General Versus Specific Trait Memory Across Ages

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ABSTRACT

General Versus Specific Trait Memory Across Ages

A thesis presented to the Department of Psychology

Graduate School of Arts and Sciences
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While some evidence suggests that age differences in memory can be ameliorated for socioemotional information, it is unknown whether these effects extend to memory for specific details (rather than general information) and across different aspects of socioemotional information. The present study examined the ability of older and younger adults to remember both specific traits and the general valence of those traits (positive or negative) for people they encountered. 41 younger adults and 27 older adults viewed a set of 24 faces on a computer monitor, each face paired with a social trait word describing the person as honest, liar, compassionate, or inconsiderate. In a surprise memory task, participants selected which trait had been presented with each face. It was hypothesized that while younger adults would show superior memory to older adults on average, this would be particularly true for memory of specific traits rather than memory for general valence (e.g., whether the trait was good or bad). Results indicated that younger adults showed superior memory on average, with marginal statistical significance trending toward younger adults showing superior specific trait memory. It was also hypothesized that both age groups would show increased memory for general valence and that both age groups would show more similar memory abilities for general valence. Analysis of error types showed that when the specific trait was not correctly recalled, significantly more responses indicated successful memory of general valence. In addition, the number of these same valence errors were nearly the same for both age groups.

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Introduction

It is a commonly accepted belief that adults begin to suffer from decreasing memory abilities as they reach later ages. Most indications are that older adults' abilities to remember are inferior to the memory abilities of younger adults. However, this later life decrease in memory may not be universal to all sorts of memory, as there are conditions under which the memory capabilities of older adults remain similar to those of younger adults. One area where memory abilities may not lessen as much with age is the recall of information with emotional or affective relevance. A better understanding of conditions under which memory abilities remain constant with age can lead to a better understanding of how memory changes over the lifespan and how older adults may be best able to utilize their memories. The present study will compare the abilities of older and younger adults to recall specific traits about people, as well as their ability to recall the more general affective component of whether the traits are positive or negative. This will be done in order to determine if the ability to recall general trait information is preserved with age, even as the ability to recall specific trait information fades.

Memory in older adults has been found to decline across many situations, with older adults often giving false positive judgments for previously seen versus novel information. Bartlett, Leslie, Tubbs, and Fulton (1989) found age differences between older and younger adults in the ability to compare picture-based information held in the memory against new information. When both younger and older adults viewed sets of pictures of faces and were later shown pictures of novel and previously seen faces, older adults were more likely than younger adults to identify the new face pictures as having been previously seen. Older adults show less ability to improve memory than younger adults, even when taught memory-improving techniques, such as mnemonics. In such cases, greater age is associated with even less ability to improve memory (Yesavage, Sheikh, Friedman, & Tanke, 1990).

Gopie, Craik, and Hasher (2010) examined destination memory, recalling to whom you have told a given fact or anecdote, and found that older adults are indeed disproportionately impaired in comparison to younger adults when attempting to recall with which individuals they had previously shared certain facts. Furthermore, older adults were also more confident than younger adults that they had not shared facts with individuals with whom they had, in fact, shared the facts. The reverse effect of forgetting the source from where one has learned information, called source amnesia, is also more prevalent in older adults than it is in younger adults (McIntyre & Craik, 1987). Older adults are more likely than younger adults to forget where they learned real or fake facts. Older adults are also more confident than younger adults when they attribute learned information to the wrong source (Gopie et al., 2010).

There are indications that memory deficiencies in older adults can occur as a result of problems with encoding the information to be remembered. Older adults can have increased difficulties processing objects simultaneously with background information included with those objects, resulting in a greater number of errors related to contextual memory (Chee et al., 2006). Older adults are also more susceptible to being disrupted in memory tasks. Gutchess and colleagues found disruption in processing the context for memory to be pervasive with age (Gutchess et al., 2007).

Certain conditions can improve the memory abilities of adults regardless of age. Increased affective or emotional relevance has been shown to improve the memory of both older and younger adults. Kanungo and Dutta (1966) found that memory for adjectives improved when there was greater emotional involvement. Individual members of a group known to have strong feelings of pride and group identification were better able to remember adjectives when they were presented as being descriptive of people in their own group than when adjectives were presented as being descriptive of people belonging to another, fictitious group. Warring and Kensinger (2009) found that both younger and older adults showed similarly enhanced memory for emotional over neutral items that were presented two days earlier. Brain activity in both younger and older adults indicates recruitment of the amygdala and the orbito-frontal cortex during the successful encoding of positive and negative emotional objects. This indicates better encoding of these objects which can relate to better memory for them later on (Kensinger, Garoff-Eaton, & Schacter, 2007; Kensinger & Schacter, 2008). Altgassen and colleagues manipulated the emotional valences of items to be remembered by younger and older adults. Emotionally valenced cues resulted in an increase in memory performance in both younger and older adult participants. Age deficits for older adults were only found for items that were given no emotional valence (Altgassen, Phillips, Henry, Rendell, & Kliegel, 2010). Denburg, Buchanan, Tranel, and Adolphs (2003) assessed the emotional memory in adults ranging in age from 35 to 85 and found an overall decline in memory with increasing age. Memory performance across ages was improved when the stimuli were more emotionally significant, with participants showing improved memory for general gist and lessened memory for visual detail.

The inclusion of affective or emotional relevance in the information to be remembered often causes older adults' levels of performance on memory tasks to improve to the point of being similar to the levels of performance shown by younger adults. Rahhal, May, and Hasher (2002) found significant differences between the abilities of older and younger adults for perceptual memory such as who said a statement. However, this same study found negligible differences between older and younger adults for memory about affective decisions like the truth or character of a speaker. May, Rahhal, Berry, and Leighton (2005) showed support for the same idea with younger adults outperforming older adults in remembering perceptual context information like an items location and non-emotional conceptual information such as the quality (e.g. how appetizing a food is) of an item. In the same study, there was no age difference in memory for conceptual emotional information such as the safety of an item.

There are some indications that older adults' improved memory for things with affective or emotional significance may occur at the expense of other sorts of memory. Kensinger, Piguet, Krendl, and Corkin (2005) found that when older and younger adults viewed a complex scene with emotional content, both age groups demonstrated enhanced memory for the emotional content and reduced memory for other details. When given specific instructions to pay attention to all details, younger adults were as likely to remember the emotional content as the non-emotional content, but older adults still showed better memory for emotional content to the detriment of their memory for the non-emotional content. Kensinger, Gutchess, and Schacter (2007) found similar results.

Older adults are likely to have worse memories in general than younger adults; however, there are circumstances that lessen this effect of aging. Information with affective or emotional relevance tends to improve memory and lead to memory abilities in older adults that are much closer to the level of memory ability in younger adults. However, we hypothesize that these benefits are limited to general memory, and do not extend to specific details. We predict that younger and older adults will show much more similar ability to remember whether the trait shown for a person was generally positive or negative. The more affective nature of recalling whether the gist of a trait was generally good or bad should increase older adults' recall abilities to the point that they are closer to those of younger adults. In contrast, we hypothesize that younger adults will demonstrate memory for specific character traits (e.g. honest, liar, compassionate, or inconsiderate) in individuals that is superior to that of older adults.

Methods

Participants

41 younger adult participants (ages 18-35) were drawn from the Brandeis University undergraduate research pool. 27 older adult participants (ages 60-85) were drawn from the Brandeis University community member research pool. Five younger adult and three older adult participants had their data omitted based on exhibiting below-chance performance in the study protocol. Younger adult participants were compensated with academic course credit. Older adult participants were compensated with a payment for their involvement.

Materials

E-Prime software was programmed with encoding and retrieval tasks featuring 24 frontal face, color photographs of individuals with neutral expressions. The photographs were drawn from the Productive Aging Laboratory Database (Minear & Park, 2004). These photographs were comprised of eight older adult faces, eight middle-aged adult faces, and eight younger adult faces with four male and four female faces in each group. Each photograph was paired with one of four positive or negative traits from one of two opposite trait pairings. The trait parings were honest/liar (honesty-based traits) and compassionate/inconsiderate (compassion-based traits) and were chosen based on the traits having equivalent levels of emotional valence and emotional arousal as rated by 25 older and 60 younger adults. Each trait was assigned to six of the faces with one young male face, one young female face, one middle-aged male face, one middle-aged female face, one old male face, and one old female face in each group. Each of these groups of four faces were balanced by attractiveness, distinctiveness, and trustworthiness based on previously collected ratings by young adults. In addition, there were four counter-balanced versions of the face/trait pairings such that each face appeared with each trait across the different version. Each participant saw only one of the four versions of face/trait pairings. This helped assure that each trait was associated with a balanced set of faces across participants.

Research Design

This was a mixed design. Age was a between subjects variable, with both the older younger adult participants completing the same tasks. Trait type (i.e., general or specific) was a within subjects variable. All participants were exposed to the same set of traits.

The dependent variables measured in this study were participants' memory of specific traits and general valence of traits used to describe pictures of individuals. Memory for specific traits was operationalized as the computerized recording of how many specific traits participants successfully recalled and paired with the faces with which the traits were originally presented (e.g., choosing honest for a face initially presented as honest). Memory for general valence was operationalized as the computerized recording of how many times participants chose a trait of the correct valence (positive or negative) that matches the trait originally paired with a face (e.g., choosing honest or compassionate for a face initially presented as honest).

The predictor variables in this study were the age of the participants and the level of memory (general or specific). It was hypothesized that younger participants would outperform older participants in memory for specific traits, but there would be little or no age difference for memory of general trait valence.

Procedure

All materials and procedures were approved by the local Institutional Review Board. A computer running E-Prime software was used for the presentation of faces and traits to be memorized as well as for recording participant input for trait recall. All participant input was performed using a keyboard with white stickers labeled ‘1,’ ‘2,’ ‘3,’ and ‘4’ on the 1, 2, 3 and 4 keys and white stickers labeled ‘Y’ and ‘N’ on the J and K keys.

Participants met one on one with a single investigator in a small room with a computer. The participants were given the opportunity to review and sign a statement of informed consent. Participants were directed to the computer for the encoding task. Instructions were presented in text on the computer screen and simultaneously provided verbally by the investigator. The instructions were split over several screens that participants advanced by pressing the spacebar on the computer keyboard. The instructions were as follows:

“Welcome to the study. Your task is to imagine you must hire a person to care for a sick relative. Press the spacebar to continue. There will be a series of potential caregivers displayed on the computer screen. You will see a picture of each person's face, along with a written character trait that describes the person. Press the spacebar to continue. As you see each person's face and trait, think about whether you would be comfortable hiring this person as your sick relative's caregiver. If yes, you would be comfortable hiring this person as a caregiver, press the key with the white 'Y' sticker. If no, you would not be comfortable hiring this person as a caregiver, press the key with the white 'N' sticker. Press the spacebar to continue. Each person will be displayed for five seconds. There will now be a short practice session. If you have any questions, you may ask the investigator now. Press the spacebar to begin the practice session."

At this point, participants were shown four face/trait pairings using black and white middle-aged faces that were distinct from any used for the main study. As the faces were viewed, participants indicated with key presses whether or not they would be comfortable with the people being displayed as caregivers. This was designed to help keep participants focused on the task. Once the practice session was completed, participants saw the following instructions:

"You have completed the practice session. If you have any questions, please ask the investigator. Remember, press 'Y' if you would be comfortable with the person as a relative's caregiver and 'N' if you would not be comfortable. When you are ready to begin the task, press the spacebar."

If there were no further questions, participants will begin the encoding task. The encoding task displayed each face for five seconds with the corresponding trait printed below the face. Each face/trait pairing was displayed once in a randomized order. As participants viewed the encoding task, they indicated with key presses whether or not they were comfortable with the people being displayed as caregivers. Upon viewing all 24 face/trait pairings and completing the encoding task, participants received the message, "This section of the study is complete. Please inform the investigator that you have finished the section."

At this point, the investigator administered a short distracter task to assure that participants could not continue to rehearse the face/trait pairings in working memory. Participants were instructed to verbally count backwards by sevens starting at 1000. After

30 seconds of this task, participants were directed back to the computer to be presented with verbal and text instructions regarding the retrieval task. The instructions were as follows:

"The same set of faces you saw earlier will be displayed on the computer screen. Your task is to try and recall which trait was associated with each face to the best of your ability. Press the spacebar to continue. Indicate which trait you think was associated with each person using the number keys. Press 1 if you think the person was honest. Press 2 if you think the person was a liar. Press 3 if you think the person was compassionate. Press 4 if you think the person was inconsiderate. Press the spacebar to continue. This task is meant to be difficult and it is likely that all participants will give some incorrect answers. If you do not know an answer, try to remember to the best of your ability. This task is not timed; the screen will not progress until you have given your answer. When you are ready to begin the task, press the spacebar."

The surprise recall nature of the retrieval task was intended to better simulate the conditions of real life social memory, where the initial situation in which traits were presented (determining fitness of a caretaker) is not specifically connected with attempting to memorize the character traits. If there were no further questions, participants began the retrieval task. The retrieval task displayed each of the 24 faces in a separate, randomized order. Under the faces was a listing of all four traits labeled with the appropriate key to indicate which trait is remembered to have been associated with that face. During the retrieval task, faces were displayed until a participant pressed a number key indicating which trait they remembered as being associated with that face. Upon viewing all 24 faces, entering the remembered traits, and completing the retrieval task, participants received the message, "This section of the study is complete. Please inform the investigator that you have finished the section."

The investigator then administered a digit comparison test (Hedden et al., 2002), Shipley vocabulary test (Shipley, 1986), and the demographic and health form. These were used to assess participants' level of mental functioning, health, and demographic information. The digit comparison test requires participants to compare strings of three to nine digits and determine whether they are the same. The Shipley vocabulary test requires participants to choose which of four words most closely matches the definition of a fifth word. In addition, older adults were screened for dementia by completing the mini-mental state exam (Folstein, Folstein, & McHugh, 1975). Once participants completed these additional tests and forms, they were debriefed by the experimenter. Participants were informed that the study was meant to examine whether general memory for traits is better preserved with age than specific memory. Participants were asked not to share this information with other individuals who may be participants or may know participants until the end date of the study. The experimenter then answered any further questions from the participants, and once again thanked them for their assistance.

Results

Analyses of the data involved examination of older adults' and younger adults' abilities to correctly recall specific traits and general positive or negative trait valence. Four separate ANOVAs were used to analyze the data, one each for hits, false alarms, hits – false alarms, and types of errors.

Hits

Hits were calculated based on how often participants correctly identified faces with the previously paired specific trait or a trait of the same general positive or negative valence. Hits were proportionalized by dividing the number of hits for a given category by the maximum possible number of hits for that category (e.g., the number of hits for the "honest" trait achieved by the participant divided by the maximum possible number of hits for the "honest" trait). Hits were analyzed using a 2 (specific trait vs. general valence) x 2 (valence: positive/negative) x 2 (trait type: honesty/compassion) x 2 (age: young/old) ANOVA.

For hits, there was a significant main effect of specific trait vs. general valence, *F* (1,58)=637.58, p<.001, η^2=.92, such hits were higher for general valence (*M*=.70) than for specific traits (*M* =.42). There was also a significant main effect of trait type (honesty/compassion), *F* (1,58)=6.32, p=.02, η^2=.10, with honesty-based traits (*M* =.59) better remembered than compassion-based traits (*M* =.53), and a main effect of age, *F* (1,58)=6.45, p=.01, η^2=.10, with younger adults (*M* =.60) remembering better than older adults (*M* =.52). There were also significant interactions of specific trait vs. general valence by valence (positive/negative), F (1,58)=10.78, p=.01, η^2=.16, and specific trait vs. general valence by valence (positive/negative) by trait type (honesty/compassion), F (1,58)=5.47, p=.02, η^2=.09. There was also an interaction of valence (positive/ negative) by trait type (honesty/compassion) that was trending toward significance, F (1,58)=3.7, p=.059, η^2=.06. All other main and interaction effects were not statistically significant (ps>.10).

These results also suggest that liar is remembered particularly well in comparison to other traits. Refer to Figure 1.

False Alarms

False alarms were calculated based on how often participants answered with a particular trait when that trait or its general valence had not previously been paired with the displayed face. False alarms were proportionalized by dividing the number of false alarms for a given response category by the maximum possible number of false alarms for that category (e.g., the number of false alarms for the “honest” trait committed by the participant divided by the maximum possible number of false alarms for the “honest” trait). False alarms were analyzed using a 2 (specific trait vs. general valence) x 2 (valence: positive/negative) x 2 (trait type: honesty/compassion) x 2 (age: young/old) ANOVA.

False alarms showed a significant main effect for specific trait vs. general valence, F (1,58)=80.5, p<.001, η^2=.58, with more false alarms for general valence (*M*=.30) than specific traits (*M*=.19). There was also a significant main effect of age, F

(1,58)=6.66, p=.01, η^2=.10, with older adults (*M*=.27) making more false alarms than younger adults (*M*=.22). There was also a main effect of valence (positive/negative) that trended toward significance, *F* (1,58)=2.83, p=.098, η^2=.05. There was also a significant interaction of specific trait vs. general valence by age, *F* (1,58)=5.39, p=.02, η^2=.09, such that, relative to young adults, older adults showed a particular increase in false alarms for general valence compared to specific traits. Younger adults also showed an increase in false alarms for general valence compared to specific traits, but it was not as pronounced as in older adults. There was also a significant interaction of valence (positive/negative) by trait type (honesty/compassion), *F* (1,58)=21.96, p<.001, η^2=.28. There was also a significant interaction of valence (positive/negative) by trait type (honesty/compassion) by age, *F* (1,58)=4.21, p=.045, η^2=.07. There was also a significant interaction of specific trait vs. general valence by valence (positive/negative) by trait type (honesty/compassion), *F* (1,58)=21.96, p<.001, η^2=.28. There was also a significant interaction of specific trait vs. general valence by valence (positive/negative) by trait type (honesty/compassion) by age, *F* (1,58)=4.21, p=.045, η^2=.07. All other main and interaction effects were not statistically significant (ps>.10).

These results indicate that older adults show a particular increase in false alarms for general valence. Refer to Figure 2.

Hits - False Alarms

Hits – false alarms were calculated by subtracting the proportionalized false alarms described above from the proportionalized hits describe above. This served as a corrected recognition measure to correct for differences in the overuse of a trait label, even when incorrect. Hits – false alarms were analyzed using a 2 (specific trait vs. general valence) x 2 (valence: positive/negative) x 2 (trait type: honesty/compassion) x 2 (age: young/old) ANOVA.

For hits – false alarms, there was a significant main effect of specific trait vs. general valence, F (1,58)=60.62, p<.001, η^2=.51, with higher scores for general (*M*=.39) than specific traits (*M*=.23).There were also significant main effects of valence (positive/negative), F (1,58)=8.55, p=.01, η^2=.13, with scores higher for negative (*M*=.33) than positive traits (*M*=.29), and of trait type (honesty/compassion), F (1,58)=6.01, p=.02, η^2=.09, with memory for honesty-based traits (*M*=.34) better than memory for compassion-based traits (*M*=.29). The main effect of age, F (1,58)=6.59, p=.02, η^2=.10, reflected the higher performance of younger (*M*=.37) compared to older (*M*=.25) adults. In addition, there was a significant interaction of specific trait vs. general valence by valence (positive/negative), F (1,58)=8.55, p=.01, η^2=.13, with negative specific traits being better remembered than positive specific traits, and more balanced memory for general valence. There were also interactions that trended toward significance for specific trait vs. general valence by age, F (1,58)=2.91, p=.093, η^2=.05, and specific trait vs. general valence by trait type (honesty/compassion), F (1,58)=2.82, p=.099, η^2=.05. All other main and interaction effects were not statistically significant (ps>.10).

These results indicate that memory tends to be better in younger adults than in older adults. Refer to Figure 3.

Misses: Error Types

Error Types for misses were calculated based on how often participants answered with a specific trait when that trait had not previously been paired with the displayed face. Errors were classified as three different types: same valence, same trait dimension, and unrelated. A same valence error occurred if a participant answered with the wrong trait that matched the valence (positive or negative) of the correct trait (i.e., mistaking "honest" and "compassionate"; interchanging "liar" and "inconsiderate"). A same trait dimension error occurred if a participant answered with the wrong trait that matched the trait dimension (honesty or compassion) of the correct trait (i.e., mistaking "honest" and "liar"; interchanging "compassionate" and "inconsiderate"). An unrelated error occurred if a participant answered with the wrong trait that did not match the valence or trait dimension of the correct trait (i.e., mistaking "honest" and "inconsiderate"; interchanging "compassionate" and "liar"). Types of errors were proportionalized by dividing the number of errors of each type by the maximum possible number of errors (e.g., the number of same valence errors divided by the maximum possible number of errors). Error types were analyzed using a 3 (type of error: same valence/same trait dimension/unrelated) x 2 (age: young/old) ANOVA.

Error types showed a significant main effect for type of error, F (2,58)=42.18, $p<.001$, $\eta^2=.42$, with more same valence errors (*M*=.28) than same trait dimension errors (*M*=.15) or unrelated errors (*M*=.15). There was also a significant main effect of age, F (2,58)=4.77, $p=.03$, $\eta^2=.08$, with older adults (*M*=.20) making more errors than younger adults (*M*=.18). There was also a interaction that trended toward significance for type of error by age, F (2,58)=2.34, $p=.10$, $\eta^2=.04$, such that older adults showed more same trait dimension errors (*M*=.17) than younger adults (*M*=.14) and older adults showed more unrelated errors (*M*=.18) than younger adults (*M*=.12). However, same valence errors for older adults (*M*=.27) and younger adults (*M*=.28) were nearly the same, with younger adults making slightly more errors in that direction.

These results indicate that while older adults make more errors in general, both age groups show an increased number of same valence errors in comparison to other error types. Refer to Figure 4.

Discussion

The present study examined the differing ability of older and younger adults to remember general and specific character traits that apply to people they encounter. As adults tend to suffer from decreases in most sorts of memory as they age, we predicted that older adults would show generally worse memory than younger adults. As expected older adults did show significantly worse memory than younger adults overall. In fact, with memory corrected as hits-false alarms, older adults exhibited poorer specific trait and general valence memory than younger adults for each of the four traits.

We also expected that older adults would show worse memory than younger adults specifically when attempting to recall specific trait information about the people presented. This was partially supported. While there was not a statistically significant interaction of specific trait vs. general valence by age for hits – false alarms, this interaction did trend toward significance, with older adults showing a decrease in specific trait memory as compared to younger adults. In addition, there was a main effect of age when examining the error types of misses (cases where specific traits were not correctly identified), where older adults showed significantly more misses than younger adults.

We worked under the belief that the emotional relevance of recalling whether the general valence of a person's trait was positive or negative would improve both age groups' memory for general valence as compared to memory for specific traits. While the manner in which specific memory was scored makes it a subset of general memory by definition, we were able to evaluate this prediction by focusing on the analysis of error types. Both older and younger adults made substantially more errors that were of the same positive or negative valence as the correct trait as compared to errors that were of the same honesty or compassion trait dimensions and errors that were unrelated to the correct trait. Both age groups showed little difference in the number of unrelated and same trait dimension errors, the only boost came in same valence errors. This supports our assumption that the affective relevance of general positive or negative valence results in increased memory for that information.

We predicted that while younger adults would show generally superior memory as compared to older adults, the two age groups would show more similar memory for general valence due to the preservation of such affective sorts of memory with age. Our findings partially support this hypothesis. Hits – false alarms show little difference when comparing the gap between older and younger adult memory performance overall, and the gap between age groups for general valence memory. However, error type data show that both old and young make considerably more errors that are of the same valence as the correct answer as compared to errors that are of the same trait dimension or unrelated. Furthermore, the number of same valence errors made by older adults is nearly the same as the number made by younger adults. This suggests that there is an increase in memory for general valence when the specific trait is not recalled, and that increase is preserved with age.

In addition, our results showed some unexpected findings. Despite using traits that were rated as matched based on piloting of emotional valence and arousal, honesty-based traits were remembered better than compassion-based traits, and negative traits were remembered better than positive traits. These trends occurred in both older and younger adults. While Kensinger, Garoff-Eaton, & Schacter (2006) found that negative information can improve memory for specific detail in younger adults, our results suggest that this effect extends to older adults in the case of trait memory. In addition there was increased memory for liar over other traits in both age groups. Cosmides (1989) suggested that humans are evolved to be very good at picking out cheaters, due to the great fitness cost caused by such a violation of the social contract as cheating. The increased memory for the liar trait suggests that perhaps people are better adapted to pick out and remember liars just as they are cheaters, being that both are deceptions that violate the accepted social contract of society.

In summary, this study demonstrated that, while overall memory for personality traits does decline with age, both older and younger adults show better memory for the general positive or negative valence of traits than they show for the specific trait words. While there was a substantial difference between older and younger adults' abilities to remember general valences, the similar increase in same-valence errors over other error types both age groups suggests that there may be some additional preservation of valence memory with age. Based on our results, we are conducting a follow-up study designed to be more sensitive by adding a third trait dimension and increasing the number and memorability of stimuli. We anticipate that the increased sensitivity of the new protocol will help us to conclude whether memory for the valence of character traits is preserved with age.

APPENDIX A: FIGURES

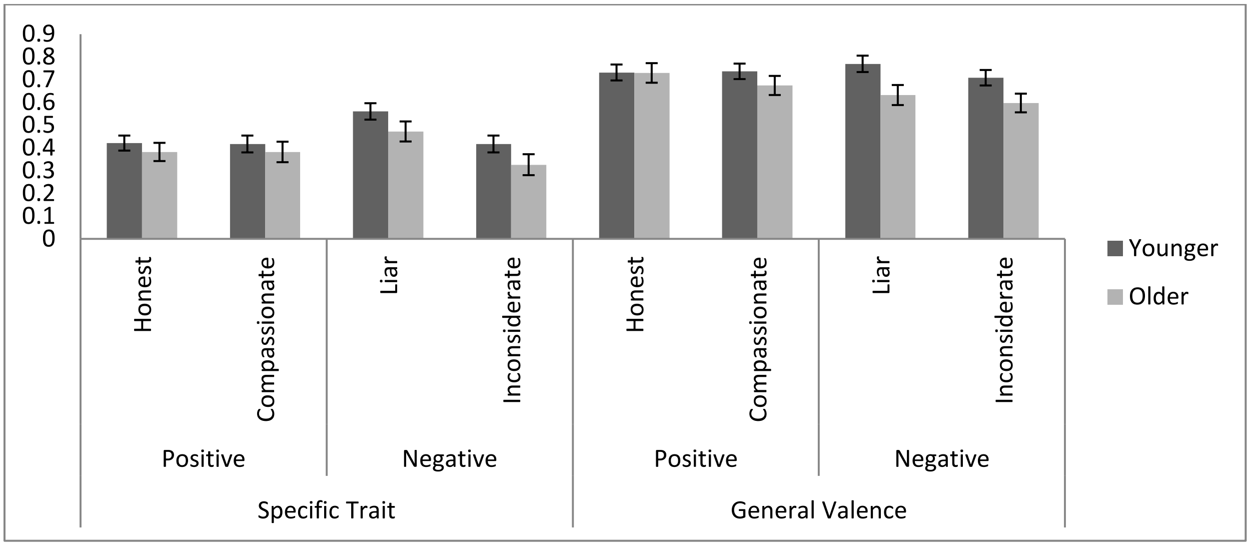

Figure 1. Graph of hits for general and specific trait memory by valence, trait type, and age.

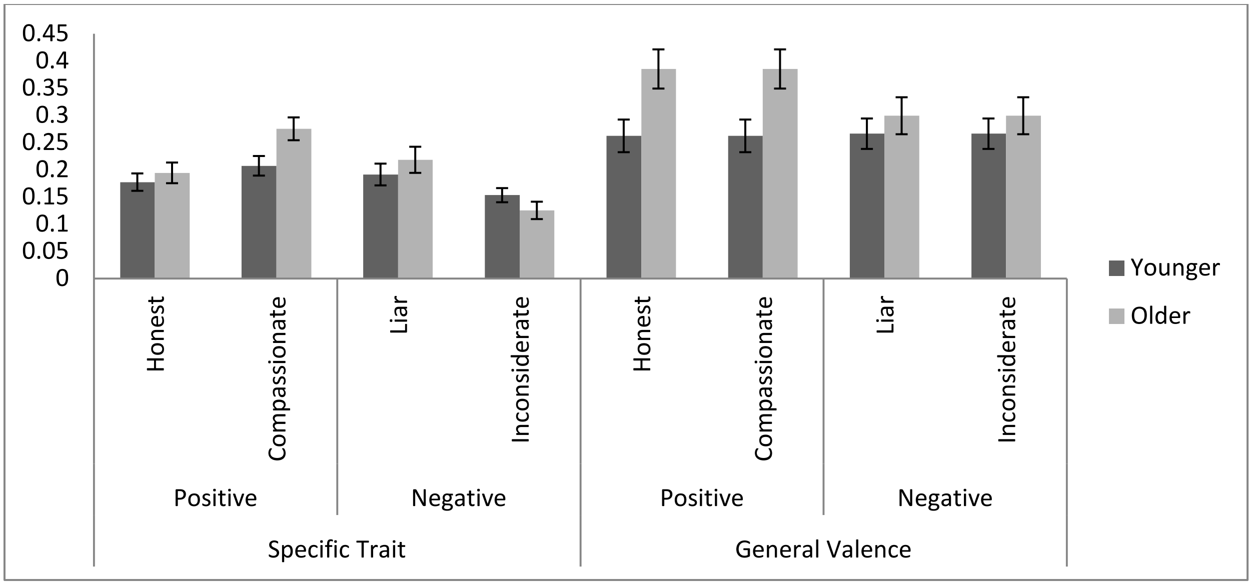

Figure 2. Graph of false alarms for general and specific trait memory by valence, trait type, and age.

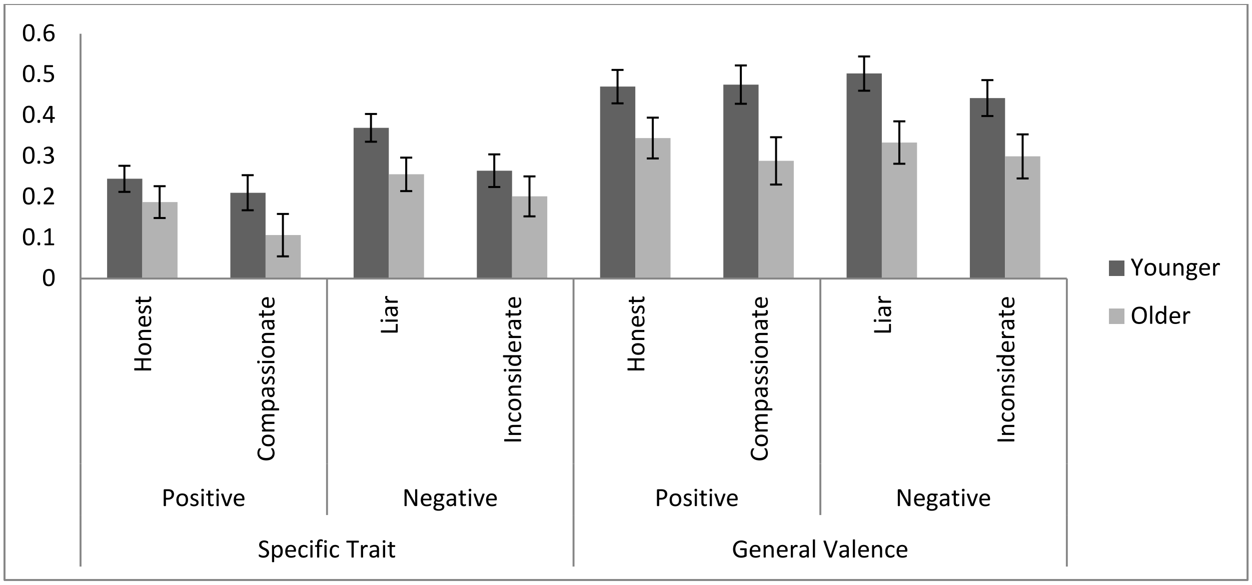

Figure 3. Graph of hits – false alarms for general and specific trait memory by valence, trait type, and age.

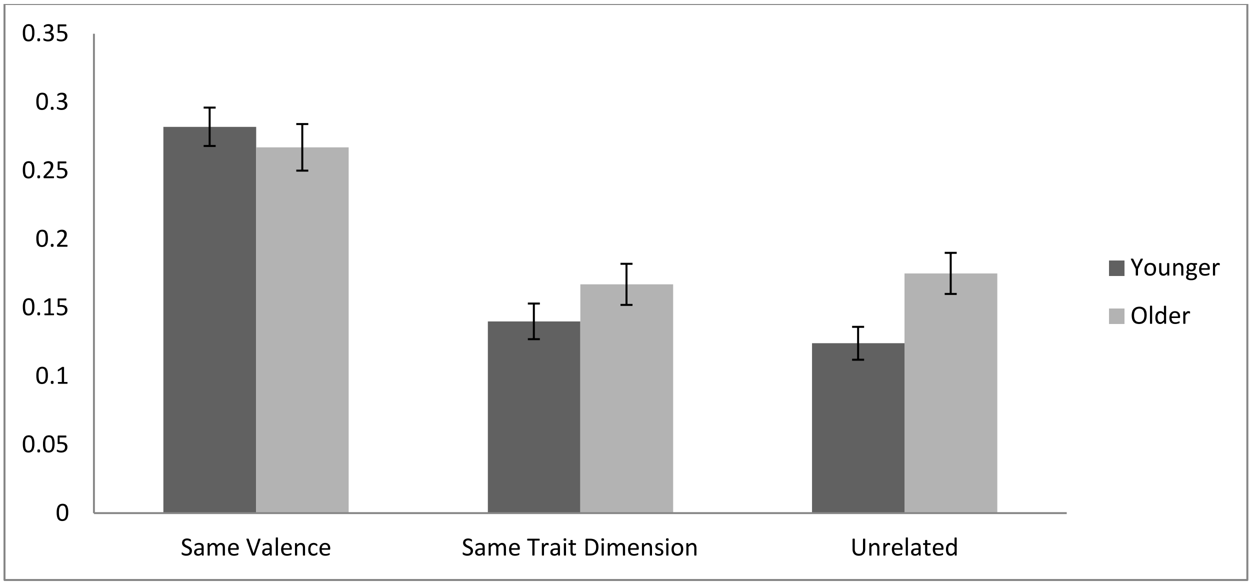

Figure 4. Graph of types of errors by age.

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