GENDER DIFFERENCES IN PLEASANT, EMOTIONAL,

AUTOBIOGRAPHICAL MEMORIES

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GENDER DIFFERENCES IN PLEASANT, EMOTIONAL,

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Abstract

The purpose of the current study was to characterize autobiographical memory (AM) in terms of its general episodic, emotional, and experiential components in order to examine gender differences in how positive life experiences are remembered. Participants were asked to recall pleasurable memories in response to positive adjectives. For each adjective, participants were asked to write a brief description of the event and rate their memories along a number of dimensions. Significant gender differences in responses were found with core themes of agency and communion; women generated more communal AMs than men. In addition, linear and non-linear analyses of the various qualia associated with positive AMs indicated that men and women also differed in how they remembered positive experiences. The results support the idea that when asked to recall positive events from the past, males and females differ, not only in what they remember, but also in how they remember these experiences.

Gender differences in pleasant, emotional, autobiographical memories

Differences between the sexes hold universal appeal. For centuries, the perceived differences of men and women have been debated. An extreme form of this view, sexism, portrayed men as superior, but feminist movements have fought for the equality of men and women in North America and in several other countries. While women still work to gain equal rights, few would disagree that there are differences between men and women. Therefore, it is not surprising that gender differences have been the subject of a considerable body of research, ranging across a number of disciplines. For example, psychologists have examined gender differences in behavior and personality, the brain, and autobiographical memory. Nevertheless, the exact physiological and psychological differences between men and women are still a matter of debate.

Gender differences in behavior are theorized to stem in part from a social context, creating gender roles, or "pattern(s) of behaviors and traits that define how to act the part of a female or male in a particular society"(Sigelman & Rider, 2006, p.G-6). Cultural views vary, but there is a general ideology that men and women think and behave differently. While this is taken to extremes in gender stereotypes, there is significant research indicating that social context validates and reinforces gender roles. For example, Bakan (1966) and Eagly (1987) have theorized that men and women differ according to two interpersonal styles: communal and agentic. Communion is the care of others over oneself, whereas agency is the care of oneself over others (Bakan, 1966). The communal aspect is typically found in women, consists of the concern for other people, and is

marked by affection and sympathy. In contrast, the agentic aspect is more evident in men and is defined by actions that are assertive, controlling, individualistic, and aggressive. Pohl, Bender, and Lachmann's (2005) research supports the notion that women are more empathic than men, and that men are more assertive than women.

In addition to evidence that gender differences are, at least in part, socialized, a wealth of evidence suggests that the brains of men and women also function differently. This may be due in part to the presence of gender-specific hormones in the prenatal stage or almost immediately after birth (Kimura, 2002). In rats, gender differences have been found in the hypothalamus, the brain area responsible for regulating hormones that control hunger, sleep, temperature, and reproductive behavior. It has been speculated that analogous differences could exist in humans (Kimura 2002). For example, magnetic resonance imaging (MRI) research has shown that typically, women have a larger corpus callosa (nerve fibers connecting the two hemispheres) than men (Bishop & Wahlsten, 1997).

Because thought processes occur in the brain, it is not surprising that males and females could differ how they process information. Intellectually, genders seem to be fairly equal; however, cognitive abilities differ greatly among males and females (see Kimura, 2002 for a review). For example, females have been found to excel at landmark memory (images of differing types of structures), verbal memory, verbal fluency, manual task precision, and mathematical

calculations (Kimura, 2002). Contrarily, men are better at spatial tasks, target-directed motor tests, and mathematical reasoning (Kimura, 2002).

These differences in cognitive ability may be due to differences in how the brains of men and women process information. For example, Speck et al. (2000) found that for working memory, males were more likely to show bilateral or predominately right hemisphere activation and females were more likely to show left-brain activation. Hoefer et al. (2007) demonstrated that emotional stimuli provoke men and women differently. The researchers used functional MRI to observe differences in cerebral activity among men and women.

Gender differences in verbal ability are well known. For example, women talk more than men (Brizendine, 2007). Also, aphasia develops more often in men than in women after brain damage (Kimura, 2002). This may be because men and women use different areas of the brain to process language. For example, Shaywitz et al. (1994) found language activates only the left interior gyrus in males, but activates both the left and right interior gyri in females, and that the functional organization of those areas varies. Witelson, Glezer, and Kigar (1995) observed that women have greater density of neurons in the temporal lobe, a finding which may account for gender differences in language processing. Gender differences in language are further complicated by the female hormonal cycle. Hampson (1990) showed that menstrual cycles affected a woman's skills on cognitive and motor tests. In particular, women with high estrogen levels show increased ability on speech tasks.

In contrast to language processing, gender differences in memory have received relatively less attention. One of the brain's primary functions is creating, storing, and recalling memories. One outstanding question is whether or not men and women differ in how they remember or re-experience personally relevant events from the past. Autobiographical memory (AM) is typically what we refer to as "memory" colloquially and its study is one of the oldest fields of psychological inquiry, with implications for health and mental health in general, in particular, the construct of the self and personal identity (Nelson, 2003). AM differs from laboratory-based memory (such as the memorization of word lists) in that AM is much more emotional in nature (Bluck & Li, 2001; Talarico, LaBar & Rubin, 2004) and is strongly associated with certain time periods in one's life (e.g. Elvevåg et al., 2003). In addition, AM is more multimodal (i.e., involving a rich combination of sensory information – sights, sounds, smells and tactile sensations) than memories induced through list learning and other laboratory methods (Talarico et al., 2004).

It is not surprising that AM recruits a widely distributed network of brain areas, some which are associated with more general episodic memory operations like the frontal cortex and areas of the medial temporal lobes (MTL; see Cabeza & Nyberg, 2000 for a review). In addition to these areas that subserve general episodic memory, AM also recruits additional areas of the MTL associated with spatial processing such as the parahippocampus (e.g., Burgess, Maguire, Spiers & O'Keefe, 2001), and areas associated with emotional processing, like the amygdala (e.g., Greenberg et al., 2005).

Some studies examining gender differences in the brain areas associated with AM suggest that little if any differences existed between the sexes, especially concerning recall of autobiographical memories. For example, Piefke and Fink (2005) examined how age and gender affected the neural activation associated with AM and found that the same areas of the brain are activated in men and women and to the same extent. However, in a subsequent study, the same researchers observed that males, in regard to AMs, typically have left brain activation, while women showed right brain activation for the same tasks (Piefke, Weiss, Markowitsch, & Fink 2005. They also noted that males showed an activation of the parahippocampal gyrus (possibly related to enhanced spatial processing) while females presented an activation of the right insula (possibly related to enhanced emotional processing) when retrieving emotional memories.

While these studies suggest that AM is different between males and females, the exact differences between the memories generated by men and women remain unclear. Previous studies have typically examined the sheer quantity of autobiographical memories generated by males as compared to females (e.g., Davis, 1999). Several studies confirm that women recall more memories than men (Fujita, Diener, & Sandvik, 1991; Robinson, 1976; Seidlitz & Diener, 1998). This may have been due to the fact that AMs for women were more emotional, and therefore, easier to recall (Fujita et al., 1991). However, not all research supports that there are gender differences in AM. Rubin and colleagues examined the AMs in older adults and did not find systematic differences in the AMs of men and women (Rubin, Schulkind, & Rahhal, 1999).

Importantly however, a content analysis of the AMs generated in their study was not performed.

In the current study, the research focus was on the kinds of memories that were elicited and their quality rather than on the quantity of memories generated. In particular, focus was placed on the agentic and communal aspects of memory. Niedzwienska (2003) found the themes to be helpful in content analysis and categorizing memorable life experiences of men and women, namely that females tended to generate flash-bulb AMs (consisting of both positive and negative events) that were more communal than men. Therefore, it was hypothesized that when prompted by positive adjectives, women would recall more memories with communal themes and men might be more likely to remember events more thematic of agency.

It is a well established finding that emotionally charged events tend to be remembered better than nonemotional events, a phenomenon that is most likely due to co-activation of the hippocampus and amygdala during encoding (Dolcos, Graham, LaBar & Cabeza, 2003; Dolcos, LaBar & Cabeza, 2004) and retrieval (Dolcos, LaBar & Cabeza, 2005). It is also known that there are differences in how men and women process emotional stimuli (e.g., Canli, Desmond, Zhao & Gabrieli, 2002; Hoefer et al., 2007) and how men and women process language (e.g., Shaywitz et al., 1994). Therefore, it was reasonable to expect that the cognitive and/or emotional processes underlying AM would also differ between males and females and that this would affect how the different genders described

their memories. In other words, AMs generated by men and women may differ in terms how they were re-experienced – physiologically, emotionally or cognitively.

To our knowledge, little research has been conducted examining in the physiological, emotional and cognitive qualities of AMs and how they may vary depending on gender. One shortcoming of existing studies of gender differences in AM is that emphasis has been placed on more general memory processes associated with AM. For example, the studies reviewed above examined how many memories were remembered, or what the memories were about. However, AM also has emotional, arousal, and experiential components that have remained largely unexamined. Therefore, exact differences between the AMs of men and women are difficult to predict. It is possible that not only do men and women differ in terms of what they remember, but there may be important differences in how men and women remember events about their lives. Characterizing the both emotional and factual content of AMs will yield a more comprehensive understanding of AM, helping to guide future research in memory studies in general, as well as research regarding gender differences.

The impetus for the current study was to provide a description of AM in males and females in order to characterize AM in terms of its general episodic, emotional and experiential components. To this end, we adopted the methodology described by Talarico et al. (2004), which has been used to describe the nature and quality of AM experiences in healthy young volunteers. Talarico et al. (2004) provided participants with adjectives for 20 distinct emotions (both positive and negative) and asked them to generate an AM for

each adjective. For each emotion, participants wrote a brief description of the event and rated the memories along a number of qualia. Some questions were specifically directed at AM properties (e.g. recollection, beliefs about accuracy, vividness, linguistic/narrative form, age), while other questions were directed at characterizing emotional variables (e.g. valence and intensity of the memories). Overall, Talarico et al. (2004) found that the emotional aspects of AM were strongly related to the phenomenological quality of AM. Specifically, emotional intensity was the most powerful predictor of AM quality (i.e., intense memories were more likely to be remembered vividly, with a greater sense of recollection, were believed to be more accurate etc.). Although their sample included both men and women, gender was not examined directly. However, the study design is well suited for examining whether men and women differed in terms of how they remembered emotional events from their past.

In the present study, the Talarico et al. (2004) methodology was adapted to compare the content and quality of AMs generated by men and women about positive events in their lives. The reason for limiting the emotional valence to positive memories was threefold. First, Talarico et al. (2004) did not find valence to be predictive of AM quality and fewer memories to recall streamlined the experiment. Second, we tried to minimize any risk of negative mood induction or any emotional discomfort that might accompany the recollection of negative events. Finally, we were specifically interested in the recollection of positive life events because this topic has received relatively little attention in the AM literature. The emotional valence of AMs has received less attention, possibly

because valence is not predictive of recollection (e.g., Talarico et al., 2004). For example, Niedzwienska (2003) asked participants to recall flashbulb memories (vivid recollections of personally important events), which consisted of both positive and negative events. Similary, Rubin and colleagues (Rubin et al., 1999) used nouns to cue AMs without controlling for the valence of the memories. However, evidence suggests that remembering positive and negative events may recruit different brain areas to varying degrees (e.g., Piefke, Weiss, Zilles, Markowitsch, & Fink, 2003). As such, positive and negative AMs may differ in important ways. A wealth of research attests to the fact that negative life events and our memories of those events can have a profound effect on psychological health (e.g., PTSD). Relatively less is known about how we remember positive events in our past.

A better understanding of how we remember positive events is worthwhile, particularly in light of evidence that recalling positive memories is a strategy used to regulate negative affect (Josephson, 1996). Furthermore, deficits in remembering positive AMs have been linked to post-traumatic stress disorder in both genders (e.g., Harvey, Bryant & Dang, 1998). In addition, the availability of positive memories has been linked to optimism (Sharot, Ricciardi, Raio, & Phelps, 2007), Optimism, in turn, is linked to overall health (Scheier & Carver, 1987). The intent of this study was to discover whether gender differences affect individuals' pleasant, emotional, autobiographical memories.

In summary, the focus of this study was to examine the phenomenological aspects of those memories and how they might differ between young men and

women. It was hypothesized that if people were asked to spontaneously generate memories, men and women would differ in their recollections. It was predicted that women would be more communal, while men would be less likely to refer to communal topics and possibly more likely to refer to agentic topics. Furthermore, it was hypothesized that the recollections of men and women would differ along a number of qualitative dimensions. For example, the memories of women should be more verbal than men, while the memories of men would be more spatial in nature. In addition, the memories of men and women might also differ in their emotional tone. The results will help to clarify the nature of AM in men and women and has a direct impact on clinical research of gender roles and emotional health, but also informs the field of memory research in general.

<div align="center">Method</div>

Participants

Neurologically normal Texas State University undergraduates ($N = 46$, 26 females, 20 males) participated for course extra credit. Four female participants did not answer questions for one of the emotional adjectives and their data was discarded, leaving the data from 42 subjects (22 female, 20 male) in the final sample. Participants' education was coded on a 4 level scale: 1 = freshman, 2 = sophomore, 3 = junior and 4 = senior. Mean education was 3.14 years ($SD = 1.22$), mean age was 22.29 years ($SD = 4.45$). Material and methods were approved by the Institutional Review Board at Texas State University.

Materials

The materials used in this study were a modified version of those used in Talarico et al., 2004). Participants were provided with 9 positively valenced adjectives: amused, delighted, happy, impressed, proud, relieved, satisfied, surprised and thrilled. Six of these adjectives were taken directly from Talarico et al. (2004); the other three were adapted from the Affective Norms for English Words (ANEW) database (Bradley & Lang, 1999). After providing the participant with an adjective, he/she was asked to write a brief description of the memory and answer the 23 ratings scale questions used in Talarico et al. (2004, see Appendix). As mentioned previously, fifteen questions were specifically directed at AM properties (e.g. recollection, beliefs about accuracy, vividness, linguistic/narrative form, age) and eight questions were directed at characterizing emotional variables (e.g. valence and intensity of the memories). Participants were asked to retrieve AMs associated with each of the 9 positively valenced adjectives.

Design and procedure

At the beginning of each session, each participant was fully informed of the procedures and questionnaires that were administered and signed the consent form. Participants were assured that if, at any time, they felt uncomfortable and wished not to continue, they were allowed to leave without penalty. Participants were also informed that if they felt they needed more time to finish the survey than allotted, or if they simply wanted to take a break, they were able to do so. There was no time limit on the survey.

The experiment consisted of asking the participant to recall nne pleasurable memories in response to nine positive adjectives. After recalling a specific memory in response to each adjective, they were asked to give a brief description of that memory and to complete the Talarico et al. (2004) questionnaire (see Appendix). The orders of the nine positive adjectives were counterbalanced to avoid order, practice or fatigue effects. One questionnaire was completed for each of the nine positive memories.

After finishing the survey, participants were thanked for their time and debriefed regarding the purposes of the experiment. They were given the debriefing form and researchers' contact information.

Data Analysis: Open-ended Responses

For the open-ended questions, narrative coding from Niedzwienska (2003) regarding agency and communion were utilized.   Agentic memories were those that conformed to one of four categories: Self-Mastery (conquering adversity, surviving a trying event unharmed, or having a miscarriage), Status/Victory (sports, exercise, winning games, or reaching a certain age), Achievement/Responsibility (academic scores and school-related achievements, obtaining jobs, cars, or homes), and Empowerment (religious). Communal memories were those that belonged to one of three categories: Love/Friendship (any responses where the central theme is friends, family, and/or significant others), Care/Help (pregnancy, pets, children, or knowing others with an illness), and Community (different examples of belonging to a community, particularly sororities and fraternities). The only code excluded from Niedzwienska's (2003)

scoring system was Dialogue, because memories involving dialogue were also represented by another communal theme. Each memory was assigned a category based upon the presence of a dominant theme. Those memories that did not have an apparent theme were assigned to a Miscellaneous category. Each participant generated a total of nine AMs. For each participant, the proportion of each memory type (communal, agentic, miscellaneous), was calculated.

Data Analysis: Ratings

The completion of the questionnaires yielded a profile of ratings across the 23 questions associated with each memory for each participant, which were then used to create an overall qualitative profile for positive memories as a whole. This procedure yielded a profile of 23 qualities for each AM corresponding to the 23 ratings: recollection, remember/know, real/imagined, vividness, field/observer perspective, verbalizability, narrative structure, specificity, rumination, reliving emotion, reliving intensity, visceral evocativeness, valence of memory, intensity of memory and age of memory. This allowed us to obtain two average profiles of positive memories, one that was associated with the female group and one that was associated with the male group.

Two complementary analyses were conducted: a linear analysis and a nonlinear analysis. First, the ratings profiles were compared to one another with SPSS via a mixed analysis of variance (ANOVA), with planned and post hoc t-tests (where necessary) in order to determine exactly how AM for females differed from that of males. Gender (male vs. female) was the between-groups

variable and the remaining variables (ratings for each of the 23 questions across the 9 adjectives) were treated as within-subjects dependent variables. Where appropriate, degrees of freedom were adjusted with Huynh-Feldt. Second, these variables were also entered as independent variables in a logistic regression with gender as the dependent variable in order to determine which elements of the AM profile most differentiated between the two groups. The intent was to find if the ratings, predictor variables, were predictive of gender, the criterion variable.

<div align="center">Results</div>

Open-Ended Responses

Each participant provided nine memories, one of each of the positive adjectives, yielding a total of 180 memories from men and 198 memories from women. To analyze the responses to the open-ended questions, we first calculated the proportion of total memories (either male or female, depending on the participant's gender) that were assigned to each of the three memory categories (agency, communion, and miscellaneous) for each participant. We then conducted a 2 x 3 mixed ANOVA with proportion of each memory category (agency, communion, misc.) as a within subjects factor and gender (male vs. female) as the between subjects factor. This analysis yielded a significant gender by memory type interaction $F(1.80, 71.8) = 3.35$, $p < .05$, suggesting that gender differences existed for only specific categories of memory.

Planned comparisons (*t*-tests) were performed in order to determine which categories differed for men and women. There were no significant differences between men and women in terms of agentic memories, $t(40) = .01$, p

= .992 (female M =39.39, SD = 12.23 vs. male M = 39.44, SD = 19.57).

Conversely, there was a significant gender difference in communal memories,

t(40) = -2.172, p < .05 (female M =53.03, SD = 13.69; male M = 43.33, SD =

15.25) and miscellaneous responses t(40) = 2.89, p < .05 (female M =7.58, SD =

9.32; male M = 17.22, SD = 12.21). These results are shown in Figure 1.

Examining within gender, males' answers were not significantly more

agentic or communal, t(19) = -.529, p = .603 (male responses: 39% agentic, 43%

communal, and 20% miscellaneous). In contrast, females' responses were more

communal than agentic in nature, t(21) = -2.64, p < .05 (female responses: 53%

communal, 39% agentic, and 8% miscellaneous).

Questionnaire Ratings

In order to determine whether men and women rated their positive

memories differently, a preliminary 9 (adjective) x 22 (question) ANOVA was

performed. Question 23, the age of the memory, was not considered to reflect a

quality of the AM and was analyzed separately. This analysis found three main

effects. First, there was a within subjects main effect of the adjective F(8.00,

320.00) = 4.21, p < .05, indicating that overall, adjective ratings differed from

each other. Second, there was a within subjects main effect of question F(10.28,

411.04) = 119.20, p < .05, indicating that ratings to each of the 22 questions were

different. These findings confirm that participants were indeed doing the task.

Third, there was a between subjects effect of gender F(1, 40) = 5.20, p < .05,

suggesting that there were overall differences in male and female responding.

However, this main effect was mitigated by a significant gender by question

interaction, indicating that men and women did respond differently from each other, but only on certain questions, $F(10.28, 411.04) = 1.96$, $p < .05$. Importantly, the analysis found no adjective by question by sex interaction $F(75.87, 3034.86) = 1.09$, $p = .27$, which allowed us to collapse question ratings across the 9 adjectives prior to post hoc analyses.

Bonferroni-corrected pairwise comparisons (i.e., t-tests) were performed on the mean ratings for each question (collapsed across the 9 adjectives) in order to determine exactly where men and women differed in terms of their ratings. The corrected alpha level was calculated at $\alpha/n = .05/21 = .0024$. Given this very conservative criterion, marginally significant results ($p < .05$) are also mentioned but must be interpreted with caution. Marginally significant results were found for Question 12, $t(40) = -2.36$, $p = .023$; Question 16, $t(40) = -2.36$, $p = .023$; and Question 20, $t(40) = -2.34$, $p = .025$. As shown in Figure 2, a) women were more likely to feel tense while remembering the event, b) were more likely to feel as though they were traveling back in time when remembering the event, and c) were more likely to have thought or talked about the event since it happened. However, after correction, only ratings to Question 18 ("When I remember the event, I think of it in words") showed significant gender differences, $t(40) = -3.13$, $p = .003$. As shown in Figure 2d, women were more likely to rate that the memory came to them in words than men.

Logistic regression analyses

In the final analysis, the data were analyzed with binary logistic regression, a nonlinear form of regression designed to predict group membership

when the outcome variable is binary (Garson, 2008). This analysis was chosen in order to determine whether any given participant could be classified as male or female on the basis of his/her responses to the different questions. This method of analysis has the potential to uncover relationships between the variables that may not be detected by linear methods of analysis, such as ANOVA or linear regression (Garson, 2008). Given that the linear analyses described above are very conservative, this approach allowed the exploration of differences between the genders with a less conservative technique.

Data were analyzed via binary logistic regression, with gender (male, female) as the dependent variable, and responses to the 22 autobiographical quality ratings (averaged across adjectives) entered as independent variables. Because the analysis was exploratory in nature, a backward stepwise approach was adopted such that only independent variables that were significant predictors of gender (Wald $p < .05$ to enter, $p < .10$ to retain) remained in the final solution.

The final model and associated statistics are shown in Table 1. This model included questions 9, 11, 12, 16, 18, and 20 and accounted for a large amount of variance in the data (Nagelkerke R^2 = .723). In addition, the Hosmer and Lemeshow test for goodness of fit indicated that this model was a good fit for the data ($\chi^{2} = 13.7$, $p > 0.05$). In terms of classification accuracy, the model was able to classify 85.0% of males and 90.9% of females, with an overall accuracy of 88.1%.

Odds ratios, shown in Table 1, suggest that males were more likely to report that positive memories elicited powerful feelings (question 9) and were

accompanied by the visceral experiences of sweat (question 11). In contrast,

men were less likely to report that their positive memories made them feel tense

all over (question 12), that they were less likely to travel back in time when they

remembered these memories (question 16), were less likely to have the memory

come to them in words (question 18), and were less likely to have thought or

talked about the positive event since it occurred (question 20). Females showed

the opposite pattern of responses. It is noteworthy that some of these gender

differences (i.e., increased ratings by females to questions 12, 16, 18, and 20)

were also identified by traditional linear analyses.

<div align="center">Discussion</div>

In spite of known neural and cognitive differences between men and

women, our understanding about how men and women remember personally

experienced events is sparse. Previous studies have failed to examine gender

differences of AM in the context of its general episodic, emotional,

phenomenological, and experiential components. This research is unique in that

it examined spontaneously generated memories about positive life events. The

current study provides additional knowledge to the area of AM by clarifying the

nature of positive AM in men and women and broadening our understanding

about how we remember good things about the past.

When the memories generated by men and women were compared,

women spontaneously remembered more communal memories than any other

kind of memory (agency or miscellaneous), and significantly more communal

memories than men. This finding is consistent with other research in the area

(Diehl, Owen, & Youngblade, 2004; Niedzwienska, 2003) that has found that

women are more communal than men and extend these results to include

positive autobiographical memories. Eagly and Steffen (1984) found that women

are believed to be more communal because of the perceived distribution of

gender roles into homemaker and employee, and that the role of homemaker is

more communal. Because homemaker/maternal tendencies are very communal

in nature, it is not surprising that the association of those tendencies would be

applied to the stereotype of women. Our results confirm that women are indeed

more communal.

     With regard to agency and contrary to initial hypotheses, men did not

generate more agentic memories than women. The finding that men and women

generated equal proportions of agentic memories differs from Diehl et al. (2004)

who did find that men are more agentic than women. The researchers

administered a self-representation task utilizing the Harter and Monsour (1992)

procedure for identifying agency and communion, and analyzed the agency and

communion codes with words from the Bem Sex Role Inventory (Bem, 1981). In

contrast, the results of the current study are similar to those from a more similar

paradigm (spontaneously generated AMs) that did not find gender differences

with regard to agency (Niedzwienska, 2003). It is possible that methodological

differences are at least partially responsible for this discrepancy. Future research

examining spontaneously generated AMs of both positive and negative valence

may help to determine whether the communal memory bias in females (and lack

of an agency bias for males) is true across a wide spectrum of human emotions.

After analyzing the ratings of the participants, the more conservative linear analysis identified four memory quality ratings that showed evidence of gender differences. Only one difference, that women were more likely to remember their memories in words, was statistically significant. This result is not surprising, given research that attests to the verbal superiority of women (see Kimura, 2002 for a review), especially if women are more fluent when it comes to retrieving emotional autobiographical memories (e.g., Fujita et al., 1991; Robinson 1976; Seidlitz & Diener, 1998). Overall differences in verbal fluency could understandably reduce the verbalizability of male memories. Furthermore, given that female memories were more communal that those of men, it is not surprising if females recalled events in which they were conversing or interacting with another person.

Logistic regression analyses confirmed that observed differences on certain ratings were able to predict gender with 88.1% accuracy and extended the findings of linear analyses. These results confirmed that women were more likely to remember a positive memory in words. In addition, nonlinear analysis revealed that women were more likely to travel back in time when remembering the event, were more likely to feel visceral and bodily tension when remembering, and were more likely to have thought or talked about the event since it happened. These findings will be discussed in turn below.

The finding that women were more likely to remember a positive event in words mirrors the results of the linear analysis. As discussed above, this is not surprising, given the fact that female AMs were more communal in nature and

that females are thought to have an overall verbal advantage over males. The

finding that women were more likely to have thought or talked about the event

since it happened might also be related to gender differences in verbal ability.

This finding also suggests that females may be more likely to use positive events

to regulate emotion. This possibility is worthy of future study and may have

significant clinical implications.

The result that women were more likely to go back in time when recalling

positive memories is intriguing. On one hand, this result is surprising, since this

ability to travel back in time, or reliving, could be related to spatial ability and the

ability to visualize (Daselaar et al., 2008), abilities that are thought to be superior

in males (Kimura, 2002). On the other hand, this feeling of reliving, or traveling

back in time, could be related to increased emotional processing on the part of

women. Emotional processing has also been shown to be enhanced during

reliving (e.g., Daselaar et al., 2008), therefore, this could account for why women

were more likely to report traveling back in time when remembering positive

events. Although this question is beyond the scope of the present study, future

studies should focus more attention on the reliving aspect of memory and how it

differs between men and women.

Another gender difference that emerged in both linear and nonlinear

analyses was that women were more likely to associate positive experiences with

visceral sensations; being more likely to feel tense all over, or experiencing gut

sensations while recalling memories. Men, on the other hand, tended to

associated physical sensations with sympathetic phenomena (i.e., "While

remembering the event, I feel sweaty or clammy"). This finding is interesting and worthy of future examination. One explanation could be that women, with more communal memories, are more receptive to subtle social and/or emotional cues that maximize the recruitment of a mirror-neuron mediated, insular system (see Keysers & Gazzola, 2007 for a review) that has been associated with both visceral sensations and the experience of empathy.

In contrast, the relatively large number of miscellaneous and agentic memories associated with male memories might be related with increased sympathetic activity associated with positive events. Another, more parsimonious explanation, could be that overall differences in physical activity levels lead to a greater likelihood that men remembered memories in which they were physically active. An alternative explanation might be that females may have been biased to deny feeling sweaty. Nevertheless, it is notable that the genders differed in terms of the physical sensations that they felt when remembering positive events. Future studies should further examine how men and women re-experience past events as memories, including both phenomenological and physiological differences.

In summary, we examined gender differences in the actual qualia of positive autobiographical memories. Whereas, previous research examined the sheer number of memories recalled, recall time, or other general aspects of AM (Davis, 1999; Fujita, Diener, & Sandvik, 1991; Robinson 1976; Seidlitz & Diener, 1998), this study is the first to analyze the emotional and episodic qualities of AMs with emphasis on gender differences. Women were more likely to associate

positive events with communal experiences than men, whereas men were equally likely to generate communal and agentic memories to positive cues. Furthermore, women were more likely to travel back in time when remembering the event, and associated the memory with visceral feelings. They were also more likely to have thought or talked about a positive event since its occurrence. Given that the generation of positive memories is of therapeutic utility, this research will help to guide future research in both AM and memory studies in general, as well as having clinical utility. Specifically, men may need more specific training in the use of positive memories to regulate emotions.

The present study has some limitations. First, replication is warranted. The current study is based on a relatively small sample (20 males and 22 females) of young undergraduate students, and may have produced results that would not be replicated a larger, more representative sample of the general population. In addition, the results reported here only apply to positive emotions and it is possible that negative emotions modulate AM processes differently in men and women. Future studies should include negative adjectives in order to gain insight into gender differences across a wider range of emotions.

In conclusion, females generated more communal memories than males in response to positive adjectives. In addition, women were more likely to report that these memories were verbal and were more likely to report traveling back in time when experiencing these memories and thinking about them since they happened. This study enhances the general knowledge of AM and its interaction with emotion and genders. When asked to remember positive life events,

women generate more memories that involve others, and experience them differently and more often than men. These behavior results converge with neuroimaging findings that suggest that there are qualitative differences in how the two genders process information, in particular the storage and experiencing of personal emotional memories.

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APPENDIX

Please write 2 to 3 sentences that describe your memory of the experience that

will help to remind you of that unique memory at a later time.

_____

_____

_____

1. While remembering the event, I feel like I am in it.

1	2	3	4	5	6	7
unclearly		clearly		as clearly as if it were happening now		not at all

2. While remembering the event, it comes to me in words or pictures as one big story or episode and not as one fact, picture, or scene.

1	2	3	4	5	6	7
not at all						completely

3. While remembering the event, I feel like I see it out of my own eyes instead of someone else's..

1	2	3	4	5	6	7
not at all						completely

4. My memory comes in pieces with missing bits.

1	2	3	4	5	6	7
not at all						completely

5. While remembering the event, I feel the exact same emotions I felt at the time of the event.

1	2	3	4	5	6	7
completely different						identically the same

6. While remembering the event, I feel the emotions as strongly as I did then.

1	2	3	4	5	6	7
not at all		a little bit		sort of		as clearly as if it were happening now

7. While remembering the event, the emotions are extremely positive.

1	2	3	4	5	6	7
not at all		a little bit		sort of		completely

8. While remembering the event, the emotions are extremely pleasant.

1	2	3	4	5	6	7
not at all		a little bit		sort of		completely

9. The emotions that I feel are extremely powerful.

1	2	3	4	5	6	7
not at all		a little bit		sort of		completely

10. While remembering the event, I feel my heart pound, or race.

1	2	3	4	5	6	7
not at all						more than for any other memory

11. While remembering the event, I feel sweaty or clammy.

1	2	3	4	5	6	7
not at all						more than for any other memory

12. While remembering the event, I feel tense all over or I feel knots, cramps, or butterflies in my stomach.

1	2	3	4	5	6	7
not at all						more than for any other memory

13. While remembering the event, I can see it in my mind.

1	2	3	4	5	6	7
unclearly		clearly		as clearly as if it were happening now		not at all

14. While remembering the event, I can hear it in my mind.

1	2	3	4	5	6	7
unclearly		clearly		as clearly as if it were happening now		not at all

15. While remembering the event, I know the place where it happened.

1	2	3	4	5	6	7
unclearly		clearly		as clearly as if it were happening now		not at all

16. While remembering the event, I feel that I travel back to the time when it happened.

1	2	3	4	5	6	7
not at all		unclearly		clearly		completely

17. My memory is based on details of my own personal experiences, not to what I would expect most people to know.

1	2	3	4	5	6	7
not at all		in some details		in some main points		completely

18. While remembering the event, it comes to me in words.

1	2	3	4	5	6	7
not at all		in some details		in some main points		completely

19. As I think about the event, I can actually remember it rather than just knowing that it happened.

1	2	3	4	5	6	7
not at all		in some details		in some main points		completely

20. Since the event happened, I have thought or talked about this event.

1	2	3	4	5	6	7
not at all		sometimes		many times		more than for any other memory

21. This memory has previously come to me "out of the blue," and I didn't have to try to think about it.

1	2	3	4	5	6	7
not at all		sometimes		many times		more than for any other memory

22. I believe the event in my memory really happened in the way I remember it and that I have not imagined or made up anything that didn't happen.

1	2	3	4	5	6	7
100% imaginary						100% real

23. How old are you in this memory? _____years old.

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I would also like to thank Sean Guillory for his help in recruiting participants.

List of Tables

Table 1. Model parameters defined by binary logistic regression and measures of

fit.

_____

Question	B[a]	Wald	p(Wald)[b]	Odds Ratio
9 The emotions I feel are				
extremely powerful	-2.42	5.24	.02*	.09
11 While remembering…,				
I feel sweaty or clammy	-2.86	3.99	.05*	.06
12 While remembering…,				
I feel tense all over…	4.15	6.24	.01*	63.31
16 While remembering…,				
I travel back in time…	1.07	3.42	.07	2.93
18 While remembering…,				
it comes to me in words	1.64	4.58	.03*	5.13
20 Since the event…, I have				
thought or talked about it…	2.10	3.14	.08	8.21

Note: [a] B represents the logit coefficient for the question; [b] p(Wald) represents the probability that the question is a significant predictor in the model (significance, $p < .05$), is marked by *)

Figure Captions

Figure 1. Proportions of responses that were categorized as predominately themed communion, agency, and miscellaneous for men as compared to women (* indicates significant gender differences, *p* < .05).

Figure 2. The mean ratings of males and females for A) Question 12 ("While remembering…, I feel tense all over"), B) Question 16 ("While remembering…, I travel back in time"), C) Question 20 ("Since the event…, I have thought or talked about it…"), and D) Question 18 ("While remembering…, it comes to me in words").