USE OF THESES

This copy is supplied for purposes of private study and research only. Passages from the thesis may not be copied or closely paraphrased without the written consent of the author.
THE PROCESS OF REMEMBERING PICTURES

Jean Elizabeth Bird

A thesis submitted in partial fulfilment
of the requirements for the degree of
Doctor of Philosophy
of the Australian National University

May, 1976
This thesis describes original research carried out by the author during the tenure of a Commonwealth Postgraduate Research Award in the Department of Psychology of the Australian National University from February, 1973, to May, 1976.

J.E. BIRD
ACKNOWLEDGEMENTS

I am very grateful to the many people who have contributed their time and efforts to this research. My supervisor for the project, Dr. Michael L. Cock, has been invaluable in providing new ideas and thoughtful criticisms of the work as it has progressed. His constant interest, and the painstaking care with which he helped me to produce a finished version of the manuscript, are very much appreciated.

I also wish to thank the other postgraduate students and members of the technical and academic staff in the Department of Psychology who have given valuable suggestions and technical assistance in designing experimental apparatus, typing response sheets and proofreading the manuscript. The constructive suggestions made by Ms Norma Chin for the presentation and typing of the thesis deserve special commendation.

Finally, I am indebted to the undergraduate students in the Department of Psychology at the Australian National University who volunteered for my experiments, since without their participation this research could not have been possible.
CONTENTS

ACKNOWLEDGEMENTS iii
LIST OF TABLES viii
LIST OF FIGURES xi
ABSTRACT xiii

CHAPTER ONE. PROBLEMS IN STUDYING MEMORY FOR PICTURES 1

1.1 The Narrow Scope of Present Conceptualizations of Memory 1
1.2 Models of Memory Based on Data from Nonverbal Studies: Their Problems 2
1.3 The Choice of Stimuli 5
1.4 Past and Present Directions in the Study of Memory for Pictures 9
1.4.1 The Verbal Loop Hypothesis 11
1.4.2 The Effects of Verbal Encoding on Memory for Pictures 14

CHAPTER TWO. MEASURING MEMORY FOR PICTURES 29

2.1 Reproduction of Pictures by Drawing 30
2.1.1 Early Studies 30
2.1.2 A Further Examination of the Reproduction Method 35
2.1.3 Later Uses of the Method of Reproduction 43
2.2 Other Methods of Reproducing Pictures 46
2.3 The Use of Words to Recall Pictures 47
2.4 Recognizing Pictures 50
2.4.1 Studies Demonstrating High Recognition Capacity 51
2.4.2 The Influence of the Distractor Set on Recognition of Pictures 56
2.4.3 Conclusion 71
2.5 The Choice of a Method for Measuring Memory for Pictures 73
2.5.1 Recognition versus Recall  73
2.5.2 The Exclusion Set Method  76

CHAPTER THREE. LONG-TERM CHANGES IN MEMORY FOR PICTURES  81
3.1 Introduction  81
3.2 Experiment 1: Effects of Delay on Recognition  83
   3.2.1 Method  83
   3.2.2 Results  90
   3.2.3 Discussion  97
3.3 Conclusion  103

CHAPTER FOUR. INTENTIONAL AND INCIDENTAL INSTRUCTION IN RECOGNITION MEMORY FOR PICTURES  105
4.1 Effect of Instructions on Recognition and Recall  106
   4.1.1 Studies of Intentional and Incidental Memory  106
   4.1.2 The Orienting Task  107
   4.1.3 Instructional Effects on Memory for Pictures  110
   4.1.4 The Present Approach  111
4.2 Experiment 2: The Manipulation of Instructions  112
   4.2.1 Method  112
   4.2.2 Results  115
   4.2.3 Discussion  123

CHAPTER FIVE. A COMPARISON OF ORIENTING TASK INSTRUCTIONS WITH STANDARD MEMORY INSTRUCTIONS IN RECOGNITION OF PICTURES  129
5.1 Introduction  129
5.2 Experiment 3: Effect of Instructions to Remember on Recognition of Pictures  132
   5.2.1 Method  132
   5.2.2 Results  138
5.3 General Discussion of Experiments 2 and 3  150
   5.3.1 Effects of Instructions on Memory for Pictures  150
   5.3.2 The Orienting Task: A Useful Independent Variable?  153
   5.3.3 The Exclusion Set Paradigm: Experiment 3  155
   5.3.4 Conclusion  157
CHAPTER SIX. THE INFLUENCE OF TEMPORAL PARAMETERS ON MEMORY FOR PARTS OF PICTURES AND THEIR COMBINATIONS

6.1 The Fragmented Memory Effect
   6.1.1 A Preliminary Study of Confusions in Recognition of Pictures
   6.1.2 Theoretical Implications

6.2 Temporal Parameters in Recognition Memory for Pictures

6.3 Hypotheses

CHAPTER SEVEN. INVESTIGATION OF TEMPORAL PARAMETERS IN RECOGNITION OF PICTURES

7.1 The Method for Testing Recognition of Parts and Wholes

7.2 Overview of the Experiments

7.3 Experiment 4: A Study of Effects of Rapid Presentation Times and ISI's on Recognition Memory
   7.3.1 Method
   7.3.2 Results
   7.3.3 Discussion

7.4 Experiment 5: The Effect of Lengthening Presentation Time on Recognition of Shapes
   7.4.1 Method
   7.4.2 Results
   7.4.3 Discussion

7.5 Experiment 6: The Effect of Lengthening ISI on Recognition of Shapes
   7.5.1 Method
   7.5.2 Results
   7.5.3 Discussion

7.6 Experiment 7: A Replication of Experiment 4
   7.6.1 Method
   7.6.2 Results
   7.6.3 Discussion

7.7 General Discussion
   7.7.1 Memory for Whole Pictures
   7.7.2 Partial Memory
   7.7.3 Conclusion
CHAPTER EIGHT. EFFECTS OF PERCEPTUAL STRATEGY ON RECOGNITION OF SHAPES

8.1 A Change in Stimuli to Examine the Fragmented Memory Effect and the Generality of Findings of Chapter Seven

8.2 Experiment 8: Effects of Perceptual Strategy on Recognition of Parts and Wholes of Shapes

8.2.1 Method
8.2.2 Results
8.2.3 Discussion

CHAPTER NINE. SUMMARY AND CONCLUDING REMARKS

9.1 Summary of Findings

9.1.1 Experiment 1: The Capacity of Memory for Pictures
9.1.2 Experiments 2 and 3: Effects of Intentional and Incidental Instructions on Memory for Pictures
9.1.3 Experiments 4 to 7: Effects of Temporal Parameters on Memory for Shapes
9.1.4 Experiment 8: Effects of Perceptual Strategy on Recognition Memory

9.2 Concluding Remarks

9.2.1 Implications for a Theory of Memory
9.2.2 Recognition Methodology: Future Directions

REFERENCES

APPENDIX 1
APPENDIX 2
APPENDIX 3
APPENDIX 4
APPENDIX 5
APPENDIX 6
LIST OF TABLES

1. Estimates of the capacity of memory for pictures in the recognition studies reviewed. 63

2. Means and standard deviations of exclusion set scores for each delay condition and each picture: Experiment 1. 91

3. Summary of the analysis of variance: Experiment 1. 94

4. The frequencies of incorrect rejections of the prototype for each delay group in Phase One and Phase Two testing. 94

5. Frequencies of responses to questions asked in the post-recognition interview: Experiment 1. 96

6. Means and standard deviations of exclusion set scores for each group: Experiment 2. 116

7. Means and standard deviations of the frequencies of correct and incorrect responses for particular confidence ratings: Experiment 2. 117

8. Means and standard deviations of hit rates for each picture in each instructional condition: Experiment 2. 118

9. Summary of analysis of variance: Experiment 2. 118

10. Means and standard deviations of arcsin P(A) and bias scores for all groups: Experiment 2. 121

11. Frequencies of responses to questions about intention to remember and rehearsal: Experiment 2. 122

12. Means and standard deviations of exclusion set scores for each instructional group: Experiment 3. 139


14. Means and standard deviations of hit rate scores for each instructional group: Experiment 3. 141

15. Summary of the analysis of variance of hit rate scores: Experiment 3. 142

16. Frequencies of responses to the post-recognition questionnaire: Experiment 3. 144
17. Possible contents of memory implied by a choice of each recognition item.

18. Means and standard deviations of proportions of responses to all items in the test sets, TP and CCP scores for each experimental group in Experiment 4.


21. Means and standard deviations of confidence ratings of insides (I), outsides (O) and wholes (W) for each item type in each experimental group in Experiment 4.

22. Means and standard deviations of recognition scores in each experimental group in Experiment 5.

23. Means and standard deviations of confidence ratings for insides (I), outsides (O) and wholes (W) of all response types in each experimental group in Experiment 5.

24. Means and standard deviations of all recognition scores in each experimental group in Experiment 6.

25. Means and standard deviations of oo scores for each group on the first and second distractor set: Experiment 6.

26. Means and standard deviations of confidence ratings for insides (I), outsides (O) and wholes (W) of each test item for each condition in Experiment 6.

27. Means and standard deviations of all response scores for each experimental group in Experiment 7.


30. Means and standard deviations of proportions of oo and oo' scores for first and second test sets in each experimental group in Experiment 7.

31. Means, frequencies and standard deviations of confidence ratings for insides (I), outsides (O) and wholes (W) of each response type for each experimental group in Experiment 7.

32. Means and standard deviations of proportions of responses to each item in the test sets, TP scores and CCP scores in each experimental group in Experiment 8.
33. Means, frequencies and standard deviations of confidence ratings for test items in each condition in Experiment 8.

A1. Means and standard deviations of exclusion set scores for each picture, in each instructional group in Experiment 3.

A2. Means and standard deviations of correct rejection scores for all pictures in each instructional group in Experiment 3.


A4. Means and standard deviations of hit rate scores for all pictures in each instructional group in Experiment 3.

A5. Means and standard deviations of circles counted in each orienting task group, for each picture, in Experiment 3.

A6. Means (and standard deviations) of confidence ratings for each prototype and its five variations in each instructional group in Experiment 3.

A7. Means, standard deviations and frequencies of confidence ratings for each item in the test set averaged over all pictures, for each position in the list and each instructional group in Experiment 3.
LIST OF FIGURES

1. Examples of stimuli used in the preliminary study of reproduction with subjects' drawings from memory. 38

2. An example of a prototype picture (Picture 2, Experiment 1) and its first (V1), second (V2) and fifteenth (V15) distractor variations. 78

3. Recognition accuracy (exclusion set size) as a function of delay in Experiment 1. 92

4. Mean exclusion set scores at each delay period tested for each of the four stimulus pictures (Experiment 1). 93

5. The confusion matrix. 119

6. Noise-signal distributions for left items (A) and right items (B). 120

7. The test set for Picture 3 in Experiment 3. 134

8. Confidence ratings for each item in the test sets, for all items regardless of their position in the list and for the first item in each list, for each group in Experiment 3. 147

9. Confidence ratings for each item in the test sets for each position in the list, for each group in Experiment 3. 149

10. Three test pictures used in the preliminary study of confusions between pictures. 162

11. A stimulus set of three shapes and the two recognition sets which were used to test memory for the first two stimuli (Experiment 5). 180

12. Percentages of: (A) both oo and oo' (including oo'') responses, and (B) both on (including oo'n) and no (including no') responses, for all experimental groups in Experiments 5, 6 and 7. 226

13. A stimulus set of three shapes, and the two recognition sets which were used to test memory for the first two stimuli, from Experiment 8. 237
14. Percentages of: (A) both oo and oo' (including o'o) responses, and (B) both on (including o'n) and no (including no') responses, for both experimental groups given 0.5 seconds of presentation time (PT) and inter-stimulus interval (ISI) in Experiments 4 and 7, and for the Figure-Ground (F-G) and Doughnut (D) groups in Experiment 8.
ABSTRACT

Eight experiments were carried out to investigate processes involved in remembering pictorial stimuli. Because of difficulties encountered in measuring memory for this kind of material, previous investigations in the area (reviewed in Chapters One and Two) have not successfully estimated the capacity of memory for pictures or specified the nature of its encoding processes. A new recognition paradigm, the exclusion set method, was developed in order to measure the accuracy of the subject's memory for representational drawings. It was used to refute two hypotheses: (1) that memory for pictures has a phenomenally high capacity (Experiment 1), and (2) that encoding of pictures is an automatic process (Experiments 2 and 3). Another method of recognition testing was then devised to examine the constructive nature of the encoding process in more detail, in a study of memory for abstract shapes (Experiments 4 to 8).

Experiment 1 tested subjects' memory for pictures after delays of one, two, seven and 60 days. There was evidence that memory is limited in capacity, since subjects were not accurate on the recognition task. Memory declined after one week's delay and again after two months.

To determine whether the elaboration of subjects' encoding strategies affects memory for pictures, intentional and incidental instructions were manipulated in Experiments 2 and 3. Three instructional groups were tested in each experiment: (1) an Incidental group not told of the memory task and instead given a picture-classification orienting task, (2) a Control group given the orienting task but told about the memory requirement, and (3) an Intentional group allowed to view the pictures freely without an orienting task. In Experiment 2, no differences between any of the groups was found, suggesting that despite subjects' different encoding strategies, all had encoded the same amount of information from the pictures. In Experiment 3, the Intentional group was altered to include a practice trial for this group only.
Intentional subjects given practice recognized more pictures than Incidental or Control subjects. This showed that different encoding activities carried out during presentation of a list of pictures can be variable and under the subject's control, rather than an automatic registration of information into memory.

Since encoding did appear to be a function of the subject's encoding activities, it was hypothesized that recognition would be affected by the amount of time subjects were given to process each picture. In particular, it was predicted that temporal variables would affect subjects' tendency to encode only parts of a stimulus without adequately encoding their combinations. The presence of inter-picture confusions in previous studies suggested that a "fragmented memory effect" is a common outcome of subjects' inadequate encoding activities. Experiment 4 found no effect of longer presentation time or ISI on recognition of shapes, but the fragmented memory effect was demonstrated empirically. The methodology of this experiment was improved and it was found that five seconds of presentation time led to more accurate recognition than two seconds (Experiment 5), though increasing the ISI from 1.5 to seven seconds had no effect (Experiment 6), and that subjects given two seconds of either presentation time or ISI performed more accurately than subjects 0.5 seconds (Experiment 7). Presentation time was found to be more beneficial than ISI, given the same total time. Thus, memory for whole shapes improved with longer presentation times and also with longer ISI's of short duration. A final experiment (Experiment 8) was carried out to see whether the fragmented memory effect could be altered, during fast presentation of pictures, with different perceptual strategies. Strategies altered the attention to different parts of the shapes but did not affect fragmented memory. The encoding process was discussed as a sequence of acts of attention to parts of pictures followed by an integration which is not always successful.