cognitive Sciences*, *1*, 229–236.

Schacter, D.L., Norman, K.A., & Koutstaal, W. (1998). The cognitive neuroscience of constructive memory. *Annual Review of Psychology*, *49*, 289–318.

Schooler, J.W., Gerhard, D., & Loftus, E.F. (1986). Qualities of the unreal. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *12*, 171–181.

Sherman, J.W., & Bessenoff, G.R. (in press). Stereotypes as source monitoring cues: On the interaction between episodic and semantic memory. *Psychological Science*.

Shimamura, A.P. (1995). Memory and frontal lobe function. In M.S. Gazzaniga (Ed.), *The cognitive neurosciences* (pp. 803–813). Cambridge, MA: MIT Press.

Shimamura, A.P., Janowsky, J.S., & Squire, L.R. (1990). Memory for the temporal order of events in patients with frontal lobe lesions and amnesic patients. *Neuropsychologia*, *28*, 803–813.

Shimamura, A.R., & Squire, L.R. (1987). A neuropsychological study of fact memory and source amnesia. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *13*, 464–473.

Spencer, W.D., & Raz, N. (1995). Differential effects of aging on memory for content and context: A meta-analysis. *Psychology and Aging*, *10*, 527–539.

Squire, L.R. (1992). Memory and the hippocampus: A synthesis from findings with rats, monkeys, and humans. *Psychological Review*, *99*, 195–231.

Squire, L.R., & Knowlton, B.J. (1995). Memory, hippocampus, and brain systems. In M.S. Gazzaniga (Ed.), *The cognitive neurosciences* (pp. 825–837). Cambridge, MA: MIT Press.

Stangor, C. (1988). Stereotype accessibility and information processing. *Personality and Social Psychology Bulletin*, *14*, 694–708.

Stangor, C., Lynch, L., Duan, C., & Glass, B. (1992). Categorization of individuals on the basis on multiple social features. *Journal of Personality and Social Psychology*, *62*, 207–218.

Stangor, C., & McMillan, D. (1992). Memory for expectancy-congruent and expectancy-incongruent information: A review of the social and social developmental literatures. *Psychological Bulletin*, *111*, 42–61.

Stuss, D.T., & Benson, D.F. (1986). *The frontal lobes*. New York: Raven Press.

Suengas, A.G., & Johnson, M.K. (1988). Qualitative effects of rehearsal on memories for perceived and imagined complex events. *Journal of Experimental Psychology: General*, *117*, 377–389.

Tajfel, H. (1981). *Human groups and social categories: Studies in social psychology*. New York: Cambridge University Press.

Taylor, S.E., & Crocker, J. (1981). Schematic bases of social information processing. In D.L. Hamilton (Ed.), *Cognitive processes in stereotyping and intergroup behaviour* (pp. 88–114). Hillsdale, NJ: Lawrence Erlbaum Associates Inc.

Taylor, S.E., & Falcone, H. (1982). Cognitive bases of stereotyping: The relationship between categorization and prejudice. *Personality and Social Psychology Bulletin*, *8*, 426–432.

Taylor, S.E., Fiske, S.T., Etcoff, N.L., & Ruderman, A.J. (1978). Categorical and contextual bases of person memory and stereotyping. *Journal of Personality and Social Psychology*, *36*, 778–793.

Waddell, K.J., & Rogoff, B. (1981). Effect of contextual organization on spatial memory of middle-aged and older women. *Developmental Psychology*, *17*, 878–885.

Weschler, D. (1981). *Manual for the Weschler Adult Intelligence Scale-Revised*. New York: Psychological Corporation.

Weschler, D. (1987). *Weschler Memory Scale—Revised Manual*. New York: Psychological Corporation.

West, R.L. (1996). An application of prefrontal cortex function theory to cognitive aging. *Psychological Bulletin*, *120*, 272–292.

APPENDIX A

Descriptions of Speakers

Athlete–Writer Pair

As a teenager, Sandy began running as a way to have some quiet time to herself at the beginning or end of each day. She used the time when she was running as a way to organise her thoughts. It soon became clear she had great talent as a runner. She competed in races while a student in college. For a while after she graduated, she stopped running. But she really missed the feeling of being in good shape, so she joined a running club and has been running and competing in local races ever since. It is difficult for her to run in the winter because of the early darkness and the ice on the roads, but she tries to stay in shape in other ways.

Patricia has always been interested in writing. An aunt gave her a journal for her thirteenth birthday. In addition to using the journal as a log of her daily activities, Patricia began to write short stories. Her high-school English teacher recognised her gift for writing and encouraged Patricia to submit her stories to local writing competitions. Patricia also began writing for her high school paper. She continued writing for the school paper at college, and her first job after college was for a local newspaper as a reporter.

Republican–Democrat Pair

Patricia was born in Arlington, Virginia. Her father was an officer in the military and her mother was a full-time housewife. She attended a private school for girls, where she developed a strong appreciation for religion. She still attends mass every Sunday. After Patricia graduated from college, she began working for RJ Reynolds, a tobacco company. She also became involved in local politics, campaigning for Republican candidates. She is still an active member of the Republican party and has been an important part of many local Republican campaigns. She enjoys being a part of the political process and feels that it is an important thing to do.

Sandy grew up in Newark, New Jersey. Her parents couldn't afford private schooling so Sandy attended the local public schools. Her sixth grade teacher introduced Sandy to a programme which involved reading to visually impaired children. Sandy continued to be active in this programme, throughout high school and also began volunteering in a local soup kitchen. In college, she realised that government action was a critical part of improving the lives of the poor, and so after she graduated she moved to Washington, DC and worked for several years with the Democratic party. She is an active member of the Democratic party—she attended the Democratic National Convention last year, and has frequently helped raise money for Democrat candidates. She enjoys discussing politics and feels that it is possible to make a difference as an individual citizen.