Aging & Mental Health

ISSN: 1360-7863 (Print) 1364-6915 (Online) Journal homepage: http://www.tandfonline.com/loi/camh20

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To cite this article: Angela Gutchess & Aysecan Boduroglu (2018): Cultural differences in categorical memory errors persist with age, Aging & Mental Health, DOI: 10.1080/13607863.2017.1421616

To link to this article: https://doi.org/10.1080/13607863.2017.1421616

AGING & MENTAL HEALTH, 2017
https://doi.org/10.1080/13607863.2017.1421616

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Cultural differences in categorical memory errors persist with age

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ABSTRACT

Objectives: This cross-sectional experiment examined the influence of aging on cross-cultural differences in memory errors. Previous research revealed that Americans committed more categorical memory errors than Turks; we tested whether the cognitive constraints associated with aging impacted the pattern of memory errors across cultures. Furthermore, older adults are vulnerable to memory errors for semantically-related information, and we assessed whether this tendency occurs across cultures.

Methods: Younger and older adults from the US and Turkey studied word pairs, with some pairs sharing a categorical relationship and some unrelated. Participants then completed a cued recall test, generating the word that was paired with the first. These responses were scored for correct responses or different types of errors, including categorical and semantic.

Results: The tendency for Americans to commit more categorical memory errors emerged for both younger and older adults. In addition, older adults across cultures committed more memory errors, and these were for semantically-related information (including both categorical and other types of semantic errors).

Conclusion: Heightened vulnerability to memory errors with age extends across cultural groups, and Americans' proneness to commit categorical memory errors occurs across ages. The findings indicate some robustness in the ways that age and culture influence memory errors.

ARTICLE HISTORY
Received 10 September 2017
Accepted 11 December 2017

KEYWORDS
Aging; culture; memory; categorization; cognition

Introduction

Marked differences in long-term memory occur with age, including heightened occurrence of memory errors. Older adults not only forget information (e.g. Balota, Dolan, & Duchek, 2000; Fandakova, Lindenberger, & Shing, 2015), but also mistakenly remember information not encountered previously (e.g. Balota et al., 1999; Koutstaal & Schacter, 1997; Schacter, Koutstaal, & Norman, 1997). Older adults are particularly prone to memory errors involving semantic aspects of information, including categorical information (Brainerd, Yang, Reyna, Howe, & Mills, 2008; Carmichael & Gutchess, 2016; Smith, Ward, Tindell, Sifonis, & Wilkenfeld, 2000).

Understanding factors that protect against memory errors are important to ensure accurate memory, especially with age. Recent work demonstrates that culture can impact proclivity to particular types of memory errors. American young adults commit more memory errors for categorical information than Turks, a culture representing a blend of East and West (Schwartz, Boduroglu, & Gutchess, 2014). This cultural difference in memory errors converges with a Western focus on categorization in how information is organized and the explanations provided for organizing information, compared to an Eastern emphasis on similarity and functional relationships (Chiu, 1972; Ji, Zhang, & Nisbett, 2004; Unsworth, Sears, & Pexman, 2005). Categories have been shown to aid memory recall organization (Bousfield, 1953). Older adults, however, differ across cultures in how much they rely on categories when recalling information, with American older adults using a categorical strategy more than Chinese older adults (Gutchess et al., 2006).

Investigating aging across cultures offers potential insights into risk and resiliency. In the present study, we investigate whether culture impacts the risk for false memories. It may be that older adults from some cultures are more prone to false memories for certain types of materials than others. Park and colleagues (Park & Gutchess, 2002, 2006; Park, Nisbett, & Hedden, 1999) proposed that how aging impacts cultural differences depends on the nature of processes. For automatic processes, cultural differences should be maintained or even exacerbated (due to more time in a culture) with age, as they reflect biases or information processing styles that do not draw heavily on cognitive resources. For effortful processes, cultures could converge or show differential rates of decline with age. Thus, if memory errors resulting from strategy preferences (e.g. categorical errors for Americans) reflect effortful process, then cultural differences in young would be predicted to be reduced with age. Alternatively, patterns of memory errors may reflect more automatic processes (e.g. guessing categorically-related words), in which case cultural differences in memory errors should be consistent with age. That is, Americans, regardless of age, should commit more memory errors for categorically-related information, extending prior findings (Schwartz et al., 2014) to older adults. Finally, it may be the case that strategies do little to mitigate the cognitive demands that elicit memory errors with age. In this case, one would predict high false memory rates for older adults, regardless of culture. This could indicate that older adults are universally prone to memory errors, providing some evidence that greater vulnerability to memory errors is a result of biological aging processes.

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Supplemental data for this article can be accessed at https://doi.org/10.1080/13607863.2017.1421616

The selectivity of memory errors with age is also of interest. In prior work with this paradigm, older adults were prone not only to higher rates of false memory for categorically-related information, but also for other types of semantic information (Carmichael & Gutchess, 2016). The present study will also allow us to test whether this pattern characterizes aging more generally, across cultures.

Thus, in this study we extend cross-cultural work with young adults (Schwartz et al., 2014) to older adults in the US and Turkey, testing whether Americans' increased proneness to categorical false memories extends to older adults. We also assessed whether the increased tendency to commit memory errors with age increases non-selectively across multiple kinds of information.

Methods

Participants

Thirty nine younger and 31 older Americans were recruited near Brandeis University, and 39 young and 20 older Turks were recruited near Boğaziçi Üniversitesi.[1] Table 1 presents demographic and neuropsychological scores.

Stimuli and procedures

Participants viewed 32 word pairs for four seconds each. Half of the word pairs were categorically related (e.g. minute–hour; cotton-wool; magazine-book) and half were unrelated (e.g. minute–chair), created by scrambling word pairs. Assignment of pairs to the related or unrelated condition was counterbalanced across participants. Word pairs were created from American and Turkish norms and presented in the participant's native language; see Schwartz et al. (2014) for more detail.

On the self-paced free recall test, participants saw the first paired word (e.g. minute; cotton; magazine) and completed the pair. Responses were scored separately for related and unrelated trials for correct responses and those left blank, though these were combined for errors as this factor was not of interest and to reduce the number of bins (see Schwartz et al., 2014). Errors could be a mispaired word from the original list or a participant-generated word. Errors were scored according to whether they were categorical (taxonomic) (e.g. second; linen; newspaper), other semantic (e.g. clock; shirt; page), non-semantic (e.g. a rhyming word), other list word, or unrelated. Additional details included in supplemental materials. To capture age differences, analyses were conducted on raw numbers of errors.

Results

Correct responses

Memory for correctly recalled items (see Table 2) was tested in a 2 × 2 × 2 mixed ANOVA, with culture (American/Turkish) and age (younger/older) as between participants variables and word pair type (related/unrelated) as a within participant variable. For culture effects, there was a significant interaction of culture x age, $F(1, 125) = 7.58$, $p = .007$, $\eta_p^2 = .06$.[2] Based on effect sizes, the age difference in memory was exaggerated for the Turks, $F(1, 57) = 62.71$, $p < .001$, $\eta_p^2 = .52$, compared to the Americans, $F(1, 68) = 13.30$, $p < .001$, $\eta_p^2 = .17$. There was a significant main effect of word pair type, $F(1, 125) = 566.00$, $p < .001$, $\eta_p^2 = .82$, such that related words ($M = 11.46$, SD = 3.58) were better remembered than unrelated words ($M = 5.12$, SD = 3.95), in addition to a significant main effect of age, $F(1, 125) = 63.19$, $p < .001$, $\eta_p^2 = .34$, with younger adults ($M = 9.83$, SD = 2.81) recalling more words than older adults ($M = 5.92$, SD = 2.97). There was also a significant age x word pair type interaction, $F(1, 125) = 7.61$, $p = .007$, $\eta_p^2 = .06$, reflecting a larger age difference for unrelated, $t(127) = 8.18$, $p < .001$, than related words, $t(127) = 5.27$, $p < .001$. None of the other main effects or interactions approached significance (all $\eta_p^2 < .015$).

Table 2. Number of items recalled, number of blanks, and number of errors of nonsemantic, other list, and unrelated errors (means and SDs), separated by related and unrelated trials.

	American		Turkish	
	Younger	Older	Younger	Older
Correct Related	12.08 (2.87)	10.48 (3.95)	13.28 (2.26)	8.20 (3.85)
Correct Unrelated	6.36 (3.57)	2.61 (3.06)	7.62 (3.47)	1.70 (1.59)
Blanks Related	1.87 (1.66)	1.06 (1.86)	1.51 (1.83)	3.10 (2.75)
Blanks Unrelated	4.95 (3.28)	3.77 (3.92)	5.59 (3.26)	6.75 (4.35)
Errors—Nonsemantic	.05 (.22)	.19 (.48)	.00 (.00)	.00 (.00)
Errors—Other list words	1.08 (1.29)	.97 (1.52)	1.10 (1.55)	.85 (1.23)
Errors—Unrelated	.31 (.52)	.97 (1.28)	.18 (.45)	.35 (.93)

Number of blanks

To examine whether culture differently influenced the number of blanks left by participants across age groups, we conducted a 2 × 2 × 2 mixed ANOVA, with culture (American/Turkish) and age (younger/older) as between participant variables and word pair type (related/unrelated) as a within participant variable. There was a significant culture x age interaction, $F(1, 125) = 6.47$, $p = .01$, $\eta_p^2 = .05$, such that for the culture difference was larger for older, $t(49) = 2.98$, $p = .004$, than younger adults, $t(76) = .28$, $p = .78$. There was a significant main effect of culture, $F(1, 125) = 8.11$, $p = .005$, $\eta_p^2 = .06$, with Turks ($M = 4.02$, SD = 2.66), leaving more blanks than Americans ($M = 2.97$, SD = 2.53), and a significant main effect of word pair type, $F(1, 125) = 172.23$, $p < .001$, $\eta_p^2 = .58$, with more blanks left for unrelated ($M = 5.13$, SD = 3.70) than related ($M = 1.76$, $SD = 2.04$) word pairs. The interaction of culture by word pair type was marginal, $F(1, 125) = 3.55$, $p = .06$, $\eta_p^2 = .03$. No other main effects or interactions approached significance (all $\eta_p^2 < .01$). See Table 2.

Table 1. Demographic and Neuropsychological Information (means and SDs).

	American		Turkish		
	Younger	Older	Younger	Older	Sig diff?
Age (years)	19.10 (1.05)	77.87 (7.05)	21.08 (1.91)	66.01 (4.19)	*^#
Gender	15 M, 24 F	12 M, 18 F, 1 N/A	11 M, 27 F, 1 other	10 M, 10 F	N/A
Pattern matching	36.26 (4.81)	26.52 (8.12)	33.31 (5.78)	13.25 (6.34)	*^#
MMSE	N/A	27.58 (2.86)	N/A	27.00 (1.75)	

Significant diff: * main effect of age, ^ main effect of culture, # interaction of age x culture

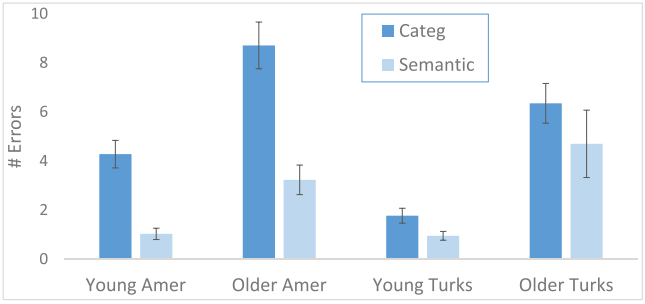

Figure 1. Number of memory errors, across culture and age groups.

Error types

We conducted a 2 × 2 × 2 ANOVA to assess the effects of culture (American/Turkish) and age (younger/older) on the occurrence of the error types of primary interest (categorical/other-semantic). We focused on categorical and semantic errors because these accounted for the majority of errors (see Table 2 for the other error types) and were in line with findings of cultural differences in categorical errors (Schwartz et al., 2014) and age differences in semantically-related errors (Carmichael & Gutchess, 2016). In addition to a main effect of error type, $F(1, 125) = 56.52$, $p < .001$, $\eta_p^2 = .31$, there were significant main effects of age, $F(1, 125) = 57.19$, $p < .001$, $\eta_p^2 = .31$ and a marginal main effect of culture, $F(1, 125) = 3.09$, $p = .08$, $\eta_p^2 = .02$. The means are displayed in Figure 1. Critically, there were significant interactions of age x error type, $F(1, 125) = 4.20$, $p = .04$, $\eta_p^2 = .03$, and culture x error type, $F(1, 125) = 17.68$, $p < .001$, $\eta_p^2 = .12$.[3] None of the other interactions approached significance, ps $\geq .35$ and $\eta_p^2 \leq .01$.

We conducted additional analyses to further understand the interactions with error type. The interaction of age x error type was reflected by the finding of a significant main effect of age on semantic errors, $F(1, 125) = 28.09$, $p < .001$, $\eta_p^2 = .18$, with older adults ($M = 3.80$, SD = 4.65) committing more errors than younger adults ($M = .99$, SD = 1.28). This age difference was restricted to semantic errors, as the interaction of culture by age was not significant for categorical errors, $F(1, 125) = .01$, $p = .91$, $\eta_p^2 = .00$.

Accounting for the interaction of culture x error type, there was a main effect of culture for categorical errors, $F(1, 125) = 13.14$, $p < .001$, $\eta_p^2 = .10$, with Americans ($M = 6.24$, $SD = 4.88$) making more errors than Turks ($M = 3.32$, $SD = 3.38$). The cultural difference only occurred for categorical errors, as the main effect of culture on semantic errors was not significant, $F(1, 125) = 1.55$, $p = .22$, $\eta_p^2 \leq .01$.

Discussion

This cross-sectional study substantiates and extends two prior false memory effects. First, cross-cultural differences in the tendency to commit categorical false memories extend across age groups. Even though older adults exhibit higher rates of false memory than younger adults, both younger and older Americans make more categorical memory errors than Turks (Schwartz et al., 2014).

Second, increases in false memory for semantically-related information with age (Carmichael & Gutchess, 2016) characterizes both Western and Eastern cultures. Notably, this increase in false memory is not limited to categorically-related information but also encompasses other types of semantically-related information. This adds to a rich literature substantiating robust memory errors with age by systematically demonstrating that this is true across cultures.

Taken together, the results across these two cultures suggest that aging is associated with an increased tendency to commit memory errors for semantically-related information. This finding suggests that cultural background per se may not offer protection against this vulnerability in memory. Based on study of these two cultures, we do not find evidence that culturally-specific ways of organizing information reduce the risk of heightened memory errors with age. Although study of additional varied cultures would be necessary to argue that memory errors are a universal byproduct of cognitive aging, the fact that Americans and Turks exhibit different patterns of errors in young adulthood yet aging in both cultures is associated with increased tendencies for semantically-related errors suggests that meaning-based memory errors are robust with age. Though note that there is some specificity in the types of memory errors across cultures, with Americans' greater vulnerability to categorical errors than Turks persisting in older adults.

In addition, the pattern of results may provide evidence that categories exert separable effects on accurate and erroneous memories, with culture failing to interact with the relatedness of word pairs in accurate memory. The results may also indicate that categories play a distinct role in errors in long-term vs. short-term memory, as prior work did not find age differences in short-term memory (Sapkota, van der Linde, & Pardhan, 2015).

One limitation is that the Turkish older adult sample is younger and poorer on pattern matching than American older adults. These sampling differences may affect performance on accurate trials, such that Turkish young adults remembered disproportionately more word pairs than older adults, compared to the magnitude of the Americans' age difference in memory, though these cultural differences could reflect strategy differences in the use of blanks. Critically, the patterns of memory errors with age are consistent across cultures despite potential sampling differences. The patterns of performance across age and cultural groups persist even when age and pattern matching are entered as covariates. This, combined with effect sizes approaching medium effects and the failure of interactions involving age and culture to reach significance, suggests that the patterns of errors are relatively impervious to these sampling differences. The selection of appropriate neuropsychological measures on which to compare cultures, particularly with age (e.g. Hedden et al., 2002), is an important endeavor for future work, but also poses challenges due to historical cultural differences in educational access and life expectancy.

In conclusion, increased memory errors for semantically-related information may be pervasive with age, consistent with prior work underscoring the confidence and prevalence with which people commit memory errors (e.g. Roediger & McDermott, 1995). Culture-specific memory strategies or ways of organizing information do not seem to offer protection against memory errors with age.

Notes

1. Younger adult (Schwartz et al., 2014) and American data (Carmichael & Gutchess, 2016) were published previously.
2. Results persist with pattern matching and actual age as covariates. See Supplementals.

3. Results persist with pattern matching and actual age as covariates. See Supplementals.

Acknowledgments

This material is based upon work supported by the National Science Foundation under grant number BCS-1147707 (A. Gutchess) and A. Boduroglu was supported by the BAGEP Award of the Science Academy. The authors gratefully acknowledge experimental assistance from Müge Özbek, Peter Millar, Işılay Konuk, Ryn Flaherty, and Anna Carmichael.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

This work was supported by the National Science Foundation [grant number BCS-1147707] and BAGEP Award of the Science Academy.

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