Running Head: MEMORABILITY FUNCTIONS

Memorability Functions in Verbal Memory: Longitudinal Analysis of Gender Performance

Lisa C. McGuire

Allegheny College

Sherry L. Willis and K. Warner Schaie

The Pennsylvania State University

Abstract

The purpose of the present investigation was to qualitatively analyze longitudinal age differences by gender in verbal memory performance using relative memorability analysis. Participants ($N = 875$; $n = 399$ males and $n = 476$ females) from the Seattle Longitudinal Study were divided into three age groups: middle-aged ($M = 39.91$; $n = 120$ males and $n = 132$ females); young-old ($M = 60.77$; $n = 222$ males and $n = 264$ females); and old-old ($M = 74.42$; $n = 80$ males and $n = 137$ females). The age group by gender analysis revealed qualitative differences in the developmental patterns of verbal memory for males and females.

Memorability Functions in Verbal Memory: Longitudinal Analysis of Gender Performance

List-learning performance has been shown to demonstrate the impact of aging and neurological dysfunction on memory performance (Buschke, 1984; Hultsch, 1975; Schmidt, Tombaugh, & Faulkner, 1992). on List-learning task performance is usually represented quantitatively as the number of words correctly remembered by each participant. This approach may not be sensitive to subtle qualitative changes in verbal memory performance (Stine & Wingfield, 1988), especially longitudinal changes in performance. Relative memorability analysis allows for qualitative changes in memory performance to be discerned.

In relative memorability analysis, the unit of analysis is the probability of recall for each to-be-remembered item (Rubin, 1985). In a list-learning task, the experimental unit is the probability of recall for each word on the word list and not the actual participants. In the present investigation, the probability of unit recall at Time 1 as a function of the probability of unit recall at Time 2 was examined by age group as a function of gender.

The memorability functions are interpreted based on the resulting slope values from the regression of probability of Time 1 units on probability of Time 2 units. A slope of 1.0 would suggest that at Time 1 and Time 2 each unit was recalled with identical probabilities. Slope greater than 1.0 indicates that at Time 2 participants were more likely to recall units with a high probability of recall at Time 1, but Time 2 recall would precipitously decline as memorability in Time 1 declined. On the other hand, a slope of less than 1.0 would suggest that at Time 2, high probability words from Time 1 would not likely be recalled. A slope greater than 1.0 suggest enhanced discriminability of Time 2 relative to Time 1, while a slope less than 1.0 suggest enhanced discriminability of Time 1 relative to Time 2.

Method

Participants

Participants in the present investigation were obtained from the 1984 and in the 1991 assessment sessions of the Seattle Longitudinal Study (Schaie, 1983, 1993, in Press). Participants ($N = 875$; $n = 399$ males and $n = 476$ females) were divided into three age groups according to their age at the first assessment session (1984). The middle-aged group ranged in age from 22 to 49 years old ($M = 39.91$, $SD = 6.74$, $n = 252$; $n = 120$ males and $n = 132$ females), the young-old group ranged in age from 50 to 70 years old ($M = 60.77$, $SD = 5.75$, $n = 486$; $n = 222$

males and $n = 264$ females), and the old-old group ranged in age from 71 to 86 years old ($M = 74.42$, $SD = 2.89$, $n = 137$; $n = 80$ males and $n = 137$ females). The age groups differed in their level of education, income, verbal ability, and speed ($p < 0.05$).

Materials and Procedure

Verbal Memory. Verbal memory is the ability to encode, store, and recall meaningful language units. Verbal memory was measured by an Immediate Recall test and a Delayed Recall test (Zelinski, Gilewski, & Schaie, 1993). Participants were administered the Immediate Recall and the Delayed Recall tests, consisting of the same list-learning task in 1984 and 1991. Participants studied a list of 20 concrete nouns for 3.5 minutes and then engaged in free recall. Immediate recall was assessed immediately following stimulus presentation and delayed recall was assessed after a 1 hour delay. The two-week test-retest correlation for the Immediate Recall task was .820 and .732 for the Delayed Recall task. The mean number of words recalled by participants on immediate recall as a function of age, gender, and occasion is shown in Table 1. The memorability functions include only immediate recall performance and the unit of analysis was the probability with which each word was recalled.

Results

Memorability functions were independently created for each age group as a function of gender by regressing the probability of correctly recalling each word in 1984 on the probability of word recall in 1991. Figure 1 illustrates the memorability functions for males, while Figure 2 demonstrates the memorability functions for females.

To examine differences in the memorability analyses, slope coefficients were examined. Slope coefficient and correlation coefficients for the memorability functions are shown Table 2. Significant gender differences in the slopes were found for middle-aged and old-old adults, with males having smaller slope coefficients than females suggesting that males were less likely in 1991 to recall high probability words from 1984 than females. The slope of young-old males was significantly larger than that of middle-aged males and also old-old males. Middle-aged males and old-old males were less likely in 1991 to recall high probability words from 1984 than young-old males. The slope for young-old males was close to 1.0 suggesting that words in 1984 and 1991 were recalled with equivalent probabilities. No other differences between slope coefficients were statistically significant.

Discussion

The impact of aging and neurological dysfunctioning on memory performance are demonstrated via list-learning performance (Buschke, 1984; Hultsch, 1975; Schmidt et al., 1992). Traditional quantitative analyses have examined the number of words correctly recalled suggesting that fewer words are recalled with increasing age. A different picture emerges when using the qualitative approach of relative memorability analysis. The results from this more sensitive approach provided a more complex view of the developmental trajectory of verbal memory. The young-old adults' slope for males was larger than that of middle-aged and old-old males as it was for the overall age group analysis. However, a different pattern emerged for females. The slope coefficients for middle-aged and young-old females were equivalent, but less than 1.0 indicating that in 1991 fewer high probability words were recalled from 1984. The slope coefficient for the old-old adults had the greatest magnitude, suggesting that in 1991 the likelihood of recalling higher probability words was similar to 1984. These results suggest that males and females could have qualitatively different developmental trajectories for verbal memory across the adult lifespan. For males, there could be age-related declines in middle-age followed by a period of stability in young-old adulthood and then declines in verbal memory performance in old-old adulthood. The pattern for females suggests that age-related changes beginning in middle-age through young-old and stabilizing in old-old adults.

References

Buschke, H. (1984) Cued recall in amnesia. *Journal of Clinical Neuropsychology, 6,* 433-440.

Hultsch, D. (1975). Adult age differences in retrieval: Trace-dependent and cue-dependent forgetting. *Developmental Psychology, 11,* 197-201.

Rubin, D.C. (1985). Memorability as a measure of processing: A unit analysis of prose and list learning. *Journal of Experimental Psychology: General, 114,* 213-238.

Aging, 8, 44-55.

Schaie, K.W. (1983). The Seattle Longitudinal Study: A 21-year exploration of psychometric intelligence in adulthood. In K.W. Schaie (Ed.), *Longitudinal studies of adult psychological development* (pp. 64-135). New York: Guilford.

Schaie, K.W. (1993). The Seattle Longitudinal Study: A thirty-five year inquiry of adult intellectual development. *Zeitschrift für Gerontologie, 26,* 126-137.

Schaie, K.W. (In Press). *Intellectual development in adulthood: The Seattle Longitudinal Study.* New York: Cambridge University Press.

Schmidt, J.P., Tombaugh, T.M., & Faulkner, P. (1992). Free-recall, cued-recall and recognition procedures with three verbal memory tests: Normative data from age 20 to 79. *The Clinical Neuropsychologist, 6,* 185-200.

Stine, E.A.L., & Wingfield, A. (1988). Memorability functions as an indicator of qualitative age differences in text recall. *Psychology and Aging, 3,* 179-183.

Zelinski, E.M., Gilewski, M.J., & Schaie, K.W. (1993). Individual differences in cross-sectional and 3-year longitudinal memory performance across the adult life span. *Psychology and Aging, 8,* 176-185.

Table 1

Sample Description as a Function of Age and Gender.

	Middle-Aged			Young-Old			Old-Old			Total
	Males	Females	Total	Males	Females	Total	Males	Females	Total	Total
n	120	132	252	222	264	486	57	80	137	875
Age	39.58 (6.13)	40.21 (6.87)	39.91 (6.74)	61.19 (5.42)	60.42 (5.78)	60.77 (5.63)	74.09 (2.89)	74.65 (3.07)	74.42 (2.99)	56.89 (13.10)
Education	16.02 (2.51)	15.09 (2.60)	15.54 (2.59)	15.21 (3.03)	14.17 (2.61)	14.65 (2.86)	13.32 (3.71)	13.80 (2.60)	13.59 (3.12)	14.74 (2.89)
1984 Recall	15.18 (3.29)	16.37 (3.30)	15.80 (3.35)	12.62 (3.54)	13.81 (3.72)	13.27 (3.68)	10.25 (3.38)	11.88 (3.14)	11.19 (3.33)	13.67 (3.85)
1991 Recall	15.67 (3.28)	16.65 (2.87)	16.19 (3.11)	12.18 (3.72)	13.61 (3.83)	12.95 (3.85)	9.21 (3.92)	10.71 (3.35)	10.09 (3.66)	13.44 (4.14)

Table 2

Slope Coefficients and Correlations for Memorability Functions by Age and Gender.

	B	r
Middle-Aged	.820[c]	.963
Males	.714[a d e]	.917
Females	.904[a]	.925
Young-Old	.957[c]	.976
Males	.987[d]	.972
Females	.901	.957
Old-Old	.897	.951
Males	.685[b e]	.808
Females	.939[b]	.942

Note:
Like superscripts indicate a statistically significant difference ($p < 0.05$)