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Back to the Future: Past and Future Era-Based Schematic Support and Associative Memory for Prices in Younger and Older Adults

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Abstract

Older adults typically display various associative memory deficits, but these deficits can be reduced when conditions allow for the use of prior knowledge or schematic support. To determine how era-specific schematic support and future simulation might influence associative memory, we examined how younger and older adults remember prices from the past as well as the future. Younger and older adults were asked to imagine the past or future, and then studied items and prices from approximately 40 years ago (market value prices from the 1970s) or 40 years in the future. In Experiment 1, all items were common items (e.g., movie ticket, coffee) and the associated prices reflected the era in question, whereas in Experiment 2, some item-price pairs were specific to the time period (e.g., typewriter, robot maid), to test different degrees of schematic support. After studying the pairs, participants were shown each item and asked to recall the associated price. In both experiments, older adults showed similar performance as younger adults in the past condition for the common items, whereas age-related differences were greater in the future condition and for the era-specific items. The findings suggest that in order for schematic support to be effective, recent (and not simply remote) experience is needed in order to enhance memory. Thus, whereas older adults can benefit from “turning back the clock,” younger adults better remember future-oriented information compared with older adults, outlining age-related similarities and differences in associative memory and the efficient use of past and future-based schematic support.

Keywords

memory; aging; schematic support; associative memory; past and future prices

Older adults often exhibit a variety of memory impairments relative to younger adults (for a review, see McDaniel, Einstein, & Jacoby, 2008; Zacks & Hasher, 2006). Many of the more pronounced deficits occur when binding or linking items of information together to form new associations (e.g., Chalfonte & Johnson, 1996; Naveh-Benjamin, 2000). This associative deficit is often characterized by poorer performance by older adults on tasks that involve remembering names and faces (James, 2006; Naveh-Benjamin, Guez, Kilb, & Reedy, 2004), face-face pairs (Rhodes, Castel, & Jacoby, 2008), and unrelated word pairs (Castel & Craik, 2003; Naveh-Benjamin, Hussain, Guez, & Bar-On, 2003). Although the associative deficit is observed in a number of tasks and settings, there are some factors that can lead to a reduction in this deficit. For example, tests that involve related word pairs show less, or no, associative deficit relative to unrelated word pairs (Naveh-Benjamin, 2000). In addition, tests that involve remembering conceptual and important information, rather than more perceptual information, show a reduction or even an elimination of the associative deficit (Rahhal, May, & Hasher, 2002). These studies suggest that although the associative deficit is often observed, there are some factors that can reduce this deficit in older adults.

One important factor that can influence the presence or absence of the associative deficit is the degree to which older adults can rely on prior knowledge and schema-based processing. For example, Hess and Slaughter (1990) found that older adults benefited from scene organization when trying to remember the location of objects that varied in terms of the likelihood of occurrence in a particular scene. In addition, a word-frequency cohort effect has been shown, in that relative to younger adults, older adults are more likely to recall more words that were common during a past era (e.g., kettle, shun, blackboard) compared with both more contemporary or rare words (Worden & Sherman-Brown, 1983). However, other work has shown limited or negligible effects of task experience or expertise, such as when older pilots were asked to remember air traffic control messages (Morrow, Menard, Stine-Morrow, Teller, & Bryant, 2001), or when prior knowledge could improve memory for prose passages or spatial layouts (Arbuckle, Cooney, Milne & Melchior, 1994). Thus, it is unclear how and when certain forms of experience or knowledge can influence memory for older adults and potentially reduce the associative deficit in old age. It may be that in order for prior knowledge to be facilitative, it needs to be based on current and active bodies of knowledge and not based on infrequent use or more remote memory. We were interested in testing this possibility in the present studies.

The type or form of schematic support may be particularly important to consider in order for older adults to use the support to organize and remember items and relevant associations. Craik and Bosman (1992) defined schematic support as the use of prior knowledge or semantic memory to process new information that can be stored as episodic memory (see also Craik, 2002). Based on this notion, Castel (2005) found that older adults, compared with younger adults, were equally able to remember associations between items and prices for realistic “market value” item-price pairs (e.g., pickles \$3.29) but were impaired for unrealistic pairings (e.g., ice cream \$17.59). This finding suggests that when information is consistent with past and current experience, and has some relevance to frequent real-world behavior, older adults perform as well as younger adults (see also Hess, 2005). However, it remains unclear how experience-based schematic support, based on a current knowledge set

versus more remote knowledge from the past, may influence older adults' memory performance. Older adults may also only benefit if they have had sufficient experience with the specific objects and prices during the time period in question. In general, it is useful to better understand how older adults can rely on accumulated knowledge from the past to remember, and whether this knowledge base can enhance the encoding and retrieval of new episodic information.

To better understand how specific forms of schematic support can influence associative memory, we examined to what degree “era-based” schemas could influence how people remember prices. For example, some older adults may express that they can remember when a movie cost \$1.50, reflecting the ability to remember prices for things that have been experienced in the remote past. Building on this notion, we tested to what degree older adults could remember item-price pairs that reflected prices from both the past and the future, relative to younger adults. We hypothesized that if older adults have had sufficient experience with item-price information from the remote past, then age-related differences for this information would be reduced or eliminated. In addition, the past prices, although now outdated, may have more realistic value for older adults, given they have had some experience with these items and the associated price range. This process may reflect a reliance on a specific form of personal schematic support—one that older adults have experienced and may remember purchasing these items at those prices years ago, whereas younger adults likely do not have this personal form of schematic support (as they have not experienced these prices during their adulthood). However, given that no one has experience with, and knowledge of, future-based prices, typical age-related associative memory deficits should be observed for future items' prices. Furthermore, these age-related differences may be less pronounced for items that participants have some degree of experience with (e.g., more common items such as a cup of coffee) relative to items that are specific to an era (e.g., robot maid), as both age groups can benefit from item-based schematic support that then allows for the efficient binding of the prices for the common items in the future.

In the present study, participants were asked to imagine that it was about 40 years ago (around 1970) or about 40 years in the future (around 2050). We choose the 40-year manipulation because that is when most of the older adults tested were in early to middle adulthood and thus were likely to be at a time for optimal memory functioning, whereas the younger adults tested had yet to be born. We were also interested in using the 40-year manipulation because it would allow for a test of more remote memory in older adults. After being asked to imagine the past or future, participants were then presented with items, accompanied by the item's price from that time period, and were told that they should remember the item-price pairs for a later cued recall test, in which they would be asked to recall the price of each item.

We hypothesized that older adults would perform better in the past relative to the future condition compared with younger adults. For example, in the past condition, when presented with information such as “movie tickets \$1.50,” older adults may be able to remember this information quite well, as it is consistent with prices from past experiences. To further explore this era-based schematic support, we also examined item-price pairings that might exist in the future to determine if age-related differences may be present for future-based

information. Thus, in the future condition, participants were asked to imagine it is about 40 years in the future (around 2050), and they studied item-price pairs that reflected the possible prices in 2050 (e.g., first-class postage stamp, \$0.86). Given that no individual has personal experience with prices of items in the future, we hypothesized that older adults would have more difficulty remembering these prices, as they are inconsistent with past and current schemas for these items. In a second experiment, we also examined this issue by including items that were specific to the era (e.g., for the past, “record player \$60”; for the future, “robot maid \$1,700”), to determine to what degree the items themselves may provide schematic support for older and younger adults. Overall, we were particularly interested in whether “turning back the clock” may lead to reduced age differences in price recall, whereas future-based prices might lead to larger age-related differences in memory for prices.

Experiment 1

To examine how era-based schematic support might influence associative memory for prices, we presented younger and older adult participants with items and prices from either a past or future time period. Specifically, in Experiment 1, participants were asked to imagine it was approximately 40 years in the past or 40 years in the future, and were told that they would need to remember item-price pairs from that time period. They then studied the item-price pairs, and were then given a cued recall test, in which each item was presented and participants had to recall the price. After completing one condition (e.g., past), the participant then engaged in the other condition (e.g., future). Critically, all of the items in both conditions were relatively common items that were not era-specific (socks, movie ticket, cup of coffee, couch), and each item appeared in each condition. For example, for one participant, socks appeared in the past condition, whereas for the next participant, socks appeared in the future condition, and the prices reflected the approximated or hypothetical price from the era in question. This allowed us to keep the item constant in both conditions, with the only difference being the prices and the instructional manipulation of imagining the past or future. We predicted that age-related differences in associative memory for prices would be small or negligible for the past condition, but present or magnified for the future condition.

Method

Participants—The participants consisted of 30 older (17 females; M age = 73.0, SD = 6.7) and 30 younger (25 females; M age = 20.2, SD = 2.2) adults. Older adults were all living in the Los Angeles area and were recruited through community flyer postings as well as through the UCLA Cognition and Aging Laboratory Participant Pool. Older adults had good self-reported health ratings (M = 8.5 on a scale of 1 to 10, with 1 indicating extremely poor health and 10 indicating excellent health), and had an average of 16.8 years of education. Older adults were paid \$10 an hour for their time and reimbursed for parking expenses. Younger adults were all University of California, Los Angeles, undergraduates and received course credit for their participation.

Materials—Twenty common items representing a range of prices were selected (e.g., pack of gum, gallon of milk, camera, and washing machine). All items chosen are presently common and widely available, but were also common in the early 1970s and likely to still be common in 2050. As mentioned, the items were chosen so as to capture a wide range of prices, including less expensive items such as oranges or a pack of chewing gum, and more expensive items such as a camera or a couch. Prices of the items from the early 1970s were mainly adapted from the online 1970, 1971, and 1972 Sears Christmas catalogs (<http://www.wishbookweb.com>) as well as from the Web site <http://www.thepeoplehistory.com/1970s.html>, which contains detailed prices of various items from that time period. Images representing each item from the 1970s were found in the Sears catalogs as well as through Google Images. Prices for the 2050 items were extrapolated from present prices of those items and the current trajectory of price increases. Images for the future items were found primarily on Google Images (see Figure 1 left panel for a sample of the materials).

Procedure—Participants were instructed to imagine that it was either 40 years in the past (around 1970) or 40 years in the future (around 2050). Whether the participant started with the past or future was counterbalanced between participants. They were told that they would be shown 10 items and their prices, and that prices reflected a normal retail value for the item during that time. Participants were informed that after viewing all of the item-price pairs, they would be shown the image of the item again and would need to recall the price. Items were shown in fixed random order, one at a time, for 8 s each. During the study, participants saw an image of the item, and the name of the item and price were displayed directly above the item. Immediately after item presentation, a cued recalled test was given, during which the image of the item was shown and participants had to verbally recall the price. Following the recall test in one blocked condition (e.g., past), participants received instructions and completed the subsequent blocked condition (e.g., future). After both conditions had been completed, participants were asked to rate how difficult it was to imagine it was 40 years in the past and 40 years in the future on a scale from 1 to 7 (1 = *easy*, 7 = *very difficult*). All of participants' responses were recorded by an experimenter.

Results and Discussion

The results from Experiment 1 are shown in Figure 2. In order to examine the effects of age group (younger vs. older adults) and condition (past vs. future), a 2×2 mixed model ANOVA was conducted. Overall, older adults recalled fewer item prices compared with younger adults, $F(1, 58) = 13.13$, $MSE = 4.69$, $p = .001$, $\eta_p^2 = .19$. There was a main effect of condition such that participants recalled more prices from the past compared with future condition, $F(1, 58) = 18.18$, $MSE = 3.71$, $p < .001$, $\eta_p^2 = .14$. Importantly, there was an Age Group \times Condition interaction, $F(1, 58) = 4.35$, $MSE = 3.71$, $p < .05$, $\eta_p^2 = .08$. In order to explore the nature of the interaction, post hoc t tests were conducted. For the items in the past, both younger and older adults correctly recalled a similar number of prices, $t(58) = 1.34$, $p = .18$. However, younger adults recalled significantly more of the future prices compared with older adults, $t(58) = 4.03$, $p < .001$. In addition, older adults recalled more of the past compared with future prices, $t(29) = 4.64$, $p < .001$, whereas younger adults recalled a similar number of item prices in both the past and future conditions, $t(29) = 1.49$, $p = .15$.

This pattern of results persisted even with a less stringent measure of recall (i.e., recall within $\pm 15\%$ of the actual price).

The postrecall test difficulty ratings (i.e., “How difficult it was to imagine it was 40 years in the past/future?”) were analyzed. Older adults rated the future condition as more difficult than the past ($M = 4.4, SD = 1.8$ and $M = 2.7, SD = 1.8$, respectively), $t(29) = 5.37, p < .001$. However, despite recalling a similar number of past and future item prices, younger adults also rated the future as more difficult than the past ($M = 4.3, SD = 1.4$ and $M = 3.1, SD = 1.2$, respectively), $t(29) = 3.36, p < .01$. Furthermore, controlling for the difficulty ratings did not reduce the overall effect of age on the number of items recalled.

Lastly, an Age Group \times Block (first blocked condition vs. second blocked condition) ANOVA was conducted in order to examine any potential effects of interference. There was an effect of block, such that recall for item prices was higher on the initial block compared with the second block, $F(1, 58) = 18.64, MSE = 3.78, p < .001, \eta_p^2 = .24$. However, age group did not interact with block, $F(1, 58) = .01, p = .93$, suggesting that older adults did not suffer disproportionately from the effects of interference.

Although older adults recalled fewer prices overall compared with younger adults, this age-related difference was eliminated for item prices within the past condition. Thus, it appears that older adults were able to utilize their prior knowledge and experiences in such a manner that enhanced memory for these item-price pairings. The impact of schematic support on memory is further demonstrated by the pattern of results observed with younger adults. Specifically, younger adults, who do not have experience with either past or future prices (i.e., do not have schematic support), were not greatly impacted by the past and future time manipulations. Overall, these data demonstrate the sizable impact the presence of schematic support, and, alternately, lack thereof, can have on memory performance, particularly for older adults.

Experiment 2

In Experiment 1, younger and older adults showed similar memory performance for the prices of items in the past, but age differences were observed for the future items. However, all of the items in Experiment 1 were relatively common items (likely providing similar levels of familiarity for both younger and older adults), paired with either prices from the past or future. In order to further investigate how more era-specific schematic support might influence memory, we conducted a second experiment, to first replicate the main findings from Experiment 1, and then to extend them to more unique era-specific items. Thus, in Experiment 2, participants engaged in both a past- and future-based condition, but half of the items were specific to the era, whereas the other half of the items were common items similar to those used in Experiment 1. For the past items, the “era-specific” item-price pairings included items such as a record player, wood-paneled station wagon, and typewriter. For the future items, the items included a robot maid, skin cancer cure cream, and a 3D laptop. We were interested in whether the past era-specific items may influence older adults more so than younger adults, given that older adults likely had some interaction with these items in the remote past, but not more recently, whereas younger adults could

likely identify these items, but had little or no interaction with the past era-specific items. However, older adults' knowledge of past era-specific item prices could be less robust than knowledge of past common items. That is, past common items may disproportionately benefit from both prior and current knowledge sets, as they could be items that were purchased throughout one's lifetime, creating a stronger basis of schematic support. As for the future-specific items, both age groups should have no experience with these items, although younger adults may be more inclined to consider and attend to these items as ones that they might encounter in the future.

Method

Participants—The participants consisted of 32 older (17 females; M age = 80.0, SD = 5.5) and 32 younger (24 females; M age = 21.1, SD = 5.1) adults. Older adults were in good self-reported health (M = 8.4 on a rating scale from 1 to 10, with 10 indicating excellent health), and had an average of 17.1 years of education. All recruitment procedures and compensation were identical to that described in Experiment 1.

Materials—The materials consisted of prices and images of 10 common items utilized and described in Experiment 1, and 10 era-specific items (five past and five future). Both era-specific past and future items were chosen to reflect a wide range of prices. In addition, the era-specific past items were those that most people (both younger and older adults) were likely to be somewhat familiar with, but were not presently as widely available for purchase (i.e., typewriter, Ford station wagon, record player). The future items and prices were selected after researching Web sites that projected likely future inventions, such as the site <http://toptrends.nowandnext.com/2008/10/31/future-inventions/> and <http://science.howstuffworks.com/innovation/inventions/5-future-inventions-everyones-been-waiting-for.htm>. Within each condition, the five era-specific items and five common items were shown intermixed in a fixed random order. The images and prices for the 1970s era-specific items were selected in the same manner as described in Experiment 1 (see Figure 1 for a sample of the materials).

Procedure—The procedure was identical to that described in Experiment 1, save for one addition to the instructions. In the past condition, participants were informed that some (but not all) of the items shown may be items that are no longer common today, and in the future condition, participants were told that some (but not all) of the items may not be common today or invented yet. Order of the conditions (past and future) was counterbalanced between participants, and appearance of the common items was counter-balanced between the past and future conditions.

Results and Discussion

The results from Experiment 2 are shown in Figure 3. In order to investigate the effects of condition (past vs. future), item type (common vs. era-specific) and age group (older vs. younger), a $2 \times 2 \times 2$ mixed model ANOVA was conducted. Overall, older adults remembered fewer prices compared with younger adults, $F(1, 62) = 9.12$, $MSE = 2.2$, $p < .01$, $\eta_p^2 = .13$. There was a main effect of condition, $F(1, 62) = 12.0$, $MSE = .95$, $p = .001$,

$\eta_p^2 = .16$, such that participants remembered more prices from the past compared with future condition. In addition, there was a strong main effect of item type, $F(1, 62) = 73.16$, $MSE = 0.72$, $p < .001$, $\eta_p^2 = .54$, with common-item prices being recalled more than era-specific item prices. The Condition \times Item Type, Age Group \times Condition, and Age Group \times Item Type interactions were all non-significant (all $ps > .12$), as was the Age Group \times Condition \times Item Type interaction, $F(1, 62) = 1.59$, $p = .21$. Using a less stringent assessment of recall (i.e., recall within $\pm 15\%$ of the actual price considered correct), the pattern of results was largely unchanged, except the effect of condition was no longer significant, $F(1, 62) = 1.46$, $p = .23$.

Based on the findings from Experiment 1 (which used only common items), we were interested in determining if a similar pattern of results was obtained in Experiment 2 for the common items (left-hand side of Figure 3). Simple interaction effect analyses were conducted (using the more stringent measure of precise recall), with two separate 2 (age group) \times 2 (condition) ANOVAs for the common items and the era-specific items. For the common items, older adults remembered fewer prices compared with younger adults, $F(1, 62) = 7.81$, $MSE = 0.96$, $p < .01$, $\eta_p^2 = .11$. Participants recalled more past than future prices, $F(1, 62) = 13.97$, $MSE = 0.69$, $p < .001$, $\eta_p^2 = .18$. As was found in Experiment 1, there was also a significant Age Group \times Condition interaction, $F(1, 62) = 5.03$, $MSE = 0.69$, $p < .05$, $\eta_p^2 = .08$. Post hoc t tests for the common items revealed that older and younger adults recalled a similar number of item prices in the past condition $t(62) = .67$, $p = .50$, but younger adults recalled more items prices in the future condition compared with older adults, $t(62) = 3.68$, $p < .001$. Furthermore, younger adults recalled a similar number of prices in the past and future conditions, $t(31) = .96$, $p = .34$, whereas older adults recalled more prices from the past compared with future condition, $t(31) = 4.76$, $p < .001$. For the era-specific items, a main effect of age group was again observed, $F(1, 46) = 6.80$, $MSE = 1.99$, $p = .01$. However, unlike the results for the common items, there was no effect of condition, $F(1, 62) = 2.67$, $p = .11$, nor was there an interaction, $F(1, 62) = .07$, $p = .80$.

The postrecall test difficulty ratings (i.e., “How difficult it was to imagine it was 40 years in the past/future?”) were analyzed. Consistent with the pattern of results, older adults rated the future condition as more difficult than the past ($M = 3.6$, $SD = 2.4$ and $M = 2.2$, $SD = 1.6$, respectively), $t(23) = 3.41$, $p < .01$, whereas younger adults’ ratings did not significantly differ between the future ($M = 3.4$, $SD = 1.3$) and past ($M = 3.0$, $SD = 1.6$) conditions, $t(23) = .78$, $p = .45$. Furthermore, controlling for the difficulty ratings did not reduce the overall effect of age on the number of items recalled.

Lastly, an Age Group \times Block (first block vs. second block) ANOVA was conducted in order to examine any potential effects of interference. There was an effect of block, such that recall for item prices was higher on the initial block compared with the second block, $F(1, 62) = 12.64$, $MSE = 1.94$, $p = .001$, $\eta_p^2 = .17$. However, age group did not interact with block, $F(1, 62) = .15$, $p = .71$, suggesting that older adults did not suffer disproportionately from the effects of interference.

For the common items, the results in Experiment 2 replicate the findings from Experiment 1. Interestingly, typical age-related associated deficits were observed for the era-specific items. Older adults may not have benefitted from the era-specific past items, relative to the common items, as they encountered them many years ago, and either never purchased them or purchased them only once (e.g., the station wagon or typewriter). This finding suggests that in order for schematic support to be facilitative, it needs to be based on current and active bodies of knowledge, and not based on infrequent use or more remote memory. An alternative explanation may be the items themselves attracted additional attention and encouraged reminiscing (some participants remarked, “I remember driving in that type of car,” when seeing the wood paneled station wagon), and although this led to the processing of the object in question, it may have detracted from binding the price to the item.

General Discussion

Although older adults often display deficits in various forms of associative memory, the present study provides some additional insight and exceptions to this general observation. When participants studied common items that were paired with prices from the past, older adults did as well as younger adults when later recalling the prices. This finding suggests that when older adults could rely on prior knowledge and experience with these types of prices, older adults can engage in schema-based processing to guide or enhance associative memory. The process may reflect a reliance on a specific form of personal schematic support, in that older adults had experience and may remember purchasing these items at those prices years ago. Although younger adults likely did not have this personal form of schematic support (as they had not experienced these prices during their adulthood), younger adults could use efficient encoding and retrieval operations to remember the past and future item-price pairs in episodic memory. Importantly, when schematic support was not present for either group (the future condition, and especially for the era-specific future items), both younger and older adults showed impairments in performance relative to the past condition, and younger adults recalled more prices than older adults.

Although prior work has shown that older adults can benefit from the presence of environmental (e.g., Craik, 1994; Naveh-Benjamin et al., 2005) and schematic support (e.g., Castel, 2005; Craik & Bosman, 1992; Hess & Slaughter, 1990; McGillivray & Castel, 2010), the present work shows that the schematic support may need to be era-specific, experienced regularly and perhaps relevant to the individual in question (see also Jenkins, 1979). The present study suggests that that for binding processes to allow for accurate associative memory, both the item (common items) and the prices (relevant to the era) must be congruent and experienced often in order for older adults to benefit from schematic support. In the past condition for both Experiment 1 and 2, age-related differences were not present for the common item-price pairings. However, in Experiment 2, when some items were specific to the era in question, younger adults consistently outperformed older adults. Younger adults may be better able to remember these novel price pairings as new episodes. For the past era-specific pairings, it may be that older adults were consumed by the past objects and failed to adequately associate the prices, or that older adults did not have sufficient experience purchasing these items. This could also occur because the common items have a high degree of familiarity, frequency of purchase, or personal relevance (see

also Germain & Hess, 2007), causing older adults to attend to the objects and bind the prices effectively. For the past era-specific items, older adults were perhaps relying on a form of remote schematic support for both the item and the prices, leading to some level of familiarity, but one that is more “faded” and does not lead to effective binding of the item price. The use of prior knowledge by older adults, as well as more controlled processes to facilitate memory for specific prices (see recent work by Bouazzaoui et al., 2013), may be a crucial component to better understand under what circumstances younger and older adults can use schematic support to assist in remembering associative information.

The present work outlines conditions in which schematic support can help older adults remember associations, as well as important boundary conditions. It may be that older adults benefit when there is a highly experienced component (almost semantic-like congruency) that links the item–price pairs. When this congruency is consistent with multiple prior experiences in real-world settings (such as for the common items in the past), older adults can show benefits in associative memory. We note that the prices from the past do not reflect a fixed price for that era (e.g., movie prices and coffee prices constantly fluctuate based on markets and locations), such that older adults may have some knowledge base of the price range (but not the precise price) in the past condition. Based on this, one might also expect older adults to experience some interference from these prices, but it may be that the variations in past and more current prices allow older adults to integrate these prices and remember them well. The future-based pairings have little to no interference but also provide no schematic support, leading to larger age-related differences in performance. However, this can be reduced for the common future items, as these items provide greater schematic support, and as such, both younger and older adults demonstrated relatively better memory for future prices when those prices were associated with currently extant/common items rather than yet-to-be-invented items.

The deficits observed for older adults when encoding and retrieving the future-based information may be consistent with other research perspectives regarding how younger and older adults think and construct future events. For example, Addis, Musicaro, Pan, and Schacter (2010) have shown that older adults have difficulty simulating future events, and will show associative memory errors for future simulations, suggesting that aging may lead to deficits in a system that can flexibly recombine details from past events into novel scenarios. Given the future-price pairings in the present study were fictitious but were designed to reflect future prices, older adults may not have engaged simulations of the future in a manner that allowed for the necessary processing to remember these prices. This may also potentially reflect motivational differences between younger and older adults when considering future-based information. Socioemotional selectivity theory (SST; Carstensen, 1995) suggests that older adults are less likely to consider future-based information and scenarios when making decisions, as older adults are aware of a more limited life span relative to younger adults. Age-related differences were greater for future information, as predicted by SST, but both younger and older adults had more difficulty recalling the future-based prices, and this may be attributed to future simulation being more challenging than placing oneself in the past (as reflected by the difficulty ratings provided by participants in Experiment 1). Although the present study was not designed to directly test socioemotional selectivity theory, future work could test this by using a goal-set or social communication

manipulation (see also Adams, Smith, Nyquist, & Perlmutter, 1997; Adams, Smith, Pasupathi, & Vitolo, 2002), such as asking older adults to remember future-based item-price information in order to communicate this information to a younger generation. Finally, the present findings may also be relevant in terms of how both younger and older adults plan for the future, and possibly rely on different forms of schematic support when considering retirement and financial planning and imagining the future self (see also Hershfield et al., 2011).

The present study provides some initial evidence that older adults can remember past item-price information by relying on both remote and more generalized forms of schematic support, as well as future-based information if the objects are common and thus are familiar. Some limitations of the study include the relatively small sample size of participants in each experiment, and the number and type of items. In addition, we did not directly or subjectively assess the commonality or familiarity of each item on an individual-by-individual basis, and this might influence how people remember the item-price information. For example, personal relevance of information (see also Germain & Hess, 2007) could influence how people process and remember each item-price pair, such that participants selectively focus on items they have owned, have purchased frequently or recently, and/or would like to purchase in the future. One could also examine subjective age to determine if older adults may in fact feel younger, or examine older adults after studying information from the past or future (cf. Hughes, Geraci, & De Forrester, in press). In addition, further research could examine this issue by creating a richer context for the past for older adults, in which participants become more immersed in the past, such as by looking at photographs from that era, listening to music from that era, or by recalling personal life events (e.g., Langer, 2009). A future goal manipulation could involve the need for social communication with younger family members or rating the interest or functionality of each of the futuristic items. Future research could also address how the emotional factors could influence how older adults remember past and future-based information, either by manipulating the emotionality of the materials or the mood that participants are in when remembering past and future-based information. For older adults, it may be that some amount of emotion is involved when remembering the more remote past, and a certain level of nostalgia may influence how older adults recall this dated information.

In summary, older adults did significantly better in the past condition when remembering item-price pairs and showed comparable performance to younger adults, but age-related differences were much greater in the future condition. We provide evidence that schematic support is beneficial when common, regularly experienced items are paired with prices, but not for more remote and era-specific object-price pairings. Although older adults can benefit from “turning back the clock,” younger adults can better remember future-oriented information relative to older adults, consistent with theories regarding age-related differences in associative memory, the use of schematic support, and future simulation.

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	Common Items (Experiment 1 & 2)	Era-Specific Items (Experiment 2)
Past	Levi Jeans – \$9 	Portable Record Player – \$60 
Future	Cup of Coffee - \$12 	Robot Maid – \$1700 

Figure 1. Sample stimuli from Experiments 1 and 2 (left panel, common items) and Experiment 2 (right panel, era-specific items) for both the past (top panel) and future (bottom panel) condition.

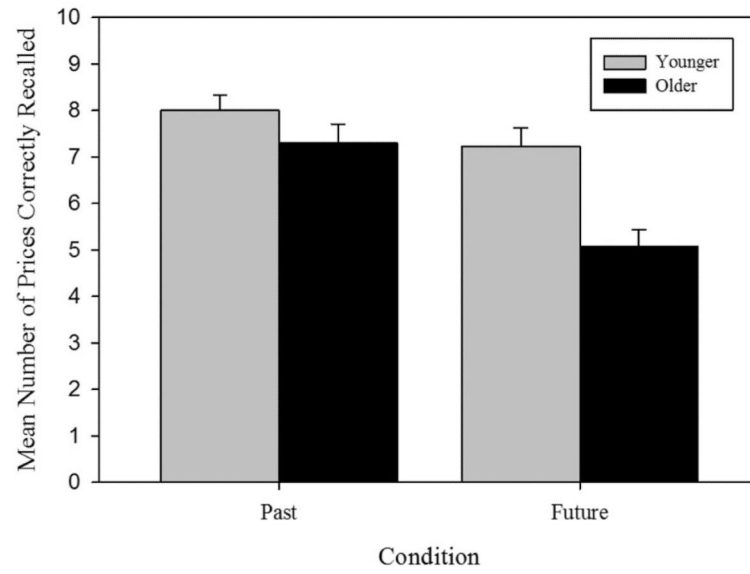


Figure 2. Correct price recall for past and future items by younger and older adults in Experiment 1. Error bars represent standard error of the mean.

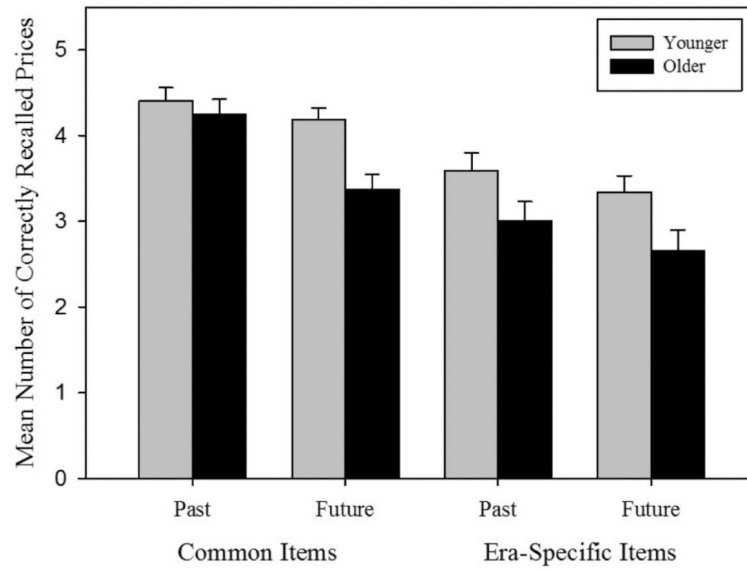


Figure 3. Correct price recall for common and era-specific past and future items by younger and older adults in Experiment 2. Error bars represent standard error of the mean.