

**AGE AND ITEM-RELATED  
INFLUENCES ON LIST  
LEARNING: RESULTS FROM  
A 3-COHORT SAMPLE  
FROM THE SEATTLE  
LONGITUDINAL STUDY.**

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## **Abstract**

252 middle-aged ( $M = 39.91$ ), 486 young-old ( $M = 60.77$ ), and 137 old-old ( $M = 74.42$ ) participants in the Seattle Longitudinal Study were tested on 2 occasions on their ability to memorize a 20-item word list.

Proportions of participants correctly recalling each word-unit within the list served as the dependent measure.

First, word-unit scores obtained in 1991 were regressed on those from 1984, yielding slope and intercept values that varied by age-group; these are discussed. Then, each set of word-unit scores (3 groups on 2 occasions) was regressed on measures of word familiarity, imageability, primacy, and recency. The relative influence of each of these variables on memorability was then compared, both between cohorts, and within cohorts over 2 occasions. Primacy and familiarity were consistently strong in their predictive capacity.

Imageability and recency were predictive of memorability in the middle-aged group, but less so in the young-old, and not at all in the old-old group. Results and possible implications are discussed.

## Introduction

- List learning performance has been shown to be related to aging, with older individuals performing more poorly than younger.
- The typical approach to studying list learning has been to examine the proportion of memory-set *items* correctly recalled by each individual in the sample.
- In this study, the proportion of *individuals* within particular age-groups correctly recalling each word served as the unit of analysis.
- This methodology enabled both cross-sectional and longitudinal analysis of qualitative differences in memory performance, and allowed us to explore potential explanations for observed differences.
- We were also able to explore potential gender differences, both longitudinally and cross-sectionally.

## Method

- Participants: were selected from the Seattle Longitudinal Study (SLS), and came from three age groups: Middle-aged (M = 40 yrs.; 52% female), Young-old (M = 61; 54% female), and Old-old (M = 74; 58% female).
- Mean years of education and vocabulary scores were lower among the young-old and lowest among the old-old.
- Materials: All participants received a large battery of pencil-and-paper psychometric tests at each of two testing occasions (1984 and 1991).
- This study is concerned only with performance on the Immediate Recall test, wherein a list of 20 nouns was presented for 3.5 minutes, and after it was removed from view, the task was to recall as many words from the list as possible.

- Design: Proportions of participants correctly recalling each of the 20 words on each occasion (1984, 1991) were calculated. Item scores (proportions) were then entered into regressions, with 1984 scores as the x variable and 1991 as the y.
- This approach enabled us to interpret the slopes and intercepts obtained when item scores for each of the three age groups were regressed.
- Psycholinguistic properties of the list words, expressed numerically, were also entered into regressions, in order to determine their relationship to the likelihood of recall in each age group at each timepoint.
- Gender effects within age groups were also assessed in a similar manner.

## Results

- Figure 1 depicts the longitudinal regression results for the three age groups. Points in the graphs represent individual words, with likelihood of recall in 1984 on the abscissa, and likelihood of recall in 1991 on the ordinate.
- Correlations between recall proportions for the two timepoints were strong. Particular words in the list were more difficult for young-old and old-old participants than they were for the middle-aged group.
- Figure 2 depicts a similar analysis, calculated for males and females, and collapsed over all three age-groups.
- No significant difference in slope or intercept was observed between genders, yet females had higher recall scores on average.

## **Results, continued**

- Table 1 presents the results of the series of regressions designed to tease out the sources of differences in word memorability, both within and between age groups.
- Primacy was a strong predictor for all age groups on all occasions.
- Familiarity was predictive of recall mainly among the young-old and somewhat for the old-old.
- Imageability and recency were predictive mainly for the middle-aged and young-old, but not for the old-old group.

## Discussion

- Cohort differences in memorability were observed, with highest mean scores obtained by middle-aged, followed by young-old, then old-old. Females consistently outperformed males.
- Over the 7-year course of the study, decline was observed only among the old-old.
- Middle-aged participants appeared to improve on the more difficult words, young-old remained stable, and old-old had greater difficulty with words that were easy on the first occasion.
- Regression results suggest that old-old participants relied less than others on word imageability and recency. Findings are in accord with other studies showing age-related decline in working memory, and supporting mnemonic imagery training as a means of improving list learning among elders.



Table 1

Sample Description as a Function of Age and Gender.

	Middle-Age		Young-Old		Old-Old		Total				
	Males	Females	Total	Males	Females	Total					
	Males	Females	Total	Males	Females	Total					
<u>n</u>	120	132	252	222	264	486	57	80	137	875	
Age (1984)	<u>M</u>	39.58	40.21	39.91	61.19	60.42	60.77	74.09	74.65	74.42	56.89
	<u>S.D.</u>	(6.13)	(6.87)	(6.74)	(5.42)	(5.78)	(5.63)	(2.89)	(3.07)	(2.99)	(13.10)
Education (in years)	<u>M</u>	16.02	15.09	15.54	15.21	14.17	14.65	13.32	13.80	13.59	14.74
	<u>S.D.</u>	(2.51)	(2.60)	(2.59)	(3.03)	(2.61)	(2.86)	(3.71)	(2.60)	(3.12)	(2.89)
ETS Vocabulary	<u>M</u>	52.14	52.24	52.19	50.80	50.68	50.74	46.28	47.03	46.72	50.52
	<u>S.D.</u>	(8.93)	(8.61)	(8.74)	(9.73)	(9.55)	(9.62)	(11.44)	(9.80)	(10.48)	(9.67)

Table 2

Word-unit Recall Proportions as a Function of Age, Gender, and Occasion.

	<u>df</u>	<u>F</u>
Age	2, 38	199.29***
Gender	1, 19	83.64***
Age x Gender	2, 38	1.66
Occasion	1, 19	8.82**
Occasion x Age	2, 38	15.08***
Occasion x Gender	1, 19	.01
Occasion x Age x Gender	2, 38	.44

\*\*  $p < .01$  \*\*\*  $p < .001$

Table 3

Mean Proportion of Words Recalled in 1984 and 1991 Trials as a Function of Age and Gender.

n	Middle-Age		Young-Old		Old-Old		Total
	Males	Females	Males	Females	Males	Females	
1984	.759	.819	.788	.690	.661	.594	.553
1991	.784	.833	.808	.681	.645	.538	.499
Total	.772	.826	.798	.686	.653	.566	.526

Table 4

Individual Word-unit Recall Probabilities in 1984 and 1991.

Group	Middle-age		Young-old		Old-old		Females		Males	
	1984	1991	1984	1991	1984	1991	1984	1991	1984	1991
□	252	1984	486	1984	137	1984	476	1984	399	1984
		1991	1991	1991	1991	1991	1991	1991	1991	1991
home	.929	.909	.889	.852	.869	.745	.895	.866	.900	.835
flag	.889	.937	.817	.776	.723	.664	.834	.834	.810	.769
bird	.873	.885	.706	.737	.693	.569	.775	.792	.724	.707
ocean	.897	.905	.739	.741	.620	.591	.775	.794	.754	.729
dirt	.861	.857	.776	.770	.774	.672	.817	.807	.779	.747
woman	.877	.873	.798	.815	.708	.730	.826	.832	.784	.802
exam	.683	.671	.461	.481	.401	.299	.521	.542	.509	.466
kettle	.869	.837	.739	.747	.657	.657	.796	.788	.724	.724
tank	.615	.710	.399	.389	.307	.301	.477	.494	.411	.436
painter	.750	.770	.584	.570	.431	.350	.626	.597	.586	.589
lemon	.786	.810	.650	.619	.518	.445	.737	.697	.586	.586
jury	.683	.746	.556	.588	.474	.343	.609	.626	.544	.559
star	.683	.710	.541	.518	.380	.365	.605	.601	.499	.489
money	.746	.754	.578	.576	.431	.489	.616	.611	.589	.617
alcohol	.734	.794	.673	.607	.555	.547	.706	.676	.632	.622
vest	.790	.790	.601	.535	.423	.358	.660	.607	.589	.549
iron	.758	.786	.636	.636	.431	.438	.662	.647	.612	.649
rattle	.627	.663	.506	.486	.365	.314	.563	.555	.466	.456
garden	.873	.873	.767	.702	.650	.562	.821	.773	.729	.677
church	.881	.913	.850	.815	.788	.672	.872	.836	.822	.802

Note: Words are listed in their order of presentation.

Table 5

Parameter Estimates and Correlations for Memorability Functions by Age and by Gender.

	Intercept	<u>B</u>	<u>r</u>
Middle-Age	.163 <sup>bc</sup>	.818 <sup>a</sup>	.954
Young-Old	.020 <sup>b</sup>	.947 <sup>a</sup>	.974
Old-Old	.015 <sup>c</sup>	.877	.942
Females	.053	.936	.982
Males	.035	.900	.979

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

Table 6

Correlations (Pearson's *r*) of Predictor Variables with Likelihood of Recall as a Function of Age-Group and Occasion.

	Middle-Age		Young-Old		Old-Old	
	1984	1991	1984	1991	1984	1991
Word Frequency <sup>1</sup>	.41	.38	.52*	.51*	.53*	.52*
Familiarity <sup>1</sup>	.47*	.43	.49*	.53*	.49*	.61**
Imageability <sup>1</sup>	.47*	.49*	.44	.40	.36	.41
Primacy <sup>2</sup>	.60**	.63**	.54*	.57**	.63**	.55*
Recency <sup>2</sup>	-.03	-.04	.04	-.06	-.10	-.14

<sup>1</sup> N = 19 due to unavailability of rating data on "exam" word-unit.

<sup>2</sup> N = 20.

\*  $p < .05$  \*\*  $p < .01$

Figure Captions

Figure 1. Memorability functions for middle-aged, young-old, and old-old groups.

Figure 2. Memorability functions for females and males.

Table 7

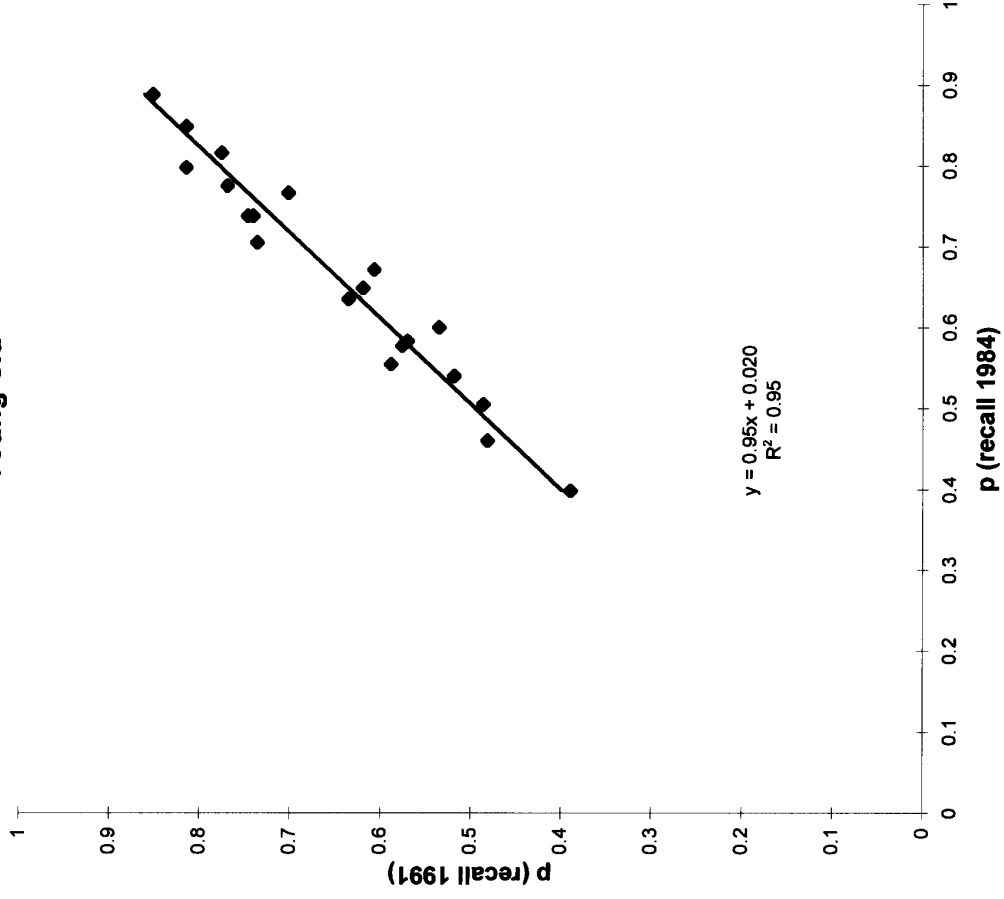
Standardized regression weights and associated t-values for variables potentially affecting recall.

Group	Occasion	Familiarity	Imageability	Primacy	Recency
Middle-Age	84 <u>B</u>	.34	.37	.63	.36
	t	1.98±	2.23*	3.93**	2.08±
	91 <u>B</u>	.26	.41	.67	.31
	t	1.50	2.59*	4.24***	1.83±
Young-Old	84 <u>B</u>	.42	.31	.56	.41
	t	2.23*	1.82±	3.27**	2.23*
	91 <u>B</u>	.43	.26	.57	.31
	t	2.42*	1.50	3.21**	1.66
Old-Old	84 <u>B</u>	.38	.23	.62	.28
	t	1.98±	1.29	3.53**	1.46
	91 <u>B</u>	.50	.23	.49	.22
	t	2.63*	1.30	2.81*	1.18
Females	<u>B</u>	.35	.36	.58	.31
	t	1.88±	2.08±	3.33**	.66
Males	<u>B</u>	.49	.22	.59	.35
	t	2.74*	1.31	3.59**	1.98±

\* p < .05      \*\* p < .01      \*\*\* p < .001      ± 0.05 - n / 10

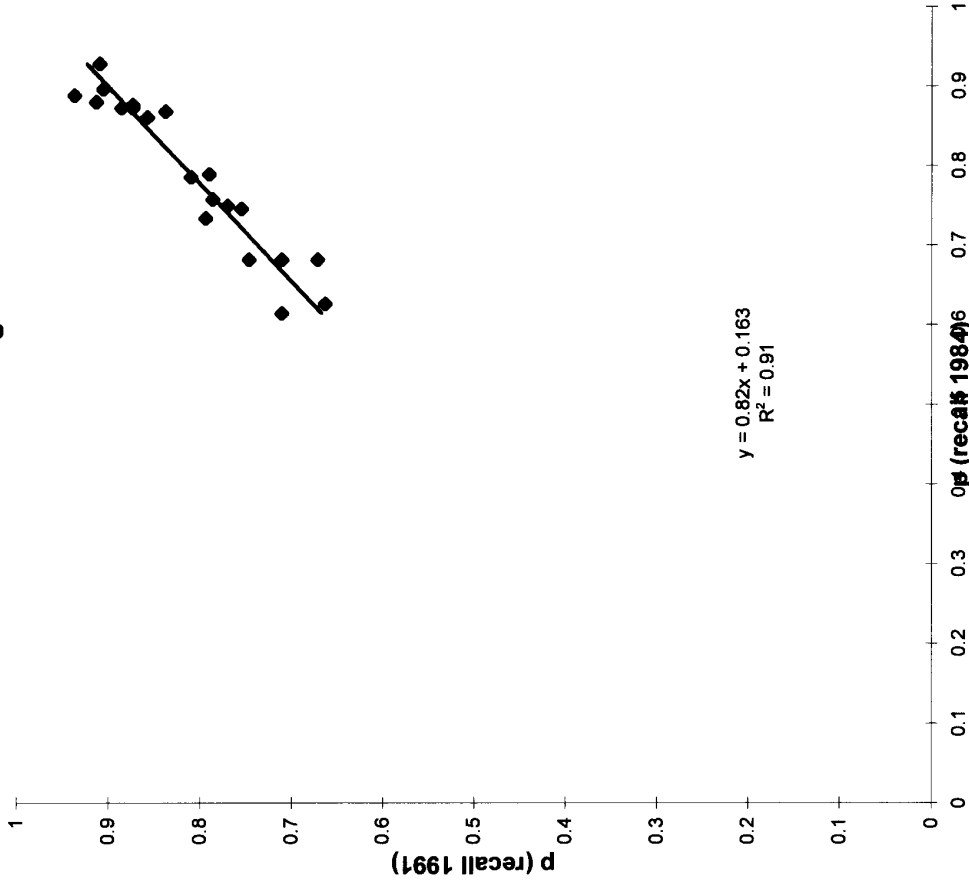
Sheet1 Chart 1

Young-old

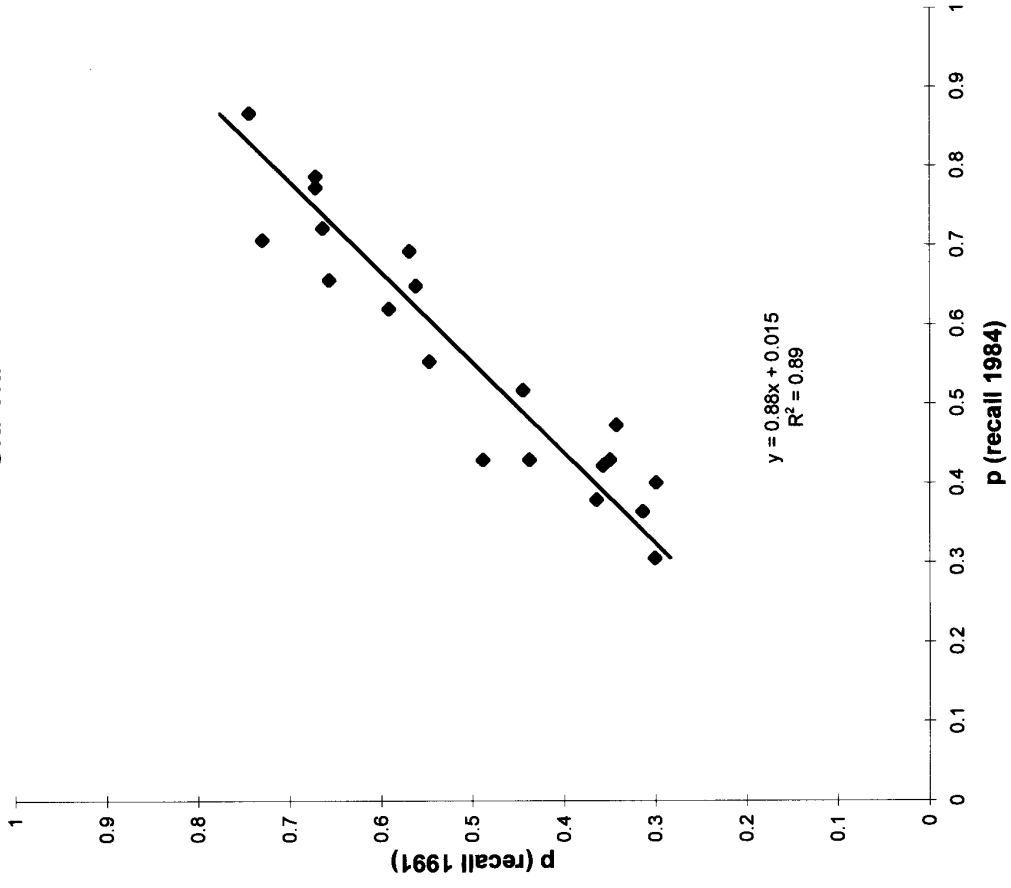




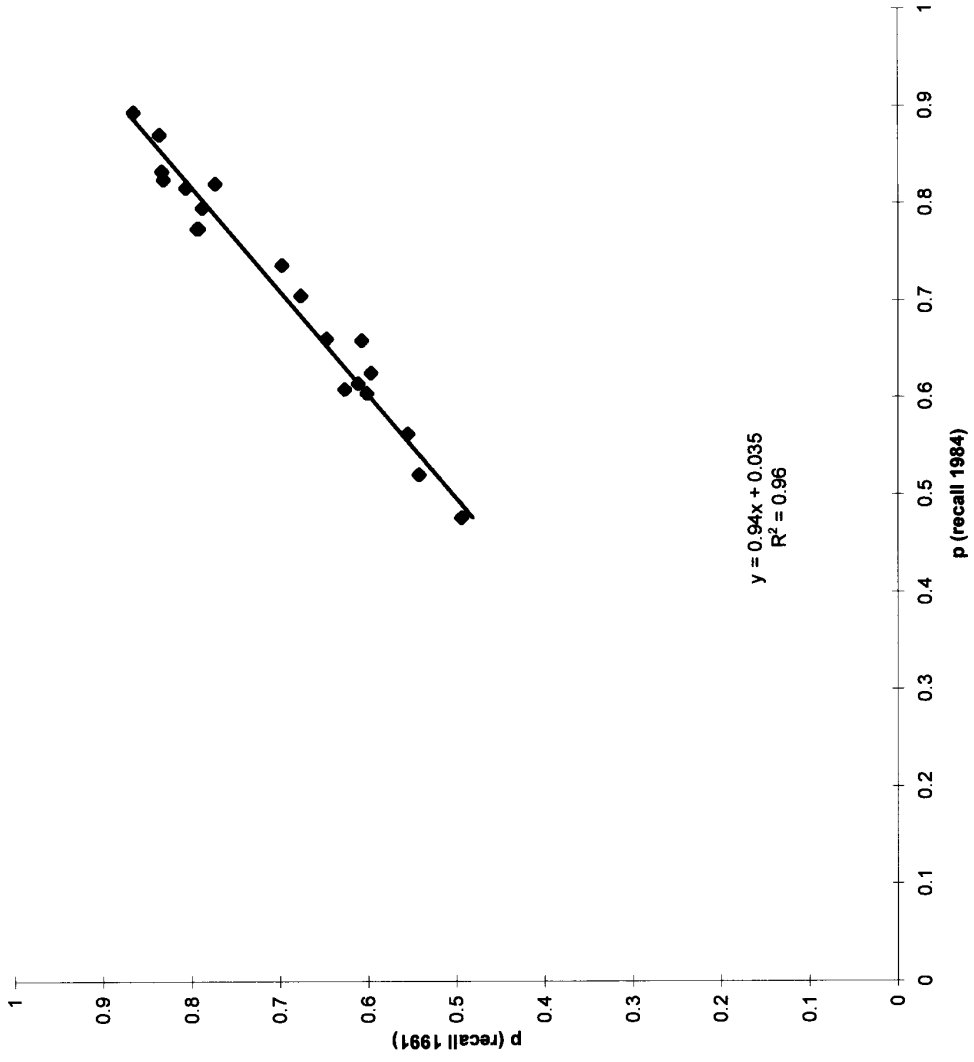
Middle-aged



Old-old



Females



Sheet1 Chart 2

Males

