

**Fachbereich Erziehungswissenschaften und Psychologie  
der Freien Universität Berlin**

**Aging and Emotional Memory:  
Evidence from a Heterogeneity-Homogeneity List  
Paradigm using Emotionally-Toned Words**

Dissertation  
zur Erlangung des akademischen Grades  
Doktor der Philosophie  
(Dr. phil.)

vorgelegt von  
Diplom-Psychologe  
Daniel Grünh

Gutachter:

Prof. Dr. Jacqui Smith, Max-Planck-Institut für Bildungsforschung, Berlin

Prof. Dr. Arthur M. Jacobs, Freie Universität, Berlin

Betreuer:

Prof. Dr. Paul B. Baltes, Max-Planck-Institut für Bildungsforschung, Berlin

Prof. Dr. Jacqui Smith, Max-Planck-Institut für Bildungsforschung, Berlin

DISPUTATION: BERLIN, 11. DEZEMBER 2006

*Selection is the very keel on which our mental ship is built. And in the case of memory its utility is obvious. If we remembered everything, we should on most occasions be as ill off as if we remembered nothing.*

William James, Principles of Psychology, 1890

---

**TABLE OF CONTENTS**

<b>LIST OF TABLES</b> .....	<b>V</b>
<b>LIST OF FIGURES</b> .....	<b>IX</b>
<b>ACKNOWLEDGMENTS</b> .....	<b>X</b>
<b>ABSTRACT</b> .....	<b>XI</b>
<b>ZUSAMMENFASSUNG</b> .....	<b>XIV</b>
<b>1. INTRODUCTION</b> .....	<b>1</b>
1.1 LIFESPAN PERSPECTIVES ON THE AGING MIND.....	2
1.1.1 The Bio-cultural Orchestration of the Aging Mind.....	2
1.1.2 Lifespan Perspectives on Memory.....	4
1.1.3 Social-cognitive Perspectives on Aging, Memory, and Emotion.....	5
1.2 MEMORY FOR EMOTIONALLY-TONED MATERIAL.....	8
1.2.1 Naturalistic Approaches to the Investigation of Emotional Memory.....	9
1.2.2 Experimental Approaches to the Investigation of Emotional Memory.....	11
1.3 MEMORY FOR POSITIVELY- AND NEGATIVELY-TONED MATERIAL.....	16
1.3.1 Differential Processing of Positive and Negative Information.....	17
1.3.2 Memory Differences for Positive and Negative Information?.....	20
<b>2. THEORETICAL CONSIDERATIONS</b> .....	<b>22</b>
2.1 AGE-RELATED DIFFERENCES IN EMOTIONAL MEMORY: EMPIRICAL FINDINGS FROM NATURALISTIC APPROACHES.....	22
2.1.1 Memory for Neutral versus Emotional Events.....	22
2.1.2 Memory for Positive versus Negative Events.....	25
2.1.3 Summary of Findings.....	26
2.2 AGE-RELATED DIFFERENCES IN EMOTIONAL MEMORY: EMPIRICAL FINDINGS FROM EXPERIMENTAL APPROACHES.....	27
2.2.1 Neutral versus Emotional Material.....	29
2.2.2 Positive versus Negative Material.....	31
2.2.3 Summary of Findings.....	43
2.2.4 Potential Reasons for Inconsistent Findings about the Positive- Negative Disparity.....	47
2.3 PROPOSALS FOR AGE-RELATED DIFFERENCES IN THE POSITIVE- NEGATIVE DISPARITY OF EMOTIONAL MEMORY.....	53
2.3.1 Attention and Processing Priority.....	54
2.3.2 Arousal.....	57
2.3.3 Emotion Regulation.....	58
2.3.4 Long-Term Consolidation.....	61
2.3.5 Mood-Congruent Memory and Mood-Dependent Retrieval.....	64
2.3.6 Summary.....	65
<b>3. OVERVIEW OF THE PRESENT STUDIES</b> .....	<b>67</b>
3.1 RATIONALE.....	68
3.2 HYPOTHESES.....	74
3.3 RESEARCH DESIGN.....	77
3.3.1 Preparatory Word Rating Study.....	77
3.3.2 Central Study: A Homogeneous-Heterogeneous List Paradigm.....	78

3.4	DATA ANALYSES.....	78
<b>4.</b>	<b>PREPARATORY WORD RATING STUDY.....</b>	<b>80</b>
4.1	METHOD.....	81
4.1.1	Participants.....	81
4.1.1.1	<i>Sample Size and Composition</i> .....	81
4.1.1.2	<i>Sociodemographic Characteristics</i> .....	81
4.1.1.3	<i>Intellectual Functioning and Self-Reported Well-Being</i> .....	81
4.1.2	Word Stimuli.....	84
4.1.2.1	<i>Database of Adjectives</i> .....	84
4.1.2.2	<i>Selection Process: Eight Control Criteria</i> .....	84
4.1.3	Rating Dimensions.....	86
4.1.4	Procedure.....	87
4.1.5	Data Analyses.....	87
4.2	RESULTS.....	88
4.2.1	Word Characteristics.....	88
4.2.1.1	<i>Marker Adjectives for Six Rating Dimensions</i> .....	88
4.2.1.2	<i>Correlations between Rating Dimensions</i> .....	90
4.2.1.3	<i>Correlations to Ratings of Previous Studies</i> .....	92
4.2.2	Age-Related Differences in Word Ratings.....	94
4.2.2.1	<i>Scatter Plots comparing Ratings of Young and Older Adults</i> .....	94
4.2.2.2	<i>Analyses of Variance for Word Ratings of Young and Older Adults</i> .....	96
4.2.3	Selection of an Item Pool for the Experiment.....	98
4.2.3.1	<i>Selection Procedure</i> .....	98
4.2.3.2	<i>Comparison of Negative, Neutral, and Positive Words</i> .....	101
4.2.3.3	<i>Age-Related Differences in the Final Item Pool</i> .....	103
4.3	DISCUSSION.....	105
4.3.1	The Generalizability of the Rating Data in the Word Rating Study.....	106
4.3.2	Age-Related Differences in the Evaluation of Emotionally-Toned Words.....	107
4.3.3	The Selection Process for the Final Item Pool.....	108
<b>5.</b>	<b>CENTRAL STUDY: A HOMOGENEOUS-HETEROGENEOUS LIST PARADIGM.....</b>	<b>112</b>
5.1	METHOD.....	112
5.1.1	Design of the Experiment.....	112
5.1.2	Material.....	114
5.1.2.1	<i>Computer and Software Program</i> .....	114
5.1.2.2	<i>List Compositions</i> .....	114
5.1.3	Word Covariates.....	117
5.1.4	Person Covariates.....	118
5.1.5	Participants.....	119
5.1.5.1	<i>Sample Size and Composition</i> .....	119
5.1.5.2	<i>Socio-Demographic Characteristics</i> .....	120
5.1.5.3	<i>Person Characteristics</i> .....	121
5.1.6	Procedure.....	124
5.1.6.1	<i>Procedure in Session I</i> .....	124
5.1.6.2	<i>Procedure in Session II</i> .....	125
5.1.7	Data Analyses.....	126

5.1.7.1	<i>Data Cleaning and Preparation</i> .....	126
5.1.7.2	<i>Statistical Analyses</i> .....	127
5.2.	<b>RESULTS</b> .....	128
5.2.1	Recall Performance in the Learning Phase.....	128
5.2.1.1	<i>Heterogeneous List Condition</i> .....	130
5.2.1.2	<i>Homogeneous List Condition</i> .....	133
5.2.1.3	<i>Summary</i> .....	134
5.2.2	Recall Performance in the Retention Phase.....	135
5.2.2.1	<i>Heterogeneous List Condition</i> .....	137
5.2.2.2	<i>Homogeneous List Condition</i> .....	139
5.2.2.3	<i>Summary</i> .....	141
5.2.3	Follow-up Analyses on Person Characteristics.....	142
5.2.3.1	<i>Correlations between Person Characteristics and Overall Recall</i> .....	143
5.2.3.2	<i>Person Characteristics as Covariates</i> .....	144
5.2.3.3	<i>Summary</i> .....	146
5.2.4	Follow-up Analyses on Output Order of Recall.....	147
5.2.4.1	<i>Analyses for the First Three Words Recalled</i> .....	148
5.2.4.2	<i>Summary</i> .....	149
5.2.5	Follow-up Analyses on Subjective Valence Categorization.....	149
5.2.5.1	<i>Subjective Valence Categories in the Learning Phase</i> .....	151
5.2.5.2	<i>Subjective Valence Categories in the Retention Phase</i> .....	152
5.2.5.3	<i>Summary</i> .....	154
5.2.6	Analyses on Word Sets across Conditions.....	154
5.2.6.1	<i>Word Sets in the Learning Phase</i> .....	155
5.2.6.2	<i>Word Sets in the Retention Phase</i> .....	156
5.2.6.3	<i>Summary</i> .....	157
5.2.7	Follow-up Analyses on Recallability.....	158
5.2.7.1	<i>Inter-Correlations for Ratings from the Word Rating Study and the Experiment</i> .....	159
5.2.7.2	<i>Recallability and Correlations to Word Characteristics</i> .....	160
5.2.7.3	<i>Differences between Age Groups and List Conditions in Recallability</i> .....	162
5.2.7.4	<i>Word Characteristics as Covariates</i> .....	164
5.2.7.5	<i>Summary</i> .....	165
6.	<b>GENERAL DISCUSSION</b> .....	168
6.1	<b>MAJOR FINDINGS</b> .....	168
6.1.1	Advantages of the Heterogeneity-Homogeneity List Paradigm.....	173
6.1.2	Advantages of the Multi-Trial Paradigm.....	174
6.1.3	Evidence for a Positivity Effect in Older Adults' Memory?.....	175
6.1.4	Evidence for Emotion-Based Processing Prioritization.....	176
6.1.5	Age-Related Differences in Differential Processing Prioritization.....	178
6.1.6	No Evidence for Differential Learning and Retention Effects for Positive, Negative, and Neutral Words.....	180
6.1.7	Implications of the Present Findings.....	181
6.2	<b>METHODOLOGICAL CAVEATS</b> .....	182
6.2.1	The To-Be-Remembered Material.....	182
6.2.2	Different Presentation Times for Young and Older Adults.....	184
6.3	<b>DIRECTIONS FOR FUTURE RESEARCH</b> .....	185
6.3.1	Variation of the Type of To-be-remembered Material.....	185
6.3.2	Variation of the Emotional-tone of the To-be-remembered Material.....	186

6.3.3	Variation of the Memory Task.....	187
6.3.4	Emotional Memory across the Lifespan.....	188
6.4	CONCLUSIONS.....	189
<b>7.</b>	<b>REFERENCES.....</b>	<b>190</b>
<b>8.</b>	<b>APPENDICES.....</b>	<b>A-1</b>
8.1	APPENDIX A: Design Features Of The Word Rating Study.....	A-1
8.2	APPENDIX B: Instructions for Rating Dimensions.....	A-7
8.2.1	Valence – Angenehmheit.....	A-7
	8.2.1.1 Main Instruction.....	A-7
	8.2.1.2 Rating Instruction.....	A-8
8.2.2	Arousal – Entspannung-Anspannung.....	A-8
	8.2.2.1 Main Instruction.....	A-8
	8.2.2.2 Rating Instruction.....	A-8
8.2.3	Control – Kontrolle.....	A-8
	8.2.3.1 Main Instruction.....	A-8
	8.2.3.2 Rating Instruction.....	A-9
8.2.4	Imagery – Bildhaftigkeit.....	A-9
	8.2.4.1 Main Instruction.....	A-9
	8.2.4.2 Rating Instruction.....	A-9
8.2.5	Self-Relevance – Im Allgemeinen bin ich.....	A-9
	8.2.5.1 Main Instruction.....	A-9
	8.2.5.2 Rating Instruction.....	A-10
8.2.6	Age-Relevance – Für welche Altersgruppe ist diese Eigenschaft typisch?.....	A-10
	8.2.6.1 Main Instruction.....	A-10
	8.2.6.2 Rating Instruction.....	A-10
8.2.7	Young-Stereotype – Was ist typisch für junge Erwachsene?.....	A-10
	8.2.7.1 Main Instruction.....	A-10
	8.2.7.2 Rating Instruction.....	A-11
8.2.8	Old-Stereotype – Was ist typisch für ältere Erwachsene?.....	A-11
	8.2.8.1 Main Instruction.....	A-11
	8.2.8.2 Rating Instruction.....	A-11
8.3	APPENDIX C: Word Characteristics in the Word Rating Study.....	A-12
8.4	APPENDIX D: Pilot Study.....	A-50
	8.4.1 Overview.....	A-50
	8.4.2 Method.....	A-50
	8.4.2.1 Participants.....	A-50
	8.4.2.2 Word Lists.....	A-50
	8.4.2.3 Procedure.....	A-51
	8.4.3 Results.....	A-52
8.5	APPENDIX E: Design Features of the Experiment.....	A-53
8.6	APPENDIX F: Additional Results in the Experiment.....	A-58
8.7	APPENDIX G: Word Characteristics in the Experiment.....	A-70

**CURRICULUM VITAE  
ERKLÄRUNG**

## LIST OF TABLES

Table 1	<i>Summary of Findings for Age Differences in Remembering Emotionally-toned Material</i> .....	28
Table 2	<i>Sample Characteristics of Experimental Studies</i> .....	45
Table 3	<i>Overview of Research Predictions</i> .....	75
Table 4	<i>Socio-Demographic Characteristics of the Total Sample and for Subsamples of Young and Older Adults</i> .....	82
Table 5	<i>Sample Characteristics for Subsamples of Young and Older Adults in the Word Rating Study</i> .....	83
Table 6	<i>Adjectives at the Bipolar Ends of each Dimension</i> .....	89
Table 7	<i>Correlations between Word Characteristics in the Word Rating Study for all Words and for the Final Item Pool</i> .....	90
Table 8	<i>Correlations between Ratings from the Word Rating Study and from Previous Studies</i> .....	93
Table 9	<i>Final Selection of Words for the Experiment</i> .....	100
Table 10	<i>Word Ratings of the Final Item Pool (90 Words) by Valence Category</i> .....	102
Table 11	<i>Analyses of Variance for the Final Item Pool by Valence Category</i> .....	102
Table 12	<i>Word Ratings of the Final Item Pool (90 Words) by Age Group and Valence</i> .....	104
Table 13	<i>Analyses of Variance for the Final Item Pool (90 Words) by Age Group and Valence</i> .....	104
Table 14	<i>Sample Design of the Experiment</i> .....	113
Table 15	<i>Characteristics of the Six Word List Compositions</i> .....	115
Table 16	<i>Socio-Demographic Characteristics of the Total Sample and for Subsamples of Young and Older Adults</i> .....	121
Table 17	<i>Person Characteristics for Subsamples of Young and Older Adults in the Experiment</i> .....	123
Table 18	<i>Overview of Main Phases in the Procedure of the Experiment</i> .....	126
Table 19	<i>Overall Recall Performance for Young and Older Adults in the Learning Phase</i> .....	129
Table 20	<i>Recall Performance in the Learning Phase by List Condition (Heterogeneous and Homogeneous), Age Group, Valence Category (Negative, Positive, Neutral), and Trial</i> .....	131
Table 21	<i>Overall Recall Performance for Young and Older Adults in the Retention Phase</i> .....	137
Table 22	<i>Mean Recall Performance in the Retention Phase by List Condition, Age Group, and Valence</i> .....	138
Table 23	<i>Correlations between Person Characteristics and Recall Performance in the Learning Phase (Trials 1-5) and Retention Phase (1-Hour and 1-Week Recall) for Young and Older Adults</i> .....	144
Table 24	<i>Changes in Effect Sizes by Entering Covariates into the Main Analyses of the Learning Phase</i> .....	146

Table 25	<i>Mean Recall of Negative (N), Positive (P), and Neutral Words (O) in the First Three Recalled Items of Young and Older Adults in the Emotion-Heterogeneous Condition</i> .....	149
Table 26	<i>Agreement between the A Priori Valence Categorization and the Subjective Valence Categorization in the Emotion-Heterogeneous List Condition</i> .....	151
Table 27	<i>Percent of Recalled Words within Subjectively Generated Valence Categories in the Heterogeneous List Condition for Young and Older Adults</i> .....	152
Table 28	<i>Correlations between Ratings from the Word Ratings Study and from the Experiment</i> .....	160
Table 29	<i>Correlations between Recallability Scores and Other Word Characteristics</i> .....	162
Table 30	<i>Recallability in the Learning Phase by List Condition, Age Group, and Valence Category</i> .....	163
Table 31	<i>Effect Sizes by Entering Word Covariates in the Analyses of Word Recallability in the Learning Phase</i> .....	166
Table 32	<i>Overview of Central Research Predictions and Main Findings</i> .....	172

## APPENDIX A

Table A1	<i>Previous Studies that Reported Rating Data for Adjectives</i> .....	A-2
Table A2	<i>Sample Characteristics in the Word Rating Study by Age Group and Sex</i> .....	A-3
Table A3	<i>Analyses of Variance for Sample Characteristics in the Word Rating Study by Age Group and Sex</i> .....	A-3
Table A4	<i>Adjectives in the Word Rating Study</i> .....	A-4
Table A5	<i>Sample Design in the Word Rating Study</i> .....	A-6

## APPENDIX C

Table C1	<i>Overall Means (SD) in the Word Rating Study</i> .....	A-13
Table C2	<i>Ratings of Valence in the Word Rating Study by Age Group and Sex</i> .....	A-18
Table C3	<i>Ratings of Arousal in the Word Rating Study by Age Group and Sex</i> .....	A-23
Table C4	<i>Ratings of Control in the Word Rating Study by Age Group and Sex</i> .....	A-28
Table C5	<i>Ratings of Imagery in the Word Rating Study by Age Group and Sex</i> .....	A-33
Table C6	<i>Ratings of Self-Relevance in the Word Rating Study by Age Group and Sex</i> .....	A-38
Table C7	<i>Ratings of Age-Relevance in the Word Rating Study by Age Group and Sex</i> .....	A-43

## APPENDIX E

Table E1	<i>Word Characteristics by Word Sets</i> .....	A-54
Table E2	<i>Psychometric Properties of Affect, Well-Being, and Personality Scales</i> .....	A-54



Table E3	<i>Person Characteristics in the Experiment by Age Group and Sex</i> .....	A-55
Table E4	<i>Analyses of Variance for Person Characteristics in the Experiment</i> .....	A-56

**APPENDIX F**

Table F1	<i>Descriptive Statistics for Overall Recall Performance of Young and Older Adults</i> .....	A-60
Table F2	<i>Intercorrelation Matrix in Recall Performance in Young and Older Adults</i> .....	A-60
Table F3	<i>Analyses of Variance for Overall Recall Performance in the Learning Phase</i> .....	A-61
Table F4	<i>Multivariate Tests of Homogeneity (Box's M) in the Learning Phase</i> .....	A-61
Table F5	<i>Univariate Tests of Homogeneity (Levene's Test) in the Learning Phase</i> .....	A-61
Table F6	<i>Analyses of Variance for the Heterogeneous and Homogeneous List Condition in the Learning Phase</i> .....	A-62
Table F7	<i>Follow-up Comparisons between Valence Categories for the Heterogeneous and Homogeneous List Condition in the Learning Phase</i> .....	A-62
Table F8	<i>Analyses of Variance for Overall Recall Performance in the Retention Interval</i> .....	A-63
Table F9	<i>Mean Recall Performance for each Trial in the Retention Phase by List Condition, Age Group, and Valence</i> .....	A-63
Table F10	<i>Analyses of Variance for Mean Recall Performance in the Heterogeneous and Homogeneous List Condition within the Retention Phase</i> .....	A-64
Table F11	<i>Follow-up Comparisons for Mean Recall Performance between Valence Categories in the Heterogeneous and Homogeneous List Condition within the Retention Phase</i> .....	A-64
Table F12	<i>Correlation Matrix for Person Characteristics used in the Analyses of Covariance</i> .....	A-65
Table F13	<i>Analyses of Variance for Mean Recall of the First Three and First Five Items Recalled in the Emotion-Heterogeneous List Condition</i> .....	A-65
Table F14	<i>Follow-up Comparisons between Valence Categories in the Mean Recall of the First Three Items Recalled in the Emotion-Heterogeneous List Condition</i> .....	A-66
Table F15	<i>Analyses of Variance for Percent of Recalled Words within Subjective Valence Categories (SV)</i> .....	A-66
Table F16	<i>Follow-up Comparisons for Percent of Recalled Words within Subjective Valence Categories (SV) in the Learning and Retention Phase</i> .....	A-66
Table F17	<i>Means for 10-Word Sets by Trial, List Condition, and Age Group in the Learning Phase</i> .....	A-67
Table F18	<i>Means for 10-Word Sets by Trial, List Condition, and Age Group in the Retention Phase</i> .....	A-67

Table F19	<i>Word Ratings by List Condition, Age Group, and Valence</i> .....	A-68
Table F20	<i>Analyses of Variance for Word Ratings in the Heterogeneous and Homogeneous List Context (L) by Age Group (A) and Valence (V)</i> .....	A-68
Table F21	<i>Analyses of Variance for Recallability of Positive, Negative, and Neutral Words in the Learning Phase, the 1-Hour and 1-Week Recall</i> .....	A-68
Table F22	<i>Follow-up Comparisons for Recallability of Positive, Negative, and Neutral Words in the Learning Phase, the 1-Hour and 1-Week Recall</i> .....	A-69
Table F23	<i>Mean Recallability by List Conditions, Age Group, Valence Category, and Retention Interval</i> .....	A-69

## APPENDIX G

Table G1	<i>Overall Means (SD) in the Experiment</i> .....	A-71
Table G2	<i>Ratings of Valence in the Experiment by Age Group and Condition</i> .....	A-73
Table G3	<i>Ratings of Arousal in the Experiment by Age Group and Condition</i> .....	A-75
Table G4	<i>Ratings of Young-Stereotype in the Experiment by Age Group and Condition</i> .....	A-77
Table G5	<i>Ratings of Old-Stereotype in the Experiment by Age Group and Condition</i> .....	A-79
Table G6	<i>Ratings of Self-Relevance in the Experiment by Age Group and Condition</i> .....	A-81
Table G7	<i>Recallability of Negative Words by Age Group and List Condition</i> .....	A-83
Table G8	<i>Recallability of Neutral Words by Age Group and List Condition</i> .....	A-84
Table G9	<i>Recallability of Positive Words by Age Group and List Condition</i> .....	A-85

## LIST OF FIGURES

Figure 1	<i>Scatter Plots between Young and Older Adults for Each Rating Dimension</i> .....	95
Figure 2	<i>Design for the List Presentation and the Free Recall Trials in the Learning Phase and in the Retention Phase</i> .....	112
Figure 3	<i>List Composition in the Heterogeneous and Homogeneous List Conditions</i> .....	116
Figure 4	<i>Mean recall as a function of list condition, age group, and learning trial (1-5)</i> .....	130
Figure 5	<i>Valence-specific recall as a function of list condition</i> .....	131
Figure 6	<i>Mean recall for the emotion-heterogeneous list condition for young and older adults in the retention phase as a function of valence</i> .....	137
Figure 7	<i>Mean recall for the emotion-homogeneous list condition for young and older adults in the retention phase as a function of valence</i> .....	139
Figure 8	<i>Mean recall percentages for a priori valence categories (left part) and subjective valence categories (right part) as a function of age group and retention interval</i> .....	152
Figure 9	<i>Recall discrepancy scores for young and older adults for the same 10-item sets of negative, positive, and neutral words presented in the homogeneous and heterogeneous list contexts</i> .....	155
Figure 10	<i>Recall discrepancy scores for young and older adults in the learning phase and in both retention intervals</i> .....	156

## APPENDICES

Figure C1	<i>Scatter Matrix between Dimensions for all Words in the Word Rating Study</i> .....	A-48
Figure C2	<i>Distribution of Word Frequency Classes</i> .....	A-49
Figure C3	<i>Distribution of Word Lengths</i> .....	A-49
Figure E1	List Sequences.....	A-57