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Age-Related Differences in Communication and Audience Design

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This article reports an experiment examining the extent to which younger and older speakers engage in *audience design,* the process of adapting one's speech for particular addressees. Through an initial card-matching task, pairs of younger adults and pairs of older adults established common ground for sets of picture cards. Subsequently, the same individuals worked separately on a computer-based picture-description task that involved a novel partner-cuing paradigm. Younger speakers' descriptions to the familiar partner were shorter and were initiated more quickly than were descriptions to an unfamiliar partner. In addition, younger speakers' descriptions to the familiar partner exhibited a higher proportion of lexical overlap with previous descriptions than did descriptions to an unfamiliar partner. Older speakers showed no equivalent evidence for audience design, which may reflect difficulties with retrieving partner-specific information from memory during conversation.

Keywords: language production, audience design, memory, aging, conversation

A fundamental observation about human communication is that people speak in different ways to different listeners. This general phenomenon—tailoring utterances to suit the communicative needs of particular conversational partners—is known as *audience design* and describes a wide variety of adjustments made by speakers for specific addressees (Clark, 1996; Clark & Murphy, 1982). Instances of audience design can be observed at almost all levels of language use (Schober & Brennan, 2003). Among the most salient adjustments are those that involve wholesale changes in the manner in which people talk to others, such as being highly informative to audiences judged to need additional help in understanding: for example, children (Glucksberg, Krauss, & Weisberg, 1966), nonnative speakers (Bortfeld & Brennan, 1997), or novices (Isaacs & Clark, 1987). Speakers may also modify relatively focused aspects of their utterances during interactions with particular addressees (e.g., Clark & Wilkes-Gibbs, 1986; Horton & Gerrig, 2002). In this article, we are interested in this latter aspect of audience design and, specifically, in the cognitive mechanisms that allow individuals to adjust utterances for specific conversational partners.

Understanding audience design at this level requires understanding how speakers gain access to beliefs about the information shared with particular partners—information about *common ground* (Clark, 1996). Horton and Gerrig (2005a) recently proposed that beliefs about common ground can emerge in part on the basis of basic, domain-general mechanisms in memory. In this account, interacting with other individuals causes one's representations of those persons to become associated in memory with a wide range of related information. During subsequent conversations, those same individuals can then act as salient cues for the retrieval of these associated memory traces. Of importance, the information most strongly accessible on the basis of such partner-specific cues is especially likely to be taken as being in common ground. A crucial implication of this account is that the ability of speakers to show evidence for audience design may be influenced by the extent to which they successfully encode and retrieve suitable partner-relevant memory associations.

This memory-based perspective motivated the current experiment, which compared the ability of younger and older adults to encode information with respect to specific conversational partners and then to flexibly use this information to guide subsequent message planning. Older individuals often exhibit changes in basic memory encoding and retrieval processes that may limit the extent to which they are able to make adjustments for particular conversational partners. Documenting such age-related differences in audience design would support the view that domain-general cognitive mechanisms can facilitate the ability of interlocutors to take into account common ground. Moreover, given the pervasiveness of audience design as a feature of social interaction, identifying difficulties with the basic processes that allow speakers to accommodate to conversational partners has important consequences for researchers' understanding of the communicative abilities of older adults.

Age-Related Changes in Source Memory and Partner Adjustments

Patterns of memory change and loss represent one of the most studied areas of cognitive aging (see Kausler, 1994, for a review). Most relevant in the current context is the observation that older

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adults often have specific difficulties with *source memory,* which involves recollecting the origins of specific items of information (e.g., Brown, Jones, & Davis, 1995; Hashtroudi, Johnson, & Chrosniak, 1989; McIntyre & Craik, 1987; Schacter, Kaszniak, Kihlstrom, & Valdiserri, 1991). One factor contributing to older adults' difficulties with source memory may be specific problems binding information about contextual details together with information about focal aspects of experiences (Chalfonte & Johnson, 1996). Older adults also may be less likely to use what available source information they do have (Multhaup, 1995). In general, individuals who have trouble accessing information about who did or said what should be less able to use this knowledge during routine conversation. If assumptions about common ground are built upon the contextual associations that people have with respect to other individuals, then older adults' underlying difficulties encoding or retrieving such associations may also impair their ability to show evidence for audience design.

Evidence regarding the ability of older adults to engage in audience design during conversation is limited, however. Some findings suggest that older speakers can tailor speech on the basis of the identity of their partners. For example, Gould and Shaleen (1999) showed that older women who worked on several communication tasks either with a college student or with an individual with mild mental retardation could modify particular high-level aspects of these interactions, such as turn taking and question asking, on the basis of perceptions of their partner's receptive abilities. Similarly, Adams, Smith, Pasupathi, and Vitolo (2002) asked older and younger women to retell a narrative to an adult experimenter or to a young child and found that older women were more likely to simplify the narrative complexity when speaking to a child. Although this implies that older adults may be able to adapt their speech on the basis of broad partner characteristics, other work has suggested that they may be less able to make use of knowledge of specific addressees. In referential communication tasks that involve matching sets of abstract figures (e.g., black and white shapes known as *tangrams*), older adults produced more speech and required more time to find mutually acceptable referring expressions with a partner compared with younger adults (Bortfeld, Leon, Bloom, Schober, & Brennan, 2001; Hupet, Chantraine, & Nef, 1993). Older speakers also appeared to benefit less from repeated experience with the task, producing more idiosyncratic descriptions that failed to incorporate expressions previously established with their partner (Hupet et al., 1993). Similarly, older adults communicating about sets of abstract shapes and about unfamiliar faces with either an age-matched older or an age-mismatched middle-aged partner did not vary the amount of their speech across partners, although they did show more idiomatic or "personalized" features when talking to age-matched partners (Kogan & Jordan, 1989). Finally, when pairs of young-young, young-old, and old-old adults were asked to work together in finding a route drawn on a map or identifying specific patterns of dots, older speakers showed less variation in fluency, complexity, or content across tasks or partners compared with younger speakers (Kemper, Vandeputte, Rice, Cheung, & Gubarchuk, 1995).

These results indicate that older speakers may be less effective at making adjustments based on specific interactions with others. From a memory-based perspective, this suggests that suitable partner-related information may not be accessible with a time course appropriate to have an impact on language production (Horton & Gerrig, 2005a). In light of evidence for age-related differences in memory processes important for audience design, we might expect effects of age on audience design. Specifically, older adults may be less likely than younger adults to modify their speech appropriately when placed in a situation where successful audience design requires drawing upon previous experiences with specific conversational partners. To evaluate this possibility, the current experiment involved a pseudocommunicative context in which both younger and older speakers described pictures for each of two addressees. Each speaker, however, shared common ground for the relevant stimuli with only one addressee, allowing us to compare speakers' utterances across partners for evidence of audience design.

The Current Experiment

This study began with a familiarization phase in which pairs of younger adults and pairs of older adults worked together on a card-matching task similar to that in Hupet et al. (1993). The individuals in each pair took turns serving as the *director* to help their partner, working as the *matcher,* arrange a set of picture cards. Over the course of multiple rounds, we expected the pairs to develop common ground for how to refer to these pictures, which then served as stimuli for the second phase of the experiment. Our interest was in the extent to which speakers of different ages would be able to selectively deploy this newly established common ground to guide the design of utterances in a subsequent communication context that placed a premium on specificity and brevity. Thus, following the familiarization phase, the pairs were separated, and each participant was seated alone in front of a monitor and a microphone and told that he or she would be helping each of two listeners, located in other rooms, to identify a series of target pictures. For this picture-description phase, one addressee was the familiar partner from the card-matching task, whereas the other addressee was supposedly a completely new, unfamiliar partner. In actuality, the computer simply recorded the speakers' descriptions, and a picture of each partner's face was used to indicate the individual hearing the description on each trial. The critical question, then, was whether speakers' utterances to each partner would show evidence for audience design.

Although we briefly describe the nature of the interactions during the initial familiarization phase, our focus was on whether descriptions differed across partner contexts in the second, picture-description phase. In general, our aim was to examine what occurs when speakers are forced to rely relatively heavily on memory-based processes. By alternating partners and by disallowing the possibility of feedback, we could assess the extent to which utterances from both younger and older speakers are shaped by information accessible from memory. Previous work with younger adults has shown that memory demands can influence the extent to which speakers modify referring expressions across partners (Horton & Gerrig, 2005b). Therefore, an important question in the present study was whether speakers of different ages can use prior experience to shape the content of their descriptions for the familiar versus unfamiliar partner. We also examined the timing of individual descriptions. Horton (in press) showed that picture-naming latencies were faster in the presence of a confederate partner who had been previously associated with the target responses. An advantage of the current computer-based partner-

cuing paradigm is that it also allowed us to test predictions concerning how quickly speakers would produce utterances for specific partners. We predicted that if speaking to the familiar addressee increases the accessibility of relevant memory associations, we would observe differences in both the content and timing of descriptions across partners. If, however, older adults have difficulties accessing partner-specific memory traces, then their descriptions would show less evidence for audience design in this communicative context.

Method

Participants

Twenty-four Georgia Institute of Technology undergraduates (mean age = 19.9 years) served as younger adult participants and received partial course credit for their participation through the psychology subject pool. The older adults were 24 individuals (mean age = 72.7 years) from the metropolitan Atlanta community who received monetary payment for their participation. The education level of the two age groups did not differ significantly (younger, $M = 13.8$ years of education, $SD = 1.17$; older, $M = 14.6$ years of education, $SD = 1.90$), $t(46) = 1.67$, $p = .10$. Raw Wechsler Adult Intelligence Scale—Third Edition (Wechsler, 1997) Vocabulary and Digit Symbol scores were available for 20 of the 24 older adults: Vocabulary, $M = 43.5$, $SD = 8.9$; Digit Symbol, $M = 58.9$, $SD = 16.8$. Although equivalent scores were not available for the younger participants, we had mean scores from a sample of 223 young adults from the same population: Vocabulary, $M = 41.4$, $SD = 8.6$; Digit Symbol, $M = 96.2$, $SD = 12.2$. All participants were native English speakers with self-reported normal or corrected-to-normal vision and hearing.

Materials

For the card-matching task, we created two identical sets of cards (one for each partner), with each card containing a color photograph of an exemplar from one of eight possible categories of living things: birds, cats, dogs, fish, flowers, frogs, lizards, and turtles. There were four different exemplars within each card category, chosen to have some degree of within-category similarity. Twelve different experimental lists were created by combining different categories of cards. Within each list, four of the card categories were assigned to Partner 1 as director and Partner 2 as matcher, whereas the other four categories were assigned to Partner 2 as director and Partner 1 as matcher. The assignment of categories to partner role was counterbalanced across pairs.

To create the stimuli for the picture-description task, we scanned the 32 pictures from the card-matching task as 200- × 200-pixel bitmap images. The four pictures in each object category were combined into eight stimulus displays, each display containing a unique, counterbalanced arrangement of pictures. For each display, a red box outlined the location of the target picture, as shown in Figure 1. Across the 64 experimental displays, each picture was the target twice, counterbalanced with position. In addition, a novel picture from each of the eight object categories was combined with three other same-category pictures into four different arrangements to create 32 filler displays. In these displays, the novel picture was always designated as the target, rotating across the four item locations.

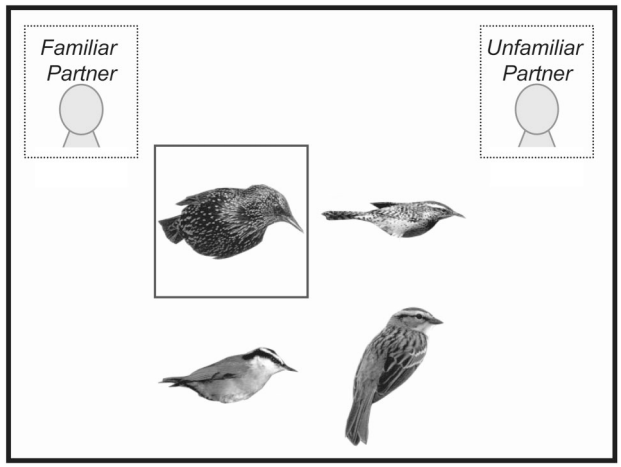

Figure 1. Example display from the picture-description task. A red square indicated the target picture, whereas a single black and white digital photo of either the familiar or the unfamiliar partner indicated the individual receiving the description on each trial. The actual object pictures were in full color.

Following construction of the basic stimulus displays, we created the unfamiliar partner versions of our stimuli by adding a digital picture of a younger or an older individual to each display, as indicated in Figure 1. Two sets of displays were created, one with the picture of the younger unfamiliar partner and one with the older unfamiliar partner. All speakers within each age group saw the same age-matched unfamiliar partner. To create the familiar partner displays, we took a digital picture of each participant at the beginning of the experimental session, and these pictures were embedded in the upper left corner of each stimulus display, as shown in Figure 1. The displays containing the picture of Partner 1 were then loaded onto the computer to be used by Partner 2, and vice versa for the displays showing Partner 2. Thus, the familiar partner for each participant was the individual with whom they worked on the card-matching task. For each session, we also created two cue displays that contained only the partner picture, one for each partner.

Procedure

During the card-matching task, individuals were seated at a table on either side of a vertical barrier. It was explained that they would be working together for six rounds to match sets of picture cards and that they would alternate between the roles of director and matcher during this task. The director's task was to describe each set of 16 picture cards so that the matcher could reproduce the director's arrangement of cards on his or her side of the barrier. Prior to each experimental session, the full set of cards for each partner was subdivided into two subsets (each containing four complete card categories) according to the particular item list designated for that pair. At the beginning of each round, the director's cards were shuffled and placed into a 4 × 4 grid on the director's side of the table. The director was told that this was the target arrangement for that round and that the cards should be

described in order from top left to bottom right. At the same time, the matcher received an identical set of 16 picture cards in no particular order. Following each round, the card subsets were switched out, and the 2 participants switched roles as well. In this manner, Partner 1 served as director for four of the eight card categories in Rounds 1, 3, and 5, whereas Partner 2 served as director for remaining four card categories in Rounds 2, 4, and 6.

After reading the instructions, the participants were given the opportunity to ask questions, after which they took part in a brief practice round. Participants were encouraged to talk as much as needed to match the cards. During each round, the experimenter noted the target order of the director's cards for that round, and an omnidirectional microphone connected to an audiotape recorder was used to record the interactions. Between rounds, the experimenter gave feedback about any mismatches to the participants by pointing out any cards that were misplaced. This phase of the experiment lasted approximately 40 min.

Following the familiarization phase, the participants were taken to two different testing rooms, where they each were told that they were going to work on a picture-description task mostly involving the same pictures from the first phase. The instructions explained that this part of the experiment concerned how people communicate over a distance and that their descriptions would be transmitted in real time via computer to each of two possible partners: the same person with whom they just carried out the card-matching task or a new participant waiting in another laboratory room who had never before seen any of the pictures. Participants were told that their task on each trial was to describe the picture designated as the target (via the red box) and that communication would be essentially one way. In addition, they were shown the cue displays that would inform them of which individual was acting as the partner on each trial.

To start each trial, the partner picture was visible for 2 s before the appearance of the picture display. Once the pictures appeared, the participants' task was to describe the target picture, but they were warned that they should produce their descriptions within a specified time limit. On the basis of pilot testing, this limit was set at 10.0 s and 12.5 s for the younger and older adults, respectively. By imposing a time limit that was relatively generous, speakers were expected to have enough time to produce adequate descriptions but still be motivated to use the more parsimonious common ground when possible. Participants could also end the trial early through a keypress.

Speech was recorded with a headset microphone connected to the computer sound card recording at a sampling rate of 22.5 kHz. Furthering the illusion that each description was being received by another individual, the message "WAITING FOR RESPONSE" was visible for a random interval of 50 ms to 5,000 ms after the description. This interval varied from trial to trial. The participants were told that the partners were instructed to wait for each description to finish before selecting the described picture. They were also told that the location of the four pictures on the partner's screen would be scrambled, making descriptions like "upper left" useless. After the random interval, participants heard a beep and saw the message "RESPONSE RECEIVED" for 5 s. This supposedly indicated when the matcher made his or her response for that display, after which they saw a message to get ready for the next trial. This phase of the experiment lasted approximately 45 min.

Debriefing

Our debriefing questionnaire assessed, in several stages, the extent to which our cover story was a success. First, we asked participants to indicate the extent to which they were aware of the difference between partners and whether this influenced their descriptions. All of the younger participants indicated awareness of the partner difference and reported giving longer and more detailed descriptions to the unfamiliar partner. For the older adults, 21 of 24 participants said that they were aware of the different partners, but only 14 thought this influenced their descriptions. Of this last group, most (12 of 14) reported trying to make adjustments appropriate to each partner. Sample responses included "with stranger I tried different expressions" and "I could use key words that were previously developed with my familiar partner, but in some cases needed to be more descriptive with my unfamiliar partner."

Finally, we led participants to believe that during the picture-description task they had possibly interacted with either human partners or simulated computer partners. When asked to identify which partners they thought they had, 18 of 24 younger adults and 18 of 24 older adults indicated they believed the partners had been real. Only 2 younger adults and none of the older adults, though, indicated that they had doubted the authenticity of their partners during the task. Thus, the majority of both the younger and older adults treated the second phase of the experiment as a genuine communicative task. All of the participants were then fully informed about the actual nature of the experimental procedures and the purpose of having an imaginary unfamiliar partner.

Design

For the card-matching task, the card categories alternated every round, with participants also alternating as director. Therefore, our analyses for the familiarization phase collapsed data from each successive pair of rounds, corresponding to the first (Rounds 1 and 2), second (Rounds 3 and 4), and third (Rounds 5 and 6) time each card was matched during the course of the task. All analyses of variance (ANOVAs) were carried out with both participants (F_1) and items (F_2) as random variables, and unless otherwise stated, reported effects are significant at $p < .05$. Proportions were subjected to an arcsine transformation before statistical analysis (Winer, Brown, & Michels, 1991). For the familiarization phase, then, round (1 and 2 vs. 3 and 4 vs. 5 and 6) was a within-participants and within-items factor, whereas age (younger vs. older) was a between-participants and within-items factor.

During the picture-description task, participants described each picture twice: once for the familiar partner and once for the unfamiliar partner. In this phase of the experiment, there were two blocks of trials, each containing 32 experimental and 16 filler displays. Although target pictures were not repeated within blocks, half the items in each block were from categories the participant had seen during the familiarization phase as director, whereas the other half were pictures they had seen as matcher. Thus, partner, block order, and original role were fully counterbalanced across versions of the task. Presentation order within blocks was randomized uniquely for each individual participant.

These considerations resulted in audience (familiar vs. unfamiliar partner), block (first vs. second), and original role (director vs.

matcher) as within-participants and within-items factors, with age (younger vs. older) as a between-participants and within-items factor. Because preliminary ANOVAs revealed no meaningful effects related to block order, we did not consider this factor further.

Results

Familiarization Phase

In general, the purpose of the card-matching task was to provide participant pairs with the opportunity to establish common ground for these pictures as a precursor for the second phase of the experiment. To evaluate the extent to which this goal was met, we examined the frequency with which directors' descriptions explicitly incorporated terms previously uttered by matchers. Also, because the establishment of common ground typically allows partners to become more efficient in their interactions over time (Clark & Wilkes-Gibbs, 1986; Hupet et al., 1993), we examined changes in description length and the number of turns required to match cards each round. These analyses were based on verbatim transcriptions of the card-matching interactions.

A relatively direct way of demonstrating that partners were considering each other's perspectives is to measure how frequently directors modified their descriptions by incorporating information previously provided by their partners. For example, one matcher, after hearing the director describe a frog as "a frog that's sort of red looking and it's looking to the left," responded by asking, "he's got like uh pimples?" After confirming this information, the director, on subsequent rounds, incorporated the matcher's perspective by describing this card as "the frog looking to the left with the pimples." To evaluate the incidence of such incorporations, William S. Horton and a trained research assistant compared each director's initial descriptions in Rounds 3 and 4 and Rounds 5 and 6 against all of the matcher's utterances about the same cards from previous rounds (intercoder agreement = 90%), coding for instances in which descriptive content was adopted from the partner. For many of the items, the matcher never provided any feedback other than a simple "okay" or "I got it" (younger, $M = 64\%$; older, $M = 69\%$). For instances in which there was the possibility of incorporation, younger adults showed evidence of incorporation 41% of the time, whereas older adults incorporated material from their partners 42% of the time (not significantly different, both Fs < 1). Thus, younger and older directors showed similar rates of adopting the perspectives of their matchers as this task progressed.

Next, to capture the sheer amount of work needed by pairs to successfully match the card sets, we counted the number of turns required by both partners to match each card in each round, excluding back-channel responses such as "uh-huh," "okay," or "right." As shown in the upper portion of Table 1, turns declined across rounds, regardless of age, $F_1(2, 92) = 21.47$, $MSE = 1.10$, and $F_2(2, 62) = 27.25$, $MSE = 1.16$. Although the older pairs generally required more turns to match each card (older, $M = 5.06$ turns per match; younger, $M = 3.48$ turns per match), $F_1(1, 46) = 14.26$, $MSE = 6.22$, and $F_2(1, 31) = 86.44$, $MSE = 1.33$, the Age × Round interaction was not reliable. We also counted the number of words in each director's initial description for each card, up to the point the matcher responded. As shown in the lower portion of Table 1, the mean number of words per description decreased across rounds as well, $F_1(2, 92) = 26.39$, $MSE = 8.95$, and $F_2(2, 62) = 17.33$, $MSE = 17.17$, and although older directors were generally more verbose (older, $M = 22.1$ words per description; younger, $M = 14.0$ words per description), $F_1(1, 46) = 18.98$, $MSE = 122.99$, and $F_2(1, 31) = 141.35$, $MSE = 22.40$, there was not a significant Age × Round interaction.

Table 1
Mean Numbers of Words per Directors' Initial Descriptions and Mean Numbers of Turns per Match During the Card-Matching Task, as a Function of Task Round and Age Group

Measure and age group	Task round		
	Rounds 1 and 2	Rounds 3 and 4	Rounds 5 and 6
Turns per match			
Older adults	5.75	4.73	4.71
Younger adults	4.41	3.28	2.77
Words per description			
Older adults	24.06	21.71	20.43
Younger adults	17.88	13.40	11.70

Thus, both younger and older pairs were able to work together to successfully match the picture cards: Directors in both age groups showed similar levels of incorporation of matchers' perspectives, and this, along with the decreases in turns and description length across rounds, suggests that both groups were successful in establishing common ground. Although the older adults generally required more turns and longer descriptions to match the cards, there is no evidence to suggest that they were not able to accomplish this task. These results largely replicate those of Hupet et al. (1993), who similarly failed to find any significant Age × Round interactions in their analyses of the number of words and turns across trials. Although Hupet et al. reported that older adults were less likely to repeat information "already provided" in preceding trials, older adults in the current task showed no less evidence of incorporating information originally produced by their partners. It may be important to note, though, that Hupet et al. used abstract tangrams, whereas the current experiment used pictures of animals and flowers. Bortfeld et al. (2001) found that pairs of older speakers needed significantly more words and were more disfluent than younger speakers when matching tangrams compared with pictures of children. It is possible, then, that the relatively familiar materials in the current study afforded older adults more opportunity to formulate appropriate referring expressions with their partners. These results provide a basis for evaluating the performance of the same speakers on the picture-description task.

Picture-Description Phase

The primary goal of this experiment was to assess the extent to which younger and older adults would show evidence for audience design, differentially adjusting their utterances for each partner. Thus, our analyses for this phase examine effects related to both the content and timing of speakers' descriptions. We predicted that speakers who are sensitive to the need for audience design would produce utterances for the familiar partner that are more succinct, begun more quickly, and more similar to previous descriptions. We report measures that capture each of these dimensions. We

considered the length of the descriptions produced for each partner and also the latencies with which these descriptions were initiated. In addition, we assessed the degree to which speakers repeated descriptive information that had been established with the familiar partner during the card-matching task.

Recall that the constraints of the task, in particular the time limit, were intended to serve as an inducement to use maximally informative and parsimonious descriptions for the pictures. This inducement is particularly important given that speakers are often highly verbose in the absence of feedback from the listener (Krauss & Weinheimer, 1966; Murfitt & McAllister, 2001). Indeed, we can see the effect of the absence of feedback on the extent to which speakers' descriptions continued for the entire allotted time. For the younger adults, 14.7% of their descriptions were truncated at 10 s, whereas 37.5% of the older adults' descriptions were truncated at 12.5 s, a significant difference, $F_1(1, 46) = 19.78$, $MSE = .846$, and $F_2(1, 31) = 202.43$, $MSE = .097$. In addition, the younger speakers were more likely to use the full response period with the unfamiliar partner ($M = 18\%$ of descriptions) than with the familiar partner ($M = 11\%$), but the percentages of full-length descriptions produced by the older adults were similar across partners (unfamiliar, $M = 38\%$; familiar, $M = 37\%$), a significant Age × Partner interaction, $F_1(1, 46) = 7.84$, $MSE = .044$, and $F_2(1, 31) = 4.55$, $MSE = .091$. As described later in our other analyses, this may reflect a lack of discrimination between partners by older adults.

Description length. To begin, we were interested in whether speakers would produce shorter descriptions when talking to familiar partners. To examine just those cases in which speakers produced everything that they wanted to say to each partner, in our analyses of description length we included only descriptions completed prior to the time limit. Two trained research assistants transcribed verbatim the sound files of the participants' descriptions for all 64 experimental items. On the basis of these transcripts, we calculated the mean number of words per description in each experimental condition, as shown in the upper portion of Table 2.

Consistent with the predictions of audience design, descriptions to the unfamiliar partner ($M = 18.40$ words) were generally longer than those directed at the familiar partner ($M = 17.03$ words), $F_1(1, 45) = 18.91$, $MSE = 3.15$, and $F_2(1, 31) = 17.58$, $MSE = 5.52$. Also, older adults produced generally longer descriptions ($M = 19.60$ words) than did younger adults ($M = 16.30$ words), $F_1(1, 45) = 6.85$, $MSE = 107.60$, and $F_2(1, 31) = 130.33$, $MSE = 4.87$. Finally, there was an Age × Partner interaction, $F_1(1, 45) = 17.89$, $MSE = 3.15$, and $F_2(1, 31) = 10.77$, $MSE = 4.55$. Only younger speakers produced significantly shorter descriptions for familiar than unfamiliar partners, $t_1(23) = 6.28$, and $t_2(31) = 6.43$. There were no differences in description length across partners for the older speakers: $t_1(23) = 0.45$, *ns,* and $t_2(31) = 0.92$, *ns.*

Table 2
Mean Lengths (in Numbers of Words per Description) and Mean Description Onset Latencies (in Milliseconds) for Speakers' Utterances From the Picture-Description Task, as a Function of Partner Status and Age Group

Measure and age group	Partner		Difference
	Unfamiliar	Familiar	
Description length			
Older adults	19.79	19.45	0.34
Younger adults	17.43	15.34	2.08
Description onset			
Older adults	1,817	1,828	−11
Younger adults	1,873	1,784	89

Although these analyses were conducted only on descriptions that were completed before the time limit, a substantial proportion of the older adults' descriptions (37%) were not finished within the time allotted. To address whether this might introduce selection biases, we identified a group of 8 older adults who produced the fewest truncated descriptions ($M = 16.8\%$) and compared their responses with the younger adults' ($M = 14.7\%$ truncated descriptions). Although this subset of older adults produced descriptions similar in length to those produced by younger adults (older subset, $M = 16.34$ words; younger, $M = 16.30$ words), they still showed no reliable difference in description length across partners (unfamiliar, $M = 16.64$ words; familiar, $M = 16.06$ words), $t_1(7) = 1.21$, *ns,* and $t_2(31) = 1.00$, *ns.* Thus, even when we restricted our analysis of description length to those older speakers who were least affected by the time limit, there is still no evidence that they were adjusting how much they said in response to the status of their communicative partners.

Description onset. Speech latencies should reflect, at least in part, the initial planning requirements of utterance formulation (Smith & Wheeldon, 1999). We predicted that if speakers were able to draw upon their prior experience in talking with the familiar partner, planning descriptions for that individual would be easier than for the unfamiliar partner. In addition, the memory-based account of audience design suggests that the presence of a familiar listener may facilitate the retrieval of associated information in memory. Thus, we predicted that sensitivity to audience design would result in shorter onset latencies for descriptions to familiar partners.

Speakers in this task often began their descriptions with an introductory frame such as "And this next one is the . . ." that was often highly routinized and that differed across individuals. Because we were interested in the length of time it took speakers to formulate the actual description for each item, we measured the interval from the onset of the stimulus display to the onset of the first content word in each description, typically either the first noun or adjective (Horton & Gerrig, 2005b). For example, in the description, "And this next picture is a bird with a brown wing and yellow belly," the target word was *bird.* To arrive at target onsets, we used two speech-processing programs designed to compute the timing of individual words in recorded speech: FastTalk (2003) and Sphinx2 (Carnegie Mellon, 2004). Each program uses transcripts to measure onset time for each word in the recording. FastTalk estimates are generally more accurate, so we used FastTalk values unless latencies for critical words were reported with low confidence, in which case we used Sphinx2 values. When both methods reported low confidence (408 cases, or 13% of the total), a trained research assistant, blind to the experimental manipulations, used sound editing software to directly measure speech onset for the target word of interest. Correlations between automated and hand measurements in our lab are generally in excess of .90.

The lower portion of Table 2 presents the mean description onsets within each experimental condition. There is no evidence of an overall age difference in onset latencies. The older adults (M = 1,831 ms) and the younger adults (M = 1,828 ms) took approximately the same amount of time on average to initiate the critical portions of their descriptions (both Fs < 1). The lack of a main effect for age may seem contrary to typical patterns of slower response times for older compared with younger adults (e.g., in picture naming; see Bowles, Obler, & Poon, 1989). However, onset latencies for the production of multiword utterances typically show relatively small age differences (Davidson, Zacks, & Ferreira, 2003; Spieler & Griffin, 2006).

Speakers did take generally longer to begin describing the targets when their addressee was the unfamiliar partner (M = 1,854 ms) compared with the familiar partner (M = 1,805 ms), $F_1(1, 46) = 5.75$, MSE = 21,494, and $F_2(1, 31) = 6.06$, MSE = 26,137, which is what one would expect if extra time were needed to formulate descriptions for a naive partner. As can be seen in Table 2, though, this pattern varied with age (marginal Age × Partner interaction), $F_1(1, 44) = 3.41$, MSE = 21,494, $p = .07$, and $F_2(1, 31) = 2.97$, MSE = 34,641, $p = .09$. Pairwise comparisons carried out separately for each age group showed that younger adults initiated descriptions more quickly for familiar than unfamiliar partners, $t_1(23) = 2.76$, and $t_2(31) = 2.87$, but older adults showed no difference across partners, $t_1(23) = 0.40$, *ns,* and $t_2(31) = 0.29$, *ns.* Presumably, the younger adults did not need as much time to prepare their descriptions when their addressee was someone with whom they had discussed the pictures previously. For the older adults, however, there is no evidence that the identity of their partners had an effect on the onset of the critical content of their descriptions.

Description overlap. Given that participants had worked with the same pictures during the card-matching task, we predicted their descriptions would frequently overlap with the descriptions established for these items previously. However, sensitivity to the needs of audience design should lead to more overlap in descriptions addressed to familiar than unfamiliar partners (Brennan & Clark, 1996). To assess this possibility, we compared each utterance produced during the picture-description task with the last description produced for the same picture (either by the speaker or by his or her partner) in the final rounds of the card-matching task. We calculated the degree of overlap by counting the number of identical words shared across the two descriptions (multiplied by 2) and dividing by the total number of words in both descriptions (Hadelich, Branigan, Pickering, & Crocker, 2004). Overlap was calculated on the basis of word types, not tokens, reducing the impact of within-description repetitions. For example, the description "blue green fish, red fins" was calculated to have 0.91 overlap with "blue blue green fish, red pointy fins" but only 0.62 overlap with "blue bodied fish, red and black pointed fins."

Table 3 presents the mean proportions of lexical overlap exhibited by descriptions in each condition. As might be expected, descriptions of items that speakers themselves had described as director during the card-matching task were more likely to exhibit overlap (M = .48) than were descriptions for items they had dealt with previously only as matcher (M = .36): main effect of original role, $F_1(1, 46) = 111.46$, MSE = .025, and $F_2(1, 31) = 161.39$, MSE = .023. This was true for both younger adults, $t_1(23) = 7.87$, and $t_2(31) = 10.78$, and older adults, $t_1(23) = 7.07$, and $t_2(31) = 10.02$. In addition, younger adults' descriptions showed significantly more overlap (M = .46) than did older adults' (M = .38), $F_1(1, 46)$, 25.51, MSE = .059, and $F_2(1, 31) = 93.39$, MSE = .021. More relevant to audience design, however, is the fact that descriptions to familiar partners were more likely to exhibit overlap (M = .43) than were descriptions to unfamiliar partners (M = .40), $F_1(1, 46) = 19.32$, MSE = .057, and $F_2(1, 31) = 20.38$, MSE = .007, but this was qualified by an Age × Partner interaction, $F_1(1, 46) = 27.24$, MSE = .057, and $F_2(1, 31) = 26.23$, MSE = .008. In general, younger adults showed more lexical overlap in descriptions directed at familiar than unfamiliar partners, $t_1(23) = 5.39$, and $t_2(31) = 5.44$, whereas the proportion of overlap in older adults' descriptions did not differ across partners, $t_1(23) = 0.85$, *ns,* and $t_2(31) = 0.78$, *ns*.

Table 3
Mean Proportions of Lexical Overlap Between Speakers' Descriptions From the Picture-Description Task and Descriptions for the Same Objects During the Final Rounds of the Card-Matching Task, as a Function of the Speakers' Original Role, Partner Status, and Age Group

Original role and age group	Partner	
	Unfamiliar	Familiar
Speaker = Director		
Older adults	.43	.44
Younger adults	.50	.54
Speaker = Matcher		
Older adults	.32	.31
Younger adults	.37	.44

Discussion

In this study, we examined the extent to which speakers of different ages made partner-related adjustments in two different communicative contexts. In the initial card-matching task, both age groups demonstrated the expected trend toward shorter, more partner-sensitive interactions. Older as well as younger speakers showed evidence of developing common ground with their partners as they worked together to establish specific ways of referring to the pictures. Then, in the second task phase, we tested whether individuals could flexibly use this common ground in a computer-based communication context that required them to switch partners on an item-by-item basis. Of interest was the extent to which speakers would show evidence of adjusting their utterances when talking to the familiar versus the unfamiliar partner. In general, only the younger adults showed consistent evidence for audience design across partners: Their descriptions to the unfamiliar partner were longer, were initiated later, and showed less overlap with previous descriptions than those directed at the familiar partner. The older adults, however, showed little evidence across measures of adjusting their speech for each partner. These data suggest quite strongly that older speakers may have difficulties in tailoring their speech in response to the communicative needs of particular conversational partners.

Memory Processes and Audience Design

To demonstrate evidence for audience design, speakers must have encoded information about listeners' knowledge, and this

information must then have had the opportunity to guide utterance formulation (Horton & Gerrig, 2002, 2005a). It is possible, then, that the older adults were simply not as successful in encoding the necessary partner-relevant information during the card-matching task. Although the data from the familiarization phase suggests that the older adults were able to establish common ground, they did exhibit numerically smaller adjustments over successive rounds compared with younger adults (as shown in Table 1), which may indicate generally less efficient performance. Conversely, they may have encoded partner-relevant information sufficiently well but were simply less able to use this knowledge during the picture-description task. This would be similar to prior work on source memory in which older adults were shown to encode source information but often failed to use this information when making memory judgments (e.g., Multhaup, 1995).

To distinguish between potential encoding and retrieval explanations for older adults' difficulties with audience design, we identified a subset of 8 older adults who, during the familiarization phase, showed the strongest tendency to shorten their descriptions from Rounds 1 and 2 to Rounds 5 and 6 ($M = 31.9\%$ decline in the number of words per description) and whose descriptions showed the most evidence of incorporation ($M = 56.8\%$). In general, the more that individual speakers refine their descriptions during the card-matching task, the more likely it is they are encoding partner-relevant information (Clark & Wilkes-Gibbs, 1986; Nohara-LeClair, 2001). Therefore, we then examined the extent to which these 8 speakers showed evidence for audience design during the picture-description task. The descriptions produced by this subset of older speakers, however, did not show any differences across partners. Descriptions for the unfamiliar partner were not significantly longer ($M = 20.78$ words per description) than those for the familiar partner ($M = 20.36$ words per description), there was no difference in their average description onsets (unfamiliar, $M =$ 1,820 ms; familiar, $M =$ 1,835 ms), and they did not show any difference in the proportion of lexical overlap (unfamiliar, $M =$ .38; familiar, $M =$ .38); all Fs < 1. Thus, even those older adults who showed the clearest evidence of being able to successfully encode partner-relevant information during the familiarization phase did not show any substantial evidence of audience design when called upon to use that information subsequently. This may suggest that the observed age differences in audience design were more likely due to difficulties with accessing partner-relevant information during utterance formulation rather than encoding per se.

In Horton and Gerrig (2005b), similar difficulties in audience design were observed in young adult speakers during a card-matching task in which an initial overlapping distribution of cards made it relatively difficult for directors to access information regarding which of two matchers had previously seen specific cards during the course of the task. Together with the data from the current experiment, these results provide support for the claim that memory difficulties, whether inherent in the situation or in the individual, may be one important reason why speakers fail to adjust their speech to reflect histories of interaction with specific conversational partners. As we have suggested, audience design—and common ground more generally—may depend in part on the nature of the memory representations to which language users have access in the time course available for speech planning. Indeed, the data from the younger adults clearly demonstrate how the availability of partner-specific associations can facilitate audience design. Conversely, anything that impairs the accessibility of this associative information may make partner-specific adjustments less apparent. By examining the language use of older adults, we can begin to investigate how effects attributable to common ground can be constrained by how people encode and retrieve information with respect to particular conversational partners.

One important caveat, of course, is that we do not have direct measures of the memory abilities of our participants. Although samples drawn from these two participant populations do typically exhibit age differences in memory performance, independent assessments of memory functioning would greatly inform more detailed considerations of how differences in particular memory processes across groups might contribute to possible differences in audience design. Indeed, an important question remains how variability in the cognitive abilities of both younger and older adults might relate not only to audience design in particular but also to conversational performance more generally.

Cognitive and Social Aspects of Conversational Behavior

The centrality of social interaction for everyday experience makes it important to understand how the use of common ground information in conversation may change as a consequence of normal aging. Bringing a complex social behavior like conversation into the laboratory, however, can present significant interpretive challenges. Presumably, audience design in many conversational contexts can be influenced by social and motivational factors beyond simple differences in memory. In the familiarization phase of the current experiment, participants could have pursued a multitude of possible social goals in addition to the primary card-matching task, which may have obscured the specific contribution of the development of common ground. For older adults, in particular, speech that does not hew closely to the current topic (i.e., off-topic verbosity) may be maladaptive and reflect adverse age-related cognitive changes (Arbuckle, Nohara-LeClair, & Pushkar, 2000; Pushkar et al., 2000). In other cases, though, off-topic verbosity may contribute to the construction of a more interesting narrative or conversational exchange (James, Burke, Austin, & Hulme, 1998). Behaviors that appear maladaptive when viewed from the standards of laboratory tasks may be beneficial in particular real-world contexts.

In accord both with our anecdotal experience and with arguments advanced more formally by other researchers (e.g., Lang & Carstensen, 2002), older adults may be especially likely to emphasize social factors in laboratory contexts. Recall that Adams et al. (2002) found that older women were more likely to simplify their speech for children in a storytelling context. These authors proposed that providing information to younger generations is an important goal for older adults, which may have facilitated their ability to accommodate the complexity of their retellings specifically for children. Similarly, the observed age differences in the amount of speech and in the number of turns in the familiarization phase of the current study may accord with these sorts of alternative construals of the social context of the interaction. However, even if the two age groups were pursuing different social goals, both appeared to exert effort toward developing common ground with their partner. Indeed, it would be highly uncooperative to do

otherwise (Clark, 1996). Moreover, and in contrast to arguments regarding the adaptive qualities of off-topic verbosity, failing to use the available common ground only burdens both conversational partners, detracting from the quality of the social interaction.

Carstensen's socioemotional selectivity theory of aging suggests further that older adults may be less motivated to interact with strangers, given general preferences in favor of existing, emotionally meaningful relationships (Fung, Carstensen, & Lutz, 1999). In our experiment, both the familiar and unfamiliar partners were strangers in the sense that there was no preexperimental relationship between the participants. The current study (and similar studies involving interactions between strangers) may underestimate the general capacity of older adults to show evidence for audience design compared with situations involving friends or family, where they may be more willing to differentiate between partners. However, one study that did compare the performance of married couples versus pairs of strangers (both young and old) on a picture-matching task (Bortfeld et al., 2001) found no differences due to pair relationship. Furthermore, Bortfeld et al. (2001) found that pairs of older adults produced more words and more disfluencies than did younger adults when talking about abstract tangrams, but smaller differences emerged when discussing pictures of children, an Age $\times$ Domain interaction that argues against explanations of age-related differences as being due more generally to differences in speech style (Mortensen, Meyer, & Humphreys, 2006).

It is also possible that older adults may simply differ in the amount of effort they put forth toward audience design, particularly in the current experimental context. Recall, though, that in the debriefing, 12 of the 24 older participants explicitly mentioned that they tried to adjust their utterances for each partner. If the willingness to engage in audience design matters, then we can examine whether partner-related adjustments are apparent at least in the descriptions of this subset of older adults. In contradiction to their self-reports, however, the descriptions from these older speakers still revealed little evidence for audience design. Descriptions to the unfamiliar partner ($M = 18.73$ words per description) were not significantly longer than those for the familiar partner ($M = 18.14$ words per description), there were no differences in description onsets across partners (unfamiliar, $M = 1{,}851$ ms; familiar, $M = 1{,}857$ ms), and there were no differences in the proportions of lexical overlap (unfamiliar, $M = .39$; familiar, $M = .38$); all Fs < 1. Simple reluctance to consider each partner does not appear to be a primary reason for the lack of evidence for audience design shown by older adults in this communicative context. Further research is needed, though, to better understand how types of interpersonal situations and specific conversational topics may influence the extent to which older adults are motivated to show evidence for audience design.

In summary, we do not wish to suggest that older adults are incapable of showing evidence for partner-sensitivity in their speech. Our familiarization phase results and similar findings (e.g., Gould & Shaleen, 1999; Hupet et al., 1993) show that older adults can indeed make appropriate adjustments in specific circumstances. In particular, they may benefit from the variety of cues that are available in most interactive settings. In this account, despite differences in underlying cognitive processes that could potentially make the conversational behaviors of older adults less efficient—whether due to limited accessibility of partner information or more effortful consideration of such information—their capacity to show evidence for audience design would be augmented in situations that permit immediate feedback from interlocutors. The logic of the current study, though, was based on the assumption that the relative accessibility of partner-relevant information from memory, independent of feedback, forms one likely starting point for audience design, even in full conversational contexts (Horton & Gerrig, 2005b). For this reason, we removed the opportunity for feedback in the second, picture-description phase to force speakers to rely relatively exclusively on memory-based processes. We wanted utterance planning to be based on estimations of what information would most likely help each partner. Within these constraints, only the younger adults showed evidence of being able to use partner-related information to guide language production.

To the extent that the observed age-related differences in audience design have their roots in the same memory encoding and retrieval processes long known to be impaired with age, the potential consequences of such differences extend beyond the more commonly used memory paradigms. In particular, we have shown how particular age-related changes in the use of partner-relevant information may matter for the effectiveness of communicative interactions. Because the effects of these changes likely interact with the social goals that are always present in any kind of conversational situation (Hess, 2005), it will be important not only to determine the relative contribution of encoding and retrieval difficulties to age differences in audience design but also to identify the broader social and communicative consequences of such differences.

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