



Swansea University
Prifysgol Abertawe



Swansea University E-Theses

Retrieval-induced forgetting and judgements in impression formation.

Fernandes, Marcelle

How to cite:

Fernandes, Marcelle (2011) *Retrieval-induced forgetting and judgements in impression formation..* thesis, Swansea University.

<http://cronfa.swan.ac.uk/Record/cronfa42462>

Use policy:

This item is brought to you by Swansea University. Any person downloading material is agreeing to abide by the terms of the repository licence: copies of full text items may be used or reproduced in any format or medium, without prior permission for personal research or study, educational or non-commercial purposes only. The copyright for any work remains with the original author unless otherwise specified. The full-text must not be sold in any format or medium without the formal permission of the copyright holder. Permission for multiple reproductions should be obtained from the original author.

Authors are personally responsible for adhering to copyright and publisher restrictions when uploading content to the repository.

Please link to the metadata record in the Swansea University repository, Cronfa (link given in the citation reference above.)

<http://www.swansea.ac.uk/library/researchsupport/ris-support/>

**Retrieval-induced Forgetting and Judgements in
Impression Formation**

Marcelle Fernandes

Submitted to the University of Wales in fulfilment of the requirements for the Degree
of Doctor of Philosophy (PhD)

Swansea University

April 2011

Supervisor: Dr. Jo Saunders

**School of Human and Health Sciences
Ysgol y Gwyddorau Dynol a Iechyd**


Swansea University
Prifysgol Abertawe

ProQuest Number: 10798170

All rights reserved

INFORMATION TO ALL USERS

The quality of this reproduction is dependent upon the quality of the copy submitted.

In the unlikely event that the author did not send a complete manuscript and there are missing pages, these will be noted. Also, if material had to be removed, a note will indicate the deletion.



ProQuest 10798170

Published by ProQuest LLC (2018). Copyright of the Dissertation is held by the Author.

All rights reserved.

This work is protected against unauthorized copying under Title 17, United States Code
Microform Edition © ProQuest LLC.

ProQuest LLC.
789 East Eisenhower Parkway
P.O. Box 1346
Ann Arbor, MI 48106 – 1346

SUMMARY (Abstract)

Selective retrieval impairs retrieval of related unwanted information, an effect known as retrieval-induced forgetting (Anderson, Bjork & Bjork, 1994). Previous research has indicated that person memory is subject to retrieval-induced forgetting while metacognitive judgements of likeability are not influenced by the effect (Storm, Bjork & Bjork, 2005). This finding is consistent with research on 'on-line' judgements, which suggest that there is little or no relationship between memory content and impression judgements (Hastie & Park, 1986). The present thesis presents five experiments that further explore the relationship between availability of information in memory, via retrieval-induced forgetting of valenced personality traits, and honesty judgement ratings. In Experiment 1 retrieval-induced forgetting was found for positive and negative traits. In Experiments 2A and 2B retrieval-induced forgetting was found for negative traits relating to female and male targets rated as honest or dishonest. Experiment 3 demonstrated no retrieval-induced forgetting effects for positive or negative traits associated with perceived honest and dishonest target professionals. In Experiment 4, an independent cue method was used to measure the presence of inhibitory processes in the retrieval practice paradigm. No retrieval-induced forgetting effect was found indicating the presence of non-inhibitory processes. In Experiments 5A-5D, participants first studied neutral and positive (Experiments 5A and 5C), and neutral and negative (Experiments 5B and 5D), traits about a target. A behavioural task was administered either prior to the final recall phase (Experiment 5A and 5B) or after the recall phase (Experiments 5C and 5D). Although all four experiments demonstrated significant retrieval-induced forgetting of positive and negative trait information on the recall task, there was a retrieval-induced forgetting effect on the behavioural task when it was administered before the recall phase and a rebound effect on the behavioural task when it was administered after the recall phase. Results from the present thesis also demonstrate that while overall findings suggest that retrieval-induced forgetting of valenced information does occur, it does not significantly influence the affective impression of that person. These results are discussed in terms of the literature on metacognitive judgements and the relationship between memory and social judgements.

Declaration and Statements

Declaration

This work has not been previously accepted in substance for any degree and is not concurrently submitted in candidature for any degree.

Signed **Marcelle Fernandes**

Date **18th April 2011**

Statement 1

This thesis is the result of my own investigations, except where otherwise stated. Where correction services have been used, the extent and nature of the correction is clearly marked in a footnote(s)

Other sources are acknowledged by footnotes giving explicit references. A bibliography is appended.

Signed **Marcelle Fernandes**

Date **18th April 2011**

Statement 2

I hereby give consent for my thesis, if accepted, to be available for photocopying and for inter library loan, and for the title and summary to be made available to outside organizations.

Signed **Marcelle Fernandes**

Date **18th April 2011**

TABLE OF CONTENTS

Acknowledgements.....	xi
Research publications and conference presentations.....	xii
List of tables and figures.....	xiv
Chapter 1: Retrieval-induced forgetting: Its nature, underlying processes & scope	1
1.1. Introduction.....	1
1.2. Strength-dependent competition models of interference.....	2
1.2.1. Paired-associate paradigm.....	3
1.2.2. Retroactive interference.....	4
1.2.3. Part-set cuing.....	6
1.2.4. Output interference.....	8
1.3. Inhibitory account of interference.....	9
1.3.1. Directed forgetting.....	10
1.3.2. The importance of the process of retrieval.....	13
1.4. Retrieval-induced forgetting.....	15
1.4.1. Adaptiveness of retrieval-induced forgetting.....	17
1.5. Inhibitory processes in retrieval-induced forgetting.....	18
1.5.1. Inhibition.....	18
1.5.2. Retrieval-specific nature of inhibitory theories.....	22
1.5.3. Cue-independence / Independent probe method.....	24
1.5.4. Cross-category impairment.....	34
1.5.5. Recognition and implicit tests of memory.....	37
1.5.6. Inhibitory models.....	42
1.6. Possible boundary conditions of retrieval-induced forgetting.....	49
1.6.1. Integration.....	49
1.6.2. Similarity.....	50
1.6.3. Durability.....	50
1.7. Alternative explanations of retrieval-induced forgetting.....	54
1.7.1. Strategy disruption model.....	54
1.7.2. Transfer-appropriate or context-specific forgetting.....	55
1.7.3. Control of spreading activation model.....	57

1.8. Role of emotion in retrieval-induced forgetting.....	63
1.9. Overview of the neural correlates of retrieval-induced forgetting.....	65
1.10. Generality of retrieval-induced forgetting.....	68
1.10.1. Unusual test materials.....	69
1.10.2. Developmental studies.....	70
1.10.3. Clinical populations.....	73
1.10.4. Drug and anxiety arousal.....	75
1.10.5. Autobiographical content.....	76
1.10.6. Eyewitness scenarios.....	77
1.10.7. Person memory.....	80
1.11. Conclusions from retrieval-induced forgetting.....	83
Chapter 2: Judgements & impression formation.....	85
2.1. The Anchoring and Adjustment Heuristic.....	86
2.1.1. Meaning and scope.....	86
2.1.2. Underlying mechanisms.....	87
2.1.3. Factors affecting the anchoring effect.....	90
2.2. Memory and impression judgements.....	93
2.2.1. Theoretical information processing models.....	94
2.2.2. Memory-based versus on-line judgement tasks.....	97
2.3. Metacognitive judgements.....	107
2.3.1. Definitions and meaning of metacognition.....	108
2.3.2. Main types of metacognitive judgements.....	110
2.3.3. Bases of metacognitive judgements.....	111
2.4. Judgements of honesty.....	120
2.5. Main aim of the thesis.....	124
Chapter 3: Retrieval-induced forgetting and impression formation.....	126
3.1. Experiment 1 – Introduction.....	126
3.2. Experiment 1 – Method.....	131
3.3. Experiment 1 – Results.....	134
3.3.1. Experiment 1 – Results: Recall performance.....	134
3.3.2. Experiment 1 – Results: Impression ratings.....	141
3.4. Experiment 1 – Discussion.....	145

Chapter 4: Adaptive nature of retrieval-induced forgetting in remembering others	148
4.1. Experiments 2A and 2B – Introduction.....	148
4.2. Experiment 2A – Method.....	152
4.3. Experiment 2A – Results.....	155
4.3.1. Experiment 2A – Results: Recall performance.....	155
4.3.2. Experiment 2A – Results: Impression ratings.....	160
4.4. Experiment 2B – Method.....	165
4.5. Experiment 2B – Results.....	166
4.5.1. Experiment 2B – Results: Recall performance.....	166
4.5.2. Experiment 2B – Results: Impression ratings.....	171
4.6. Experiments 2A and 2B – Discussion.....	174
Chapter 5: Retrieval-induced forgetting and judgements associated with people in professions.....	179
5.1. Experiment 3 – Introduction.....	179
5.2. Experiment 3 – Method.....	182
5.3. Experiment 3 – Results.....	184
5.3.1. Experiment 3 – Results: Recall performance.....	184
5.3.2. Experiment 3 – Results: Impression ratings.....	191
5.4. Experiment 3 – Discussion.....	200
Chapter 6: Non-inhibitory processes in retrieval-induced forgetting.....	204
6.1. Experiment 4 – Introduction.....	204
6.2. Experiment 4 – Method.....	206
6.3. Experiment 4 – Results.....	209
6.3.1. Experiment 4 – Results: Recall performance.....	209
6.3.2. Experiment 4 – Results: Impression ratings.....	211
6.4. Experiment 4 – Discussion.....	215
Chapter 7: The behavioural consequences of retrieval-induced forgetting.....	218
7.1. Experiments 5A and 5B – Introduction.....	218
7.2. Experiment 5A – Method.....	220
7.3. Experiment 5A – Results.....	223
7.5.1. Experiment 5A – Results: Recall performance.....	223
7.5.2. Experiment 5A – Results: Impression ratings.....	225

7.4. Experiment 5B – Method.....	228
7.5. Experiment 5B – Results.....	229
7.5.1. Experiment 5B – Results: Recall performance.....	229
7.5.2. Experiment 5B – Results: Impression ratings.....	231
7.6. Experiments 5A and 5B – Discussion.....	234
7.7. Experiments 5C and 5D – Rationale.....	235
7.8. Experiment 5C – Method.....	239
7.9. Experiment 5C – Results.....	239
7.9.1. Experiment 5C – Results: Recall performance.....	239
7.9.2. Experiment 5C – Results: Impression ratings.....	241
7.10. Experiment 5D – Method.....	243
7.11. Experiment 5D – Results.....	243
7.11.1. Experiment 5D – Results: Recall performance.....	243
7.11.2. Experiment 5D – Results: Impression ratings.....	245
7.12. Experiments 5C and 5D – Discussion.....	247
Chapter 8: General Discussion.....	252
8.1. Introduction and main findings.....	252
8.2. Retrieval as a memory modifier.....	257
8.3. Output interference at final recall.....	259
8.4. Forgetting of valenced material.....	261
8.5. Competing theories.....	262
8.6. Behavioural or implicit tests of retrieval-induced forgetting.....	270
8.7. Judgements in impression formation.....	272
8.8. Conclusions.....	276
References.....	277
Appendices.....	313

ACKNOWLEDGEMENTS

I would like to express my deepest and most sincere gratitude to my supervisor, Dr. Jo Saunders, without whom the completion of this thesis would have still been a dream. Her knowledge, expertise, constant guidance and unfailing support have been invaluable over the past four years. I would also like to sincerely thank Prof. Phil Reed, Dr. Catherine Fritz, Dr. Irene Reppa, Gemma Reynolds and Shakeila Davies for taking precious time out of their busy schedules to help and guide me with my suggested thesis revisions. I would like to thank my family, especially my mother, Emilia Fernandes, for continuously believing in me, praying for me and encouraging me every step of the way. This journey has been a memorable one and I could not have arrived at this destination without the help and support of all my colleagues and friends. I would like to specially thank my dearest friends, Ting Wang and Scott Greenlees, who have not only helped me with statistics and proofreading, but have also shared in all my joys and have never left my side in times of sorrow. Last, but not the least, I would like to thank the Psychology Department at Swansea University and the Higher Education Funding Council of Wales for providing me with the funds to pursue my doctoral studies.

RESEARCH

Journal Publications:

- **Fernandes, M.**; Saunders, J. (submitted). Retrieval-induced forgetting and metacognitive judgements of honesty in person memory. *Acta Psychologica*.
- Saunders, J., **Fernandes, M.** & Kosnes, L. (2009). Retrieval-induced forgetting and mental imagery. *Memory & Cognition*, 37, 819 – 828.

Conferences:

- **Fernandes, M.**; Saunders, J. (2010). Rebound Effects of Retrieval-induced forgetting. *Paper presented at the British Psychological Society Conference, Stratford upon Avon, U.K., April 2010.*
- **Fernandes, M.**; Saunders, J. (2010). Rebound Effects of Retrieval-induced forgetting. *Poster presented at the Society for Personality and Social Psychology Conference, Las Vegas, Nevada, U.S.A., January, 2010.*
- **Fernandes, M.**; Saunders, J. (2009). Rebound Effects of Retrieval-induced forgetting. *Poster presented at the British Psychological Society Cognitive Psychology Section Conference, Hertfordshire U.K., September 2009.*
- **Fernandes, M.**; Saunders, J. (2009). Retrieval-induced forgetting and Impression Formation. *Poster presented at Society for Applied Research in Memory and Cognition, Kyoto, Japan, July 2009.*

- **Fernandes, M.** (2009). Retrieval-Induced Forgetting and Impression Formation. *Poster presented at the British Psychological Society Annual Conference, Holiday Inn, Brighton, UK, April 2009*
- **Fernandes, M. & Saunders, J** (2007).). Imagination and Retrieval-Induced Forgetting. *Paper presented at Society for Applied Research in Memory and Cognition, Lewiston (ME), U.S., July 2007.*
- **Saunders, J., Williams, S., Fernandes, M. & Hooper, N.** (2007). Retrieval-induced forgetting or Verbal Overshadowing: Examining memory for smells. *Poster presented at Society for Applied Research in Memory and Cognition, Lewiston (ME), U.S., July 2007.*
- **Fernandes, M.** (2007). Imagination and Retrieval-Induced Forgetting. *Paper presented at the British Psychological Society Welsh Branch Annual Student Conference, Swansea, UK, March 2007*

LIST OF TABLES AND FIGURES

Tables

- Page 135 Table 1. Experiment 1 – Mean correct trait-recall proportions (and standard errors) in relation to trait valence, item type and target gender on the initial recall test.
- Page 137 Table 2. Experiment 1 – Mean correct trait-recall proportions (and standard errors) in relation to trait valence, item type and target gender on the final recall test.
- Page 142 Table 3. Experiment 1 – Means (and standard errors) of honesty ratings in relation to target gender, trait valence and item type obtained pre and post retrieval practice.
- Page 156 Table 4. Experiment 2A – Mean correct trait-recall proportions (and standard errors) in relation to item type and target honesty on the initial recall test.
- Page 158 Table 5. Experiment 2A – Mean correct trait-recall proportions (and standard errors) in relation to item type and target honesty on the final recall test.
- Page 161 Table 6. Experiment 2A – Means (and standard errors) of honesty ratings in relation to item type and target honesty obtained pre and post retrieval practice.
- Page 167 Table 7. Experiment 2B – Mean correct trait-recall proportions (and standard errors) in relation to item type and target honesty on the initial recall test.
- Page 169 Table 8. Experiment 2B – Mean correct trait-recall proportions (and standard errors) in relation to item type and target honesty on the final recall test.
- Page 172 Table 9. Experiment 2B – Means (and standard errors) of honesty ratings in relation to item type and target honesty obtained pre and post retrieval practice.

- Page 186 Table 10. Experiment 3 – Mean correct trait-recall proportions (and standard errors) in relation to trait valence, item type and target consistency on the initial recall test.
- Page 188 Table 11. Experiment 3 – Mean correct trait-recall proportions (and standard errors) in relation to trait valence, item type and target consistency on the final recall test.
- Page 192 Table 12. Experiment 3 – Means (and standard errors) of honesty ratings in relation to target consistency, trait valence and item type obtained pre and post retrieval practice.
- Page 210 Table 13. Experiment 4 – Mean correct trait-recall proportions (and standard errors) in relation to trait valence, item type and gender of the target on the final recall test.
- Page 212 Table 14. Experiment 4 – Means (and standard errors) of honesty ratings in relation to gender of the target, trait valence and item type obtained pre and post retrieval practice.
- Page 224 Table 15. Experiment 5A – Mean correct trait-recall proportions (and standard errors) reported on the final recall test.
- Page 226 Table 16. Experiment 5A – Means (and standard errors) of honesty ratings in relation to item type obtained pre and post retrieval practice.
- Page 227 Table 17. Experiment 5A – Means (and standard errors) of likability ratings in relation to item type obtained pre and post retrieval practice.
- Page 230 Table 18. Experiment 5B – Mean correct trait-recall proportions (and standard errors) reported on the final recall test.
- Page 232 Table 19. Experiment 5B – Means (and standard errors) of honesty ratings in relation to item type obtained pre and post retrieval practice.
- Page 233 Table 20. Experiment 5B – Means (and standard errors) of likability ratings in relation to item type obtained pre and post retrieval practice.
- Page 240 Table 21. Experiment 5C – Mean correct trait-recall proportions (and standard errors) reported on the final recall test.
- Page 242 Table 22. Experiment 5C – Means (and standard errors) of honesty ratings in relation to item type obtained pre and post retrieval practice.

- Page 244 Table 23. Experiment 5D – Mean correct trait-recall proportions (and standard errors) reported on the final recall test.
- Page 246 Table 24. Experiment 5D – Means (and standard errors) of honesty ratings in relation to item type obtained pre and post retrieval practice.

Figures

- Page 5 Figure 1. Retroactive and proactive interference paradigms.
- Page 11 Figure 2. Directed forgetting paradigm.
- Page 16 Figure 3. Retrieval practice paradigm.
- Page 24 Figure 4. Cue-dependent forgetting.
- Page 25 Figure 5. Cue-independent forgetting.
- Page 26 Figure 6. The Independent probe method.
- Page 35 Figure 7. Second-order inhibition in retrieval-induced forgetting.
- Page 43 Figure 8. Item representations in memory in the pattern suppression model.
- Page 46 Figure 9. Target-competitor similarity.
- Page 48 Figure 10. Competitor-competitor similarity.
- Page 59 Figure 11. Representation of retrieval-induced forgetting in terms of the control of spreading activation model.
- Page 61 Figure 12. Representation of cross-category inhibition in terms of the control of spreading activation model.
- Page 62 Figure 13. Representation of second-order inhibition in terms of the control of spreading activation model.
- Page 96 Figure 14. Five information processing models.
- Page 100 Figure 15. Flow diagram of the hypothesised model of the judgement process.
- Page 109 Figure 16. Two-level view of metacognition.
- Page 113 Figure 17. Illustration of the analogy of the direct-access model of metacognitive judgements to a computer system
- Page 115 Figure 18. Schematic model of the effects of intrinsic, extrinsic and mnemonic cues on JOLs
- Page 117 Figure 19. An accessibility model of the FOK judgements.

- Page 134 Figure 20. Outline of experimental procedure.
- Page 225 Figure 21. Experiment 5A – Mean position of seat chosen by participants in the relevant retrieval practice condition as compared to the non-relevant retrieval practice condition.
- Page 231 Figure 22. Experiment 5B – Mean position of seat chosen by participants in the relevant retrieval practice condition as compared to the non-relevant retrieval practice condition.
- Page 241 Figure 23. Experiment 5C – Mean position of seat chosen by participants in the relevant retrieval practice condition as compared to the non-relevant retrieval practice condition.
- Page 243 Figure 24. Experiment 5D – Mean position of seat chosen by participants in the relevant retrieval practice condition as compared to the non-relevant retrieval practice condition.

CHAPTER 1

RETRIEVAL-INDUCED FORGETTING: IT'S NATURE, UNDERLYING PROCESSES AND SCOPE

1.1. Introduction

One of the oldest research areas in psychology is the study of memory. Memory researchers have always been primarily interested in two key processes in social cognition: remembering (i.e. the process of successful retrieval) and forgetting (i.e. failure to retrieve). To many of us, it may appear as if remembering is a positive outcome of memory and forgetting, on the other hand, a negative one. However, forgetting plays a key role in helping us to function effectively on a daily basis, by not only preventing the retrieval of irrelevant information which enables us to successfully complete our memorial goals, but also by continuously selectively modifying and updating new information in our memory. In the words of William James (1890, p. 679), "*in the practical use of our intellect, forgetting is as important as recollecting*".

Over the past century, two central sets of theories have emerged in order to describe how forgetting takes place in memory: interference and inhibition. The present chapter will initially provide a brief overview of the research in forgetting and the phenomenon of retrieval-induced forgetting (i.e. the unintentional forgetting of information when other cue-related information is repeatedly recalled); it will then go on to elaborate on the adaptiveness of this effect and the role of other factors such as competition, strategy disruption, spread of activation, context dependence, emotion and the neural correlates involved in retrieval-induced forgetting; and finally conclude with evidence of the generality of this effect in our daily lives.

1.2. Strength-dependent competition models of interference

During the classical interference era (1900 –1970), forgetting was believed to occur when older information could not be retrieved due to the addition of related information in memory. The early theories of learning and memory were developed in terms of associations between stimulus and response (S-R), as behaviourism was the leading field of research in psychology at that time. These theories were based on the notion that interference is created at the time of retrieval, when a stimulus (i.e. cue) generates competition between its associated responses and that forgetting was a consequence of this interference (McGeoch, 1936, 1942). According to these theories, retrieval success is dependent on the retrieval cues used and the strength of the retrieval route, where the use of multiple and item specific cues in addition to a strong retrieval route between the cue(s) and the target item would most likely result in a successful retrieval attempt. Thus, early learning theorists hypothesised that during retrieval only one of the many independently learned S-R associations dominates (Crowder, 1976) and this basic rationale has been included in the modern associative theories of interference.

These associative interference theories assume the presence of response competition, where multiple items associated to a single cue compete with the target item for retrieval access. This assumption is known as the *competition assumption* (M.C. Anderson, Bjork & Bjork, 1994) in non-inhibitory theories of interference. It predicts that the greater the number of cue-related items, the greater the resulting competition and magnitude of interference (J.R. Anderson, 1974; Watkins, 1978). In other words, the employment of more item-specific cues would lead to a greater chance of the target item being retrieved from memory due to decreased interference from unwanted competing items. Besides the type of retrieval cue employed, the strength of the association between cue and target also plays an important role in retrieval success. The *strength-dependence assumption* is the second assumption in interference theories, which states that the successful cued-recall of a target item is inversely proportional to the associative strengths of its competitors (M.C. Anderson et al., 1994). In other words, the stronger the association between a certain cue and target item in comparison to the associative strengths of the competing items and that retrieval cue, the higher the likelihood of a successful retrieval attempt.

These two assumptions have provided the basis for the description of the means of retrieval in current models of memory (Gillund & Shiffrin, 1984; Mensink & Raaijmakers, 1988; Raaijmakers & Shiffrin, 1981). These models of memory view the retrieval process as similar to a ratio-rule equation, in which the retrieval probability of a target item is mathematically demonstrated as: p (retrieval of target item E1 when retrieval cue C1 is given) = Associative strength between (C1 – E1) / [Associative strength between (C1 – E1) + Associative strength between (C1 – E2) + Associative strength (C1 – E3)... Associative strength between (C1 – Eⁿ item)], where E2, E3... Eⁿ indicate competing items. Therefore, not only would an increase in the number of items result in the decrease of the target item's probability of retrieval (*list length effect*; Watkins & Gardiner, 1982); but also an increase in the associative strengths of the items via practice would generate the same outcome (*list strength effect*; Ratcliff, Clark & Shiffrin, 1990).

1.2.1. Paired-Associate Paradigm

In order to examine the associative strength-based conditions of forgetting, early verbal learning theorists employed paradigms of interference such as the A-B, A-D paired-associate paradigm. In this paradigm, the effects of response competition were controlled and examined by manipulating three factors: retrieval cues that are shared, the cue-target association and the number of competing items associated with the same cue (M.C. Anderson & Neely, 1996; Crowder, 1976). A typical paired-associate learning task involves the study of a list of word pairs, where participants learn that one word (i.e. stimuli - A) is paired with another unrelated word (i.e. response - B) such that the presentation of the first word serves as a cue to retrieve the second word. Interference effects in this paradigm can be examined by having participants study two paired-associate lists, before being asked to recall items from either list.

The most popularly used paradigm is the A-B, A-D stimulus-response combination, where the two lists share a common stimulus (i.e. A), but both lists include different responses (i.e. B and D). By maximising interference in this way, the response competition at retrieval can be studied. Besides the A-B, A-D paradigm, other variations include the A-B, C-B paradigm, where the same responses are paired with different

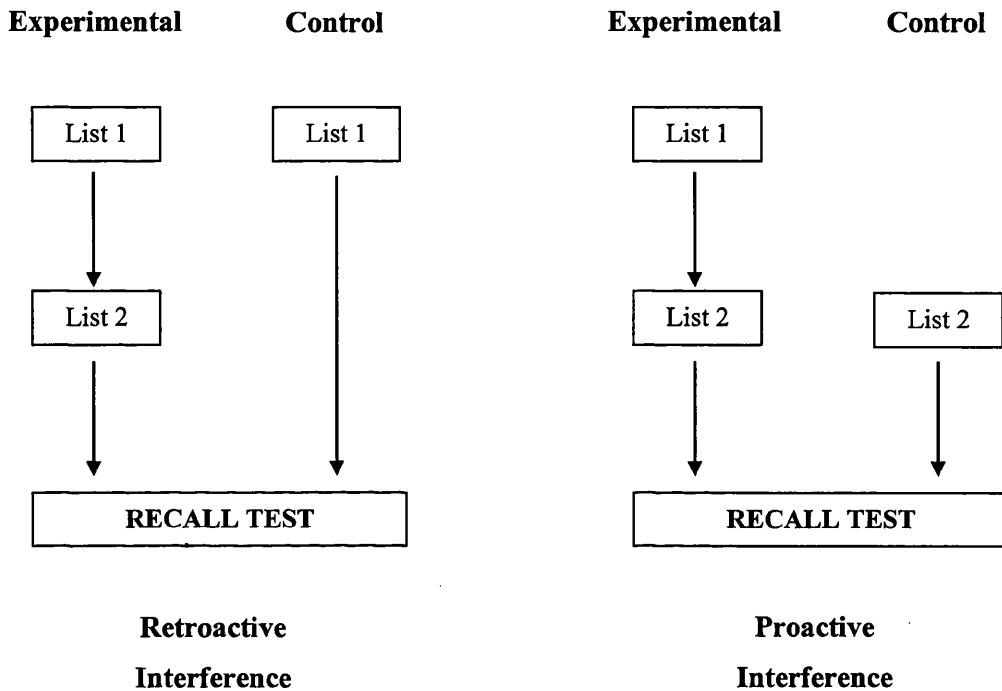
stimuli in both lists; the A-B, C-D paradigm, where the two lists differ in both stimuli and responses; and finally the A-B, A-B paradigm, where practice effects can be studied as the second list is identical to the first. The extensive research conducted has provided a wealth of knowledge regarding the effects of competition on retrieval.

1.2.2. *Retroactive Interference*

Retroactive interference was first examined by Müller and Pilzecker in 1900 (as described by M.C. Anderson, 2003) and later developed into possibly the most popularly studied phenomenon in the classical interference era. Extensive research has demonstrated the decrement in recall performance of a paired-associate list as a consequence of learning a second paired-associate list in relation to a baseline condition in which only the first list of paired-associates is learned and then recalled (Bower, 2000). A number of factors can be manipulated by controlling response competition in order to test the magnitude of retroactive interference effects. For example, large retroactive effects are found on a later cued recall test when the A-B, A-D paired paradigm is used in comparison to when the A-B, C-D paradigm is employed. This is possibly explained by the fact that response competition is induced as B and D responses are associated with the same retrieval cue (i.e. A) (McGovern, 1964; Postman, 1962; Postman & Stark, 1969). On the other hand, when recall performances are measured using recognition tasks, retroactive interference effects are found to be reduced or even eliminated, which suggests that the effects are not permanent (Postman & Stark, 1969; Chandler, 1989, 1993). In addition, increased recall of the first list on free recall tests is found to occur as the retention interval between the second list and the final recall increases, a process known as *spontaneous recovery* (Underwood, 1948a, 1948b; Barnes & Underwood, 1959). The measurement of retroactive interference in a paired-associate paradigm is illustrated in the figure below and is compared with the measurement of proactive interference in a similar paradigm (see Figure 1). Proactive interference is the opposite of retroactive interference and is said to occur when the learning of old information interferes with recall of the newly learned material. The method used to measure this kind of interference is similar to the procedure used to measure retroactive interference, with the exception that recall performance for the second list is the one in focus (see Figure 1 below). Proactive interference effects are affected in the same way by similarity of cues

between lists and retention intervals as retroactive interference effects. However, proactive interference is typically found with longer retention intervals, whilst retroactive interference is demonstrated with typically shorter intervals.

Figure 1: Retroactive and Proactive Interference Paradigms



Note: In the paradigms above, participants in both experimental conditions study two lists before completing the final recall test, and their recall performance is compared to recall of participants in the control condition who study either List 1 (retroactive interference) or List 2 (proactive interference.)

Britt and Bunch (1934) demonstrated the function of age of associative connections in retroactive inhibition in relation to Jost's law (1897), which states that "when two associative connections are originally of equal strength but of unequal age, new repetition increases the strength of the earlier more than of the later association, and, the older of the two associations fades less rapidly than does the newer" (Britt & Bunch, 1934, p. 299). They employed associations of equal strength and manipulated the age of associations, where participants in the younger-age condition mastered the original maze once, immediately preceding the 20-min retention interval, and participants in the older-age

condition mastered the original maze two times, 48 days prior to as well as immediately preceding the 20-min retention interval. Only half of the participants in both conditions learned a second maze during the 20-min retention interval and the amount of retroactive inhibition was compared between the two age groups. Their findings demonstrated higher retroactive inhibition in the younger-age condition and thus, provided evidence for Jost's law that the older of the two associative connections fades less rapidly than the newer. They concluded that the amount of retroactive inhibition varies with the age of association, where retroactive interference increases with a decreased amount of positive transfer between the two tasks (Britt & Bunch, 1934, p. 308).

Research on both retroactive and proactive interference effects not only supports the competition assumption (McGeoch, 1936, 1942), but also emphasises the role that the strength of stimulus-response association plays in these effects. The strength-dependent assumption (M.C. Anderson et al., 1994) predicts that interference is greatest when responses are highly associated to a particular stimulus cue and that interference from competitors can be decreased by an increase in the association between the stimulus cue and the target response (M.C. Anderson & Neely, 1996). The impairment seen in these studies have been accounted for by the process of *occlusion* or *blocking*, and this strength-dependent assumption has formed the basis for modern theories of interference and organisation models of memory, such as, Search of Associative Memory model (SAM – Mensink & Raaijmakers, 1988; Raaijmakers & Shiffrin, 1981) and Adaptive Control of Thought model (ACT – J.R. Anderson, 1983). According to theories of blocking, the item that has the strongest associative link (i.e. A-B) to the shared retrieval cue occludes the associative link of other competing items (i.e. A-D, A-C) and thus, successfully gains retrieval access. The other items would thus, be subject to *reproductive inhibition* according to McGeoch (1936, 1942). In other words, strengthening of any association by means of extra learning and practice would lead to the impaired recall of other competing associations via the process of occlusion.

1.2.3. Part-set Cuing

Part-set cuing is one more widely studied interference phenomenon that is based on the strength-dependent assumption (Slamecka, 1968). In this paradigm, participants study

lists of words that fall into different categories (i.e. sets) and are then required to recall as many items as they can on a subsequent category-cued recall test. *Part-set cuing inhibition* is said to occur when some of the previously learned words that are presented, in addition to the category cues at retrieval, cause impairment in recall of the other words in the category (Mueller & Watkins, 1977; Roediger & Neely, 1982; Slamecka, 1968). The term 'inhibition' in this era was used loosely to describe an effect that is contradictory to facilitation. The paradigm proposed by Slamecka (1968) involved the study of exemplars contained in five semantic category lists (i.e. L1, L2...L5). The exemplars from each study list were presented one at a time in a random order. Following this, participants in the experimental condition were presented with some of the category items as retrieval cues on a study list, while only category cues were presented for other participants in the control group. Contrary to the expectation that presentation of a category item would serve as an additional cue to facilitate recall, results demonstrated the impairment of non-cued items of participants in the experimental condition relative to the control group.

Although this effect is very strong in tests of recall, it is eliminated in tests of recognition (Slamecka, 1975), suggesting that it is only the retrieval accessibility, and not the representations, of these memories that are affected. The effects of part-set cuing have been established in an array of settings in which exemplars of the studied lists can either subjectively or instinctively be sorted into a number of diverse categories, such as, rhyming categories, semantic categories, or even categories of unrelated words typically used in experimental situations (Roediger, 1978; Roediger, Stellon & Tulving, 1977; Mueller & Watkins, 1977). Part-set cuing effects can in part be explained in terms of response competition at retrieval, where the presented retrieval cues from the 'set' (i.e. category) competed with the non-cued items for the shared 'set' cue (M.C. Anderson & Neely, 1996; Rundus, 1973; Nickerson, 1984). The strength-dependent competition principle can also account for these effects, where the stronger associations to the target will not only facilitate recall for those items, but also block retrieval access of the other non-cued items in that set through part-set cuing. In other words, the strengthening of the cue-target associations will result in the weakening of the associations between cue and competitors culminating in part-set cuing inhibition of those competing items. Thus,

drawing from these two assumptions, it can be inferred that part-set cuing effects will not be present in conditions where competition is absent, such as in tests of recognition (Slamecka, 1975; but see Todres & Watkins, 1981).

Besides these two principles, Basden and colleagues (1977) put forth a strategy disruption account to explain the detrimental effects observed in the paradigm, where the presentation of items as cues disrupts the serial order of the items in the original list studied and consequently, recall performance is impaired due to the disruption of the original organisation of categories and their exemplars (Basden, Basden & Galloway, 1977; Basden & Basden, 1995). This explanation has recently been adopted by some researchers (C.M. MacLeod, Dodd, Sheard, Wilson & Bibi, 2003) in order to explain unintentional forgetting that is caused by retrieval practice (i.e. retrieval-induced forgetting) and will be addressed later in this chapter.

1.2.4. Output Interference

Output interference is an interesting phenomenon that occurs in the absence of response competition. It describes the detrimental effects of decreased retrieval of information from memory as a consequence of the earlier retrieval of information. A typical output interference paradigm involves the presentation of study lists of items in different categories, followed by a category-cued recall test. Typical findings demonstrate a drastic decrease of recalled items for categories that were cued later at test. Moreover, this effect is demonstrated independent of the positions of both the item as well as the category in the initial study lists (Roediger & Schmidt, 1980). Therefore, the act of retrieval, and not the presence of a shared retrieval cue, seems to result in retrieval interference. In other words, output interference can be found even in the absence of retrieval competition induced by a shared cue, indicating the harmful effects of the process of retrieval. Taking into account the prevalence of this output interference effect, researchers that employ free recall tests to determine the presence of any effect in memory need to account for output interference either during test or through post-hoc calculations (Macrae & MacLeod, 1999).

1.3. Inhibitory Account of Interference

M.C. Anderson and colleagues (1994) added a third assumption of *retrieval-based learning* to the response competition and strength-based assumptions of the interference accounts. Together, these three assumptions were known as the *strength-dependent competition models of interference* (M.C. Anderson & Bjork, 1994; M.C. Anderson et al., 1994). The retrieval-based learning assumption states that the retrieval process is sufficient to facilitate recall of the retrieved items.

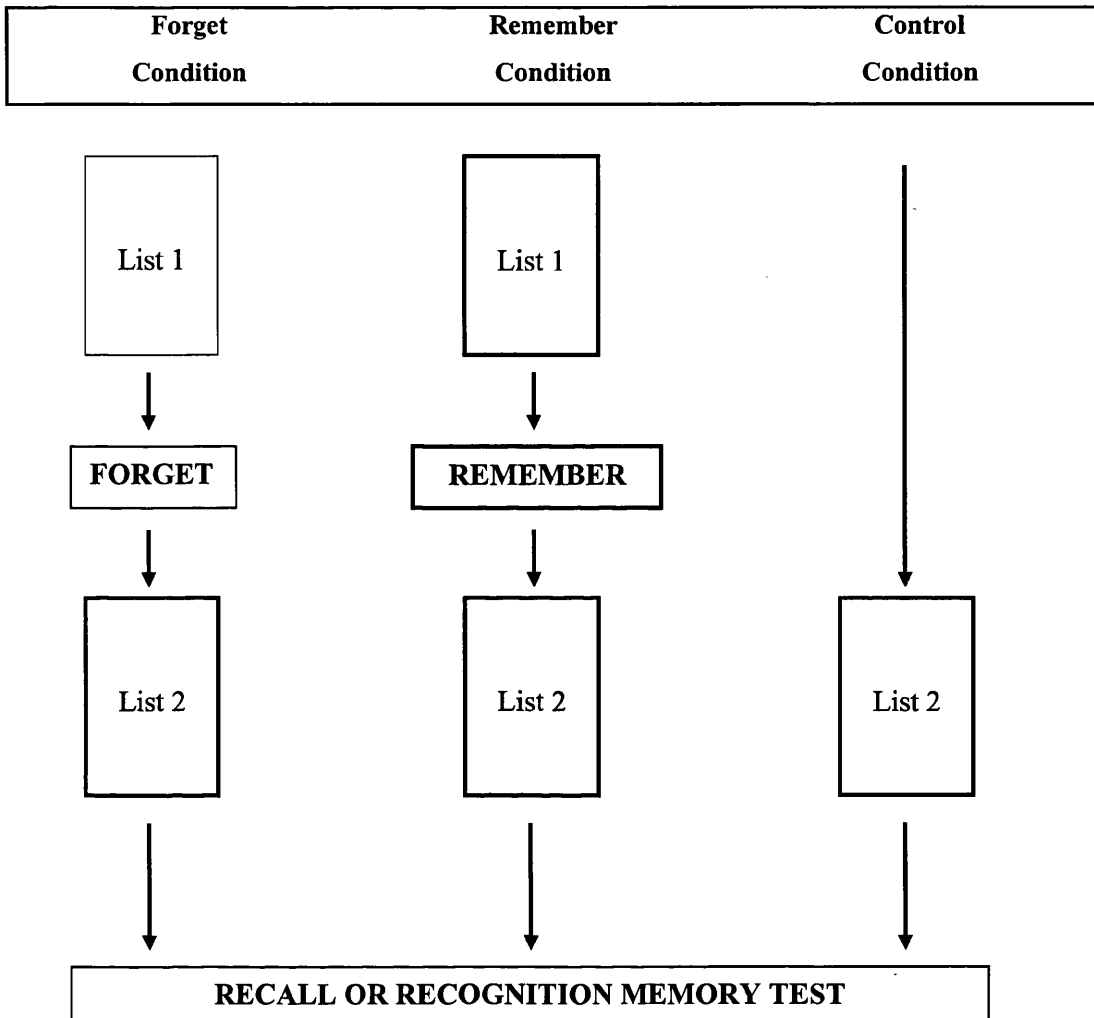
Both inhibitory and non-inhibitory accounts of interference have a similar understanding of the first assumption of retrieval response competition, but they both understand the other two assumptions of strength-dependence and retrieval-based learning a little differently. Non-inhibitory accounts of interference view the *initial strength* of the items that share a common cue as inconsequential to the facilitation process, where both weak and strong competitors are equally vulnerable to impairment. Inhibitory theories of interference, on the other hand, predict that strong competitors will require greater inhibition as compared to weak competitors, as strong competitors are more likely to create greater interference at the time of retrieval (M.C. Anderson et al., 1994). Secondly, evidence from past research has demonstrated that within strength-dependent models, *retrieval practice* of items may not be a *necessary* condition for the facilitation of those items. For example, in the part-set cuing paradigm, impaired retrieval is caused by only the presentation of a sub-set of items as cues during the final test, which suggests that simple *re-presentation*, and not retrieval, is sufficient to facilitate recall for these items and in the process produce interference effects. In comparison, inhibitory accounts stress the process of retrieval in order to resolve competition and view the processes of re-presentation of items and extra-study as being insufficient to induce inhibition of the competing items (M.C. Anderson, Bjork & Bjork, 2000). They explain the effects of part-set cuing as occurring due to change in strategy in the recall phase from the initial study phase, rather than as attributable to the reduction of interference through inhibition (Basden & Basden, 1995; Sloman, Bower & Roher, 1991). Finally, non-inhibitory interference theorists believe that since the interference occurs along the *retrieval route* between the cue and memory representation of the competing items, competition can be resolved by employing a different independent cue at the time of recall. Inhibitory

theories, on the other hand, believe that the memory representation of the competing items have been inhibited and will continue to be unavailable for retrieval even when the cues for retrieval are different to the ones used during the strengthening phase (M.C. Anderson & Spellman, 1995).

1.3.1. Directed Forgetting

The term retrieval inhibition began to be popularly used in conjunction with research using the directed forgetting paradigm. Typically, experimental studies in this paradigm are conducted using either the “item method” or the “list method”. The procedure using the item method is as follows: participants are presented words one at a time and a ‘remember’ (R) or ‘forget’ (F) cue is given after each presentation (C.M. MacLeod, 1975). On the other hand, the procedure using the list method involves the presentation of a list of words to study to participants for recall or recognition on a later test, but the ‘remember’ or ‘forget’ cue is given halfway through the list, effectively splitting the list into two: *to-be-remembered lists* and *to-be-forgotten list*. Thus, the participants that are given the ‘forget’ instructions (i.e. the forget condition) are required to try and forget the previous (i.e. to-be-forgotten) items and remember the subsequent ones (i.e. to-be-remembered items); whereas participants in the remember condition (i.e. instructions to remember) are required to remember both the to-be-forgotten (i.e., first list) and the to-be-remembered items (i.e., second list). A third baseline control condition is included where participants perform an unrelated filler task in place of the first list and then go on to learn the second list. Figure 2 below illustrates the procedure for the list method in the directed forgetting paradigm.

Figure 2: Directed Forgetting Paradigm



Note: Illustration of the list method in a typical directed forgetting paradigm

Recall performance in such a paradigm can be measured both within each condition (i.e. between the to-be-remembered and to-be-forgotten items) and across conditions (i.e. recall performance as compared to the remember condition and control condition). Typical findings using this paradigm, demonstrate greater recall for the to-be-remembered as compared to the to-be-forgotten items in the forget condition, indicating that instructions have been successful. Besides this outcome, participants in the forget condition not only remember the to-be-remembered list of items better than participants in the remember condition, but their recall is also comparable to participant's recall in the

control condition, indicating that forgetting of the to-be-forgotten list of items reduces proactive interference that usually occurs in the second list.

Evidence from past research literature demonstrates conflicting views amongst researchers with regards to the effect's underlying mechanisms. The earliest explanation for this intentional forgetting effect was selective rehearsal of items (R.A. Bjork, 1970), but this view was challenged by R.A. Bjork and Geiselman (1978) who proposed that retrieval inhibition reduced retrieval access to those items (R.A. Bjork, 1989; Geiselman & Bagheri, 1985; Geiselman et al., 1983). The retrieval inhibition account postulates that the instructions 'to forget' call upon an inhibitory mechanism that reduced accessibility of the to-be-forgotten item, in turn, reducing the interference created by these items during retrieval. As there are no such instructions to forget in the remember condition, interference from previously learned to-be-forgotten items accounts for the poor recall of items on the second list.

On the other hand, a number of researchers propose that the underlying mechanism of the effect using the item method is different to that underlying the effect in the list method (B.H. Basden & Basden, 1996, 1998; B.H. Basden, Basden and Gargano, 1993). They suggest that a distinctive processing style of rehearsal is used in the item method as opposed to the relational style of processing employed in the list method, where retrieval access to the list itself is impaired rather than inhibiting each individual item (B.H. Basden & Basden, 1998; B.H. Basden et al., 1993). Recently, a few researchers have questioned the retrieval inhibition account in directed forgetting and have proposed that list-method directed forgetting is caused by a change in the internal context between the to-be-forgotten items and the to-be-remembered items brought about by the forget cue and thus causes context-dependent forgetting of the material that was studied (Sahakyan & Kelley, 2002).

Although retrieval inhibition is usually the most favoured explanation for the directed forgetting effect (Geiselman et al, 1983; R.A. Bjork, 1989), some researchers suggest that selective rehearsal can also account for these effects in both the item method and the list method (Sheard, Dodd, Wilson & MacLeod, 2002; as cited in C.M. Macleod et al., 2003).

They demonstrated that when participants were given a 'warning' that they would have to remember all the items in both lists, forgetting effects were eliminated, suggesting that at the time of retrieval strategies are changed due to this 'warning' to include rehearsal of items from the previous to-be-forgotten list. In addition, using a median split to divide participants into high and low memory groups, Sheard and colleagues (2002) demonstrated reduced forgetting effects for the high memory group in the warning condition and increased forgetting effects in the no warning condition compared to the control condition. There was, however, no impact of warning in the low memory condition, suggesting that this group did not engage in rehearsal for either remember or forget items with or without a warning.

R.A. Bjork (1989) found that these effects are not permanent, as they were not only eliminated when tests of recognition preceded the recall test, but also that simply re-presenting as few as four to-be-forgotten items on an interpolated task served to 'release' inhibition and reinstate interference similar to that in the remember condition (E.L. Bjork & Bjork, 1996, Geiselman & Bagheri, 1985). Evidence from past research also demonstrates that the directed forgetting effect is absent in tests of implicit memory, such as general knowledge, stem completion and word fragment completion tasks (B.H. Basden & Basden, 1996; B.H. Basden et al., 1993; Paller, 1990; E.L. Bjork & Bjork, 1996), which suggests that retrieval inhibition does not inhibit memory representations of the items that are stored in long-term memory but inhibits retrieval access of the whole to-be-forgotten list to reduce interference on explicit tests of memory. This, in turn, implies that the memory representation of the to-be-forgotten items can continue to guide and influence current goals in memory. Real-life examples of this continuing influential process include decision-making process of a jury when instructed to disregard biasing testimonial evidence or pre-trial negative publicity (Caretta & Moreland, 1983; Golding, Fowler, Long & Latta, 1990; Moran & Cutler, 1991).

1.3.1. The importance of the process of retrieval

Retrieval as a process plays an essential role in governing the manner in which we perceive the physical and social world around us. It not only determines the accessibility of items in our long-term memory, but also controls what information is available in our

conscious awareness. The act of retrieval itself can be an effective method of learning, where successful retrieval practice of an item can result in an increased probability of that item being recalled on a later attempt at retrieval (Allen et al., 1969; R.A. Bjork, 1975; Carrier & Pashler, 1992; Morris & Fritz, 2000, 2002; Iglesias-Parro et al., 2009). This facilitative advantage on future retrieval attempts is viewed as being directly proportional to the increasing difficulty of the original retrieval attempts (Landauer & Bjork, 1978).

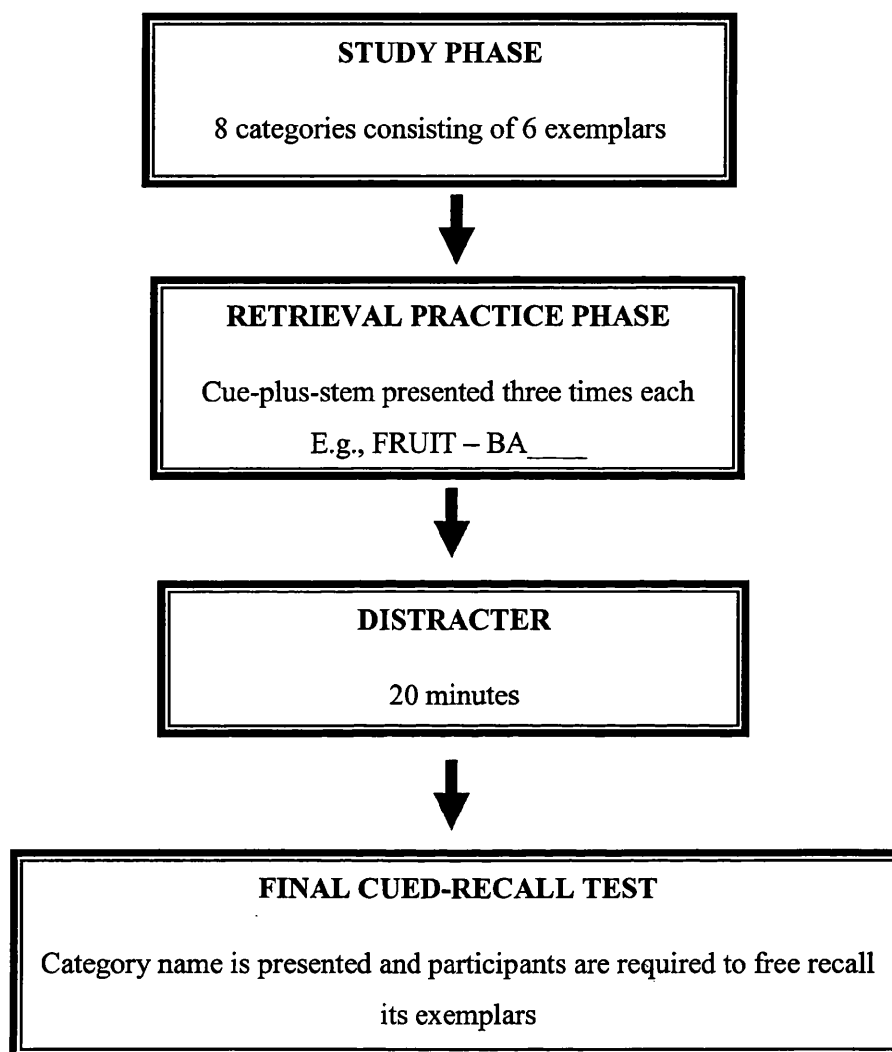
Although the benefits of retrieval on future recall have been clearly established, evidence of the contrary is also available. Roediger (1974) demonstrated the negative consequences that retrieval can have on memory, where earlier retrieval of items resulted in lower recall of later information, a phenomenon known as output interference. Thus, early research has suggested that unintentional forgetting may perhaps be the direct result of the retrieval process itself. The dual nature of retrieval has also been established by R.A. Bjork and Geiselman (1978) using the item method of the directed forgetting paradigm, where participants are given a series of to-be-remembered and to-be-forgotten items and are instructed to either remember or forget an item after its presentation. In their study, participants were presented two lists of word pairs with the directed forgetting instructions at the beginning of the study and every participant had to engage in a free recall task of all items from both lists following a period of delay at the end of the study. This procedure differed for the experimental group in that they were required to recall the to-be-remembered items immediately after initial presentation in addition to the final recall test that was administered at the end of the study. Findings of the study indicated that participants in the experimental group, who recalled the to-be-remembered items on an interpolated task, unsurprisingly recalled more to-be-remembered items on the final recall task as compared to participants in the control group, who did not receive any practice of the to-be-remembered items before the final recall test. An unexpected outcome of this study was the decreased recall of the remaining to-be-forgotten items that occurred for participants who engaged in prior retrieval practice of the to-be-remembered items as compared to the participants who did not recall any of the items during the retention interval, even though the to-be-forgotten items were presented the same number of times and were subject to the same directed forgetting instructions for both the experimental as well as the control group. These results demonstrate that the retrieval

process in itself is responsible for not only strengthening information in memory and in the process making that information subsequently more retrievable, but at the same time it is also responsible for unintentionally causing other associated information to be forgotten (R.A. Bjork & Geiselman, 1978).

1.4. Retrieval-induced forgetting

In order to examine the positive and negative consequences of a previous retrieval attempt on a later one, M.C. Anderson and colleagues (1994) designed a novel paradigm known as the *retrieval practice paradigm* (see Figure 3 below). This retrieval practice paradigm typically consists of four main phases: a study phase, a retrieval practice phases, a distracter task followed by a final recall phase. In the study phase, participants are presented with lists of category-exemplar pairs (E.g., FRUIT – BANANA, FRUIT – ORANGE, DRINKS – SCOTCH, DRINKS – BRANDY, etc). M.C. Anderson and colleagues (1994) used eight such lists containing six category-related exemplars each. Following this phase, participants engaged in repeated retrieval practice for half of the items from half of the categories (i.e., three items each from four categories). These selected categories were identified as the practised categories, while the other ignored categories during this phase were known as the unpractised categories. The retrieval task during this phase consisted of presenting the participants with the category name along with the letter stem of the correct exemplar for them to complete. (E.g., FRUIT – BA_____) and each item was practised three times. This retrieval phase, thus, creates three distinct types of items: practised items from the practised category (Rp+ items); unpractised items from the practised category (Rp- items); and unpractised items from the unpractised categories (Nrp items). After a substantial distracter phase, participants were required to engage in a final category cued- recall test, where participants were presented with the individual category names (E.g., FRUIT, DRINKS, etc) and were requested to free recall any exemplars from each category that they could recall from any point during the experiment.

Figure 3: Retrieval Practice Paradigm



Note: There are three main phases in the retrieval-practice paradigm, namely the study phase, the retrieval practice phase and the final recall phase (following a distracter phase)

Unsurprisingly, recall of the practised items was facilitated (e.g. Rp+ items, BANANA) as compared to the baseline measure of unpractised items from the unpractised categories (e.g. Nrp items, SCOTCH). The surprising and interesting outcome of this paradigm was the decreased recall of the unpractised items from the practised category (e.g. Rp- items, ORANGE) relative to the baseline items. Thus, the very act of retrieval resulted in the forgetting of related memories, a phenomenon popularly known as *retrieval-induced*

forgetting. This effect has now been replicated using a variety of stimuli in different contexts, which will be discussed later in the chapter.

1.4.1. Adaptiveness of Retrieval-induced forgetting

Forgetting is now viewed as a necessary and adaptive process that helps to prevent irrelevant unwanted information from interfering with the recall of target material (M. D. Macleod, Bjork & Bjork, 2003). This adaptive function of memory is now seen as an unintentional consequence of the retrieval process (i.e. retrieval-induced forgetting), where similar undesirable competing information is inhibited in order to promote the recall of target information. This desirable nature of forgetting has been established in a number of studies (M. D. MacLeod & Macrae, 2001; Groome & Grant, 2005; Iglesias-Parro et al., 2009). Storm, Bjork and Bjork (2008) provided support to the notion that retrieval-induced forgetting is not a permanent phenomenon by demonstrating the benefits of relearning of forgotten items on a recall test. Evidence by Groome and Grant (2005) presents further support for the adaptive nature of retrieval-induced forgetting. They investigated the relationship between cognitive failures and retrieval-induced forgetting by employing a standard retrieval practice paradigm, where participants first studied 36 category-exemplar word pairs (e.g. vegetable – onion) and then received practice for half of the category exemplars, via category-plus-two-letter-stem cues (e.g. vegetable – on___). During the filler phase, which lasted 10 mins, participants completed the Cognitive Failures Questionnaire (CFQ) devised by Broadbent and colleagues (1982). On completion of the questionnaires, participants engaged in a final test where they had to recall all the related exemplars. Their findings established that the retrieval-induced forgetting effect was inversely correlated with scores of cognitive failures, indicating that fewer cognitive failures are experienced by individuals who demonstrate a higher retrieval-induced forgetting effect. More recently, Iglesias-Parro and colleagues (2009, Experiment 1) using positive (i.e. ‘good’ candidate) and negative traits (i.e. ‘poor’ candidate) associated with four job candidates for a phone insurance company in the retrieval practice paradigm, not only demonstrated that retrieval-induced forgetting occurred for only for positive information and not negative information associated with these individuals, but also that a parallel choice bias (i.e. choice regarding the best and worst candidate for the job) emerged in accordance with the information available in

memory due to this effect. This finding makes intuitive sense as the forgetting of negative information may not be adaptive to effective functioning and decision making in everyday life.

1.5. Inhibitory processes in retrieval-induced forgetting

Drawing from propositions described above in the strength-dependent competition models, the impaired recall of Rp- items in retrieval-induced forgetting can simply be explained by non-inhibitory theories of interference, where retrieval practice strengthens the practised target-cue associations, weakens the unpractised competitors' target-cue associations or biases the meaning of the category cue. However, these theories imply that the resulting impaired recall is cue-dependent and that retrieval practice has no effect on the unpractised competitors themselves (M.C. Anderson et al., 1994; M.C. Anderson & Spellman, 1995; Levy & Anderson, 2002). On the other hand, the retrieval-induced forgetting effect can also be accounted for by inhibitory theories, which propose that inhibitory processes are responsible for the active suppression of Rp- items as a means to counteract the interference produced by unwanted competitors in the retrieval process of the target Rp+ items (M.C. Anderson et al., 1994). Although inhibitory theories also stress the role of competition at retrieval, their interpretations of strength-dependent and retrieval-based learning assumptions are different to non-inhibitory explanations.

1.5.1. Inhibition

The term 'inhibition' itself is most often used to describe an effect that occurs despite the use of an independent retrieval cue (M.C. Anderson et al., 1994; M.D. MacLeod et al, 2003). In its simplest form, inhibition is interpreted as an effect that is opposite to facilitation (popularly used in the classical interference era). A stronger descriptive interpretation of the term does not focus on only the empirical effect, but goes deeper, in that it postulates the presence of an inhibitory mechanism that operates to decrease the level of activation of a memory trace. In the context of retrieval-induced forgetting, if non-inhibitory theories are unsuccessful in the explanation of the retrieval failures, then inhibitory processes may be inferred. While non-inhibitory theories assume that the impaired recall of the unpractised Rp- items is due to the interference caused as a result of the strengthening of the target Rp+ items' association to the cue as opposed to the

strength of the association between competing items, inhibitory theories predict that this kind of impairment will vary according to the initial strength of the competing Rp- items, where strong unwanted competing Rp- items create greater interference and consequently will result in greater impairment as compared to weaker Rp- items (M.C. Anderson et al., 1994).

M.C. Anderson and colleagues (1994) attempted to test this hypothesis by manipulating the taxonomic strength of items within the three subsets, where both the Rp+ and Rp- subsets consisted entirely of either strong or weak exemplars; and the Nrp subset consisted equally of both strong and weak exemplars. As non-inhibitory theories assume that it is the strength of the Rp+ item that impairs recall of the unwanted competing items, retrieval-induced forgetting should be present in any condition where there are practice effects. On the other hand, inhibitory theories assume that it is the initial strength of the competing Rp- item, and not the Rp+ item, which induces impairment; where retrieval-induced forgetting is greater for taxonomically strong Rp- items as compared to taxonomically weak Rp- items. Findings of the study provided support for the inhibitory theories as retrieval-induced forgetting was absent when the competing Rp- items were weakly associated to the cue and there was significant impairment found when the competing Rp- items were strongly associated to the cue. As the non-inhibitory theories fail to provide an explanation for the selective interference of strong Rp- items in the retrieval-induced forgetting effect, the implication of an additional inhibitory mechanism may be inferred. The inhibitory explanation of retrieval-induced forgetting postulates that when a category cue is presented, both the target item and related but unwanted items compete for retrieval access. If the related but unwanted items are strongly associated to the cue, they will create greater interference at the retrieval stage. In order to promote efficient retrieval and prevent or at the least reduce interference, an inhibitory mechanism is brought to bear on the memorial representations of these competing unwanted items (M.C. Anderson & Spellman, 1995; R.A. Bjork, 1989). Thus, it follows that as the stronger competing items may potentially create greater interference, they are subject to greater inhibition or suppression through the inhibitory mechanism as compared to the weaker competing items that create weaker non-threatening interference at the retrieval stage.

Findings by Bäuml (1998) using moderate, weak and strong category exemplars in an output interference paradigm also provide support for inhibitory processes as underlying the retrieval-induced forgetting effect. Recalling moderate category exemplars prior to strong category exemplars led to greater impairment as compared to recalling moderate category exemplars prior to weak ones, which indicate that the weak category exemplars have no reason to be subject to inhibition as they will probably not interfere with the recall of moderate category exemplars. Similarly, using the same moderate/strong and moderate/weak lists in a part-set cuing paradigm, Bäuml, Kissler and Rak (2002) investigated the role of item strength using healthy and amnesic participants. Amnesic participants were chosen because they typically demonstrate difficulty in remembering recently acquired episodic information (Baddeley, 1997); yet possess an intact short-term and semantic memory. They have also demonstrated both retroactive and proactive interference effects (Isaac & Mayes, 1999). In healthy participants, part-set cuing impaired the recall of only strong exemplars but not the weak; whereas amnesic participants displayed impaired recall for both strong as well as weak exemplars. This suggests that retroactive and proactive interference cannot account for the type of interference displayed in the part-set cuing paradigm and that the effect must be attributed to a different mechanism. However, it cannot be said that this underlying mechanism is the same for both part-set cuing and retrieval-induced forgetting.

On the other hand, using 'similar' materials to M.C. Anderson and colleagues (1994), Williams and Zacks (2001) found retrieval-induced forgetting effects for both strong and weak competitors in their studies. However, this lack of difference may be attributed more towards experimental differences between the studies rather than to a theoretical one. Using the norms given by Battig and Montague (1969), the weak exemplars used by M.C. Anderson and colleagues (1994) were comparable in taxonomic strength in their first two studies to those used by Williams and Zacks (2001), but were taxonomically weaker in comparison in the last study. In the first study, although M.C. Anderson and colleagues (1994) did find a retrieval-induced forgetting effect for weak exemplars, their results were confounded by output interference. However, when output interference was controlled for in the second study no retrieval-induced effect was found for weak exemplars. Williams and Zacks (2001) only assume that output interference is operating

during final recall, but neither control for it nor perform a post-hoc statistical analysis to account for the effect. Moreover, as the weak exemplars are not as taxonomically weak as compared to those used by M.C. Anderson and colleagues (1994) in the last experiment, their assertion of output interference as the cause for the retrieval-induced forgetting effect may be questionable.

More recently, Jakab and Raaijmakers (2009) also tested the role of item strength in retrieval-induced forgetting. However, they manipulated item strength in a different way, where instead of focussing on each specific item, they varied the item's position within its category, where early items were defined as stronger items as compared to later items in the category (Experiments 1 and 2) or varied the number of presentations in the study phase, where items were presented either once (i.e. weaker items) or twice (i.e. stronger items) during the initial study phase (Experiment 3). Findings from the first two experiments demonstrated that the recall of items strongly depended on their position within the category, where items presented at study in the first two positions were better recalled than items presented later in the category. Moreover, the pattern of recall went against the prediction made by inhibitory theories, where recall of Rp- items was similar to that of the Nrp items at all serial positions, instead of there being greater impairment for stronger items that were positioned earlier in the category (Jakab & Raaijmakers, 2009). This pattern of recall emerged even when Rp- items were grouped together to avoid the possibility of integration between Rp+ and Rp- items in the second experiment. Findings from the final experiment, once again, demonstrated that predictions based on the inhibitory theories of retrieval-induced forgetting were not met, where instead of the prediction for increased inhibition of items presented twice at study (i.e. stronger items), results showed no enlarged magnitude of retrieval-induced forgetting for these additionally presented Rp- items (Jakab & Raaijmakers, 2009). On the other hand, the failure to find enlarged retrieval-induced forgetting effects in these studies could be attributed to item serial positioning and number of presentations as poor measures of item strength (see Norman et al., 2007).

1.5.2. Retrieval Specific Nature of Inhibitory Theories

Besides the difference in views on strength of competition between cue and target and item strength of competitors for retrieval access, non-inhibitory and inhibitory theories also differ with regards to the process by which Rp+ target items are strengthened. Non-inhibitory theories are not very specific regarding how the association between cue and target is strengthened. They imply that retrieval itself may not be a prerequisite condition in order to strengthen the cue-target association consequently creating impairment for other unwanted items; rather this strengthening could also occur through further presentations of the target items or through extra study time. In contrast, inhibitory theories assert that the active retrieval of a subset of items is necessary in the production of retrieval-induced forgetting. A number of studies have provided support for this retrieval-specific assumption of inhibitory theories. Blaxton and Neely (1983) demonstrated a faster speed of retrieval for a target category exemplar when it was preceded by retrieval of exemplars from a different semantic category and a slower speed of retrieval for a category exemplar after having previously retrieved other exemplars from the same semantic category. Similarly in a study of retroactive interference, by manipulating the degree of intervening learning of item lists through variation in study time, Bäuml (1996) investigated participants' recall performance for a first list of words. Participants either studied the additional lists at a rate of 2 seconds per item (low-interpolation condition) or at a rate of 5 seconds per item (high-interpolation condition). Participants were later required to recall target items on the initial list followed by the items on the additional intervening lists, once learning of the intervening lists concluded. While there was a strong difference in the recall of the intervening list items, the degree of retroactive inhibition did not vary between the two groups. These results support the retrieval-specific assumption of inhibition, where additional study trials lack the ability to create impairment and it can be seen that the process of retrieval is necessary to produce memory impairment.

Using the retrieval practice paradigm, M.C. Anderson and colleagues (2000a) provided support for the view that the process of retrieval practice is necessary for retrieval-induced forgetting. The study had a between subjects design, where participants either performed active retrieval practice for the target item (e.g. FRUIT – OR ___) or they

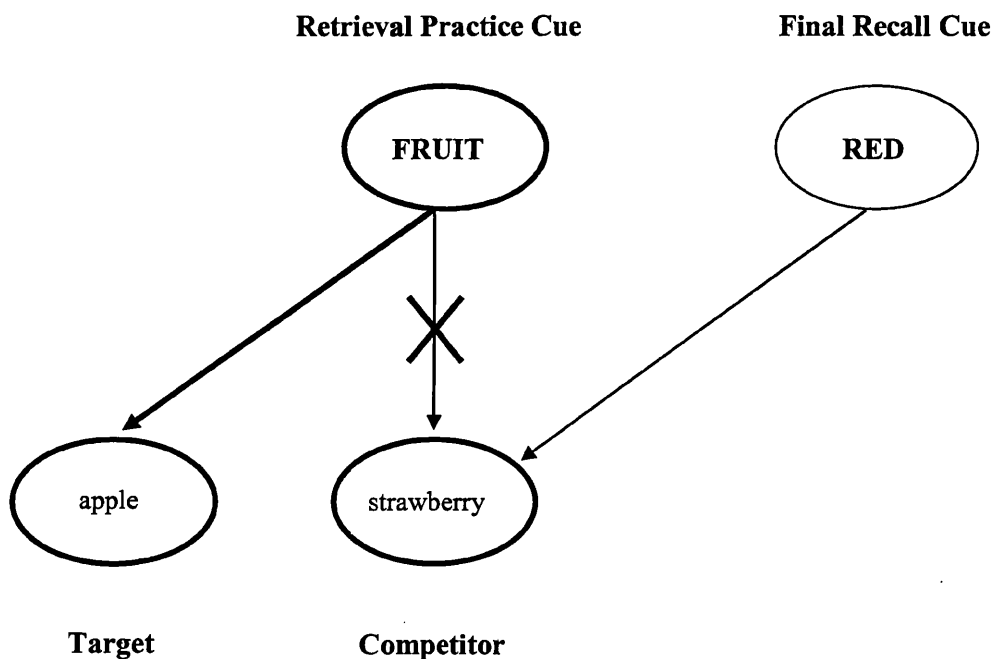
were re-presented with the target item and were required to retrieve the category cue instead (e.g. FR_____ - ORANGE). According to non-inhibitory theories, strengthening an item through re-presentation should be sufficient to create interference and subsequent impairment in the recall of Rp- items and so retrieval-induced forgetting should be found for both conditions. On the other hand, inhibitory theories predict that retrieval-induced forgetting should occur only in the condition where active and specific retrieval practice of the target item is required, as this condition promotes retrieval competition necessitating suppression in order to reduce interference. Findings demonstrated impairment of Rp- items only in the retrieval practice condition, thereby supporting the inhibitory account of retrieval-induced forgetting. Moreover, results showed a facilitated recall performance for the Rp- items in the re-presentation condition.

Similarly, Ciranni and Shimamura (1999, Experiment 5) using shapes and colours also demonstrated that retrieval of information in an intervening phase was necessary to produce a retrieval-induced forgetting effect and that simply providing additional presentations did not impair memory for related items. Bäuml (2002) further demonstrated that retrieval-induced forgetting effects can be generalised to long-term semantic memory as well. Participants initially learned a list of items that they were required to recall later in the study and in a separate intermediate phase, they either repeatedly generated related items from semantic memory or were presented with the same items intact for study. Findings showed impairment in the recall for the initial list only when participants engaged in semantic generation, indicating that the retrieval-induced forgetting effect can occur even when the retrieved target Rp+ items and non-retrieved initial Rp- items belong to different experimental tasks. More recently, with the use of mental imagery tasks, Saunders and colleagues (2009, Experiment 1) demonstrated that the re-presentation of the cue-exemplar pair did not produce any retrieval-induced forgetting effects as compared to the mental imagery and retrieval practice conditions. Iglesias-Parro and colleagues (2009) also demonstrated the presence of retrieval-induced forgetting and parallel choice bias effects only when participants had to retrieve the information from memory in the retrieval practice phase (i.e. the retrieval practice condition) and not when participants were required to read out the repeated presentation of the target-attribute (i.e. the naming condition).

1.5.3. Cue Independence / Independent Probe Method

Possibly the strongest support for the presence of inhibitory processes in retrieval-induced forgetting is the persistent inhibition of competitors despite the use of novel retrieval cues (M.C. Anderson et al., 1994; M.C. Anderson & Spellman, 1995; M.C. Anderson & Levy, 2007). Non-inhibitory theories fail to account for this effect as it contradicts its primary assumption of *cue-dependence*. They assume that multiple memories are associated to a single cue and that strengthening the association between a cue and target results in increased interference in the recall stage and the subsequent impairment in recall of the other competitors. This indicates that retrieval-induced forgetting results from interference along the retrieval route of the cue and competitor (Saunders & MacLeod, 2006). Following from this assumption, competing interference can be overcome by the simple use of a different retrieval cue that is not shared by the target (see Figure 4 below).

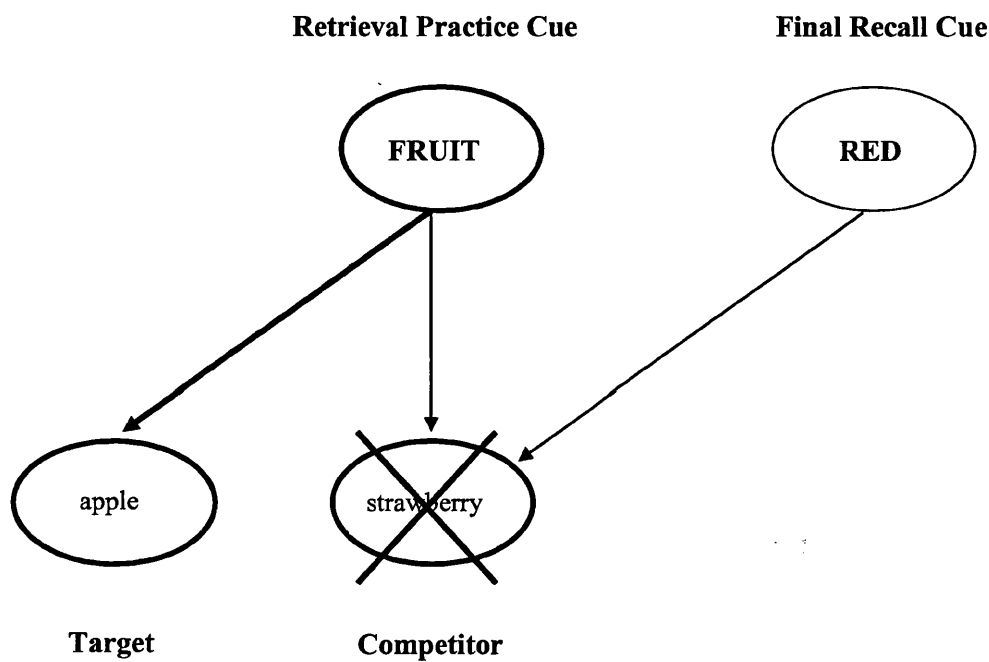
Figure 4: Cue-dependent forgetting



Note: As non-inhibitory theories assume that the competing Rp-item is impaired due to interference that occurs along the retrieval route between cue and unpractised exemplar (e.g. FRUIT – strawberry), this interference should be overcome with the employment of a new retrieval cue at test (e.g. RED)

Inhibitory theories, on the other hand, assume that since inhibitory processes operate on the memorial representation of the competitor itself, the retrieval-induced forgetting effect should also be *cue-independent* (M.C. Anderson & Spellman, 1995). According to this account, the number of memories associated with a particular cue is of less importance. Thus, the use of a novel cue in the recall phase, as compared to the original cue employed to strengthen the association between cue and target, should not affect consequent impairment of the related competitors (see Figure 5 below).

Figure 5: Cue-independent forgetting

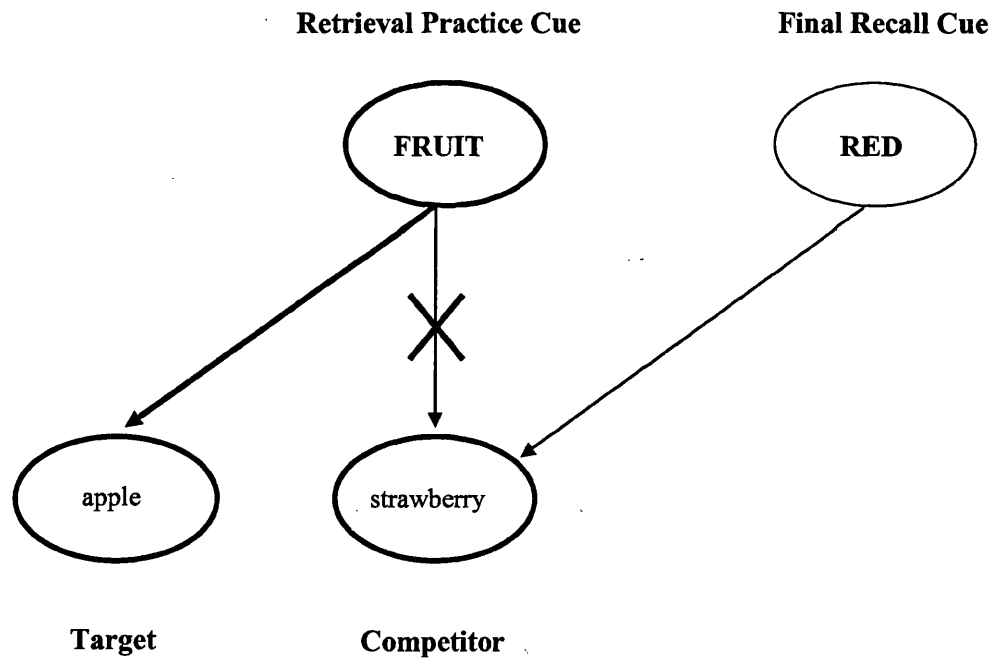


Note: As inhibitory theories assume that inhibition affects the memorial representation of the competing Rp-item in long-term memory, this item should remain unavailable for retrieval despite the use of a novel retrieval cue during final recall.

M.C. Anderson and Spellman (1995) devised a new testing procedure, known as the *independent probe method*, in order to distinguish between cue-dependent and cue-independent forgetting effects. This procedure was intended to determine the presence or absence of suppression of memorial representations. The independent probe method makes use of retrieval cues at test that are different to the ones employed to strengthen the

association between cue and target in the retrieval practice phase. This use of novel cues avoids any interference that occurs along the retrieval route between the cue and competitor (see Figure 6 below). Thus, following from the assumptions of non-inhibitory theories, if competing Rp- items are recalled at test, non-inhibitory processes can be attributed as the underlying cause of the retrieval-induced forgetting effect and that the memorial representations of these competing items in long-term memory are not affected. However, if impairment in the recall of the competing Rp- items still persists, then inhibitory processes may be inferred as underlying the retrieval-induced forgetting effect, also indicating suppression of the memorial representations of those items in long-term memory.

Figure 6: Independent Probe Method (M.C. Anderson & Spellman, 1995)



Note: The independent probe method requires recall test cues to be used that differ from those used during retrieval practice, in order to distinguish between inhibitory and non-inhibitory accounts of the impairment for unwanted competing items (Rp- items).

Results from their study were consistent with an inhibitory account, as retrieval-induced forgetting was still present despite the use of novel retrieval cues at the final recall test

(M.C. Anderson & Spellman, 1995). This suggests the presence of an inhibitory mechanism that operates on the competitors' representation in memory with a goal to suppress the related but unwanted items.

In two of the studies by Ciranni and Shimamura (1999, Experiments 3 and 4) using visuo-spatial materials, the retrieval cues employed during the recall phase were different to the ones used and strengthened in the retrieval practice phase, but were the same ones under which the stimuli were originally encoded. As results indicated a persistent retrieval-induced forgetting effect despite the use of non-retrieval practice cues, the presence of non-inhibitory processes as underlying this impairment is discounted.

Findings from the study conducted by Veling and van Knippenberg (2004) also provide evidence in support of retrieval-induced forgetting as being a cue-independent process. Two studies aimed to measure inhibition of related information as a consequence of the act of retrieval and in both studies the exemplars were presented at the final test without their categories as cues, using recognition latencies and a lexical decision task. In the first experiment, results of recognition latencies indicated that participants were slower in recognising Rp- items ($M = 810$ ms) relative to Rp+ items ($M = 678$ ms) as well as Nrp items ($M = 759$ ms). However, as this kind of test could have required participants to generate the category names as cues during the recognition process, the experimenters excluded this possibility of interference due to spontaneous category activation by employing a lexical-decision task in their second experiment, where participants were required to distinguish between words and non-words. Findings from the second experiment replicated the same pattern of results obtained in the first experiments, where participants were slower in deciding that Rp- items ($M = 574$ ms) were words as compared with both Rp+ items ($M = 542$ ms) and Nrp items ($M = 542$ ms). Thus, the results of both studies indicated a reduction in the activation level of unpractised exemplars from the same category, thereby strengthening the case for the inhibitory account of retrieval-induced forgetting (Veling & Van Knippenberg, 2004).

M.D. MacLeod and Saunders (2005) used a modified retrieval practice paradigm that included the independent probe method in order to investigate a link between retrieval-

induced forgetting and misinformation effects, a memory bias that occurs due to misinformation that affects people's reports of their own memory. Results from their study not only established robust retrieval-induced forgetting effects across all experimental conditions, but also provided evidence for inhibition of unpractised items from the unpractised set that were semantically similar to either Rp+ or Rp- items (cf. M.D. MacLeod & Saunders, 2005).

Similarly, additional support for the inhibitory account through the use of the independent probe method was demonstrated by Saunders and MacLeod (2006) across two experiments while examining retrieval-induced forgetting for complex prose materials. Using experimental materials different to those typically employed by M.C. Anderson and colleagues (such as items of information contained in two separate narratives describing the burglary of the Thompson's house or the Williams' house), Saunders and MacLeod (2006) uncovered retrieval-induced forgetting effects using semantically related but different cues at test as compared to the study and retrieval phases. In their second experiment, they tested for cross-category and second-order inhibition effects using similar materials. Their investigation is the first to replicate M.C. Anderson's evidence for first-order effects (inhibition of unpractised items from practised sets), second-order effects (inhibition of items from unpractised sets that were semantically related to unpractised items in practised sets) and cross-category inhibition effects (inhibition of items from unpractised sets that were semantically related to practised items in practised sets) outside his laboratory. They explain their findings using not only the inhibitory account in line with M.C. Anderson and colleagues' findings, but also in terms of Oram and MacLeod's (2001) competitive network model, which postulates that inhibition controls the spread of activation with a view to resolve retrieval competition. Both second-order and cross-category inhibition effects as well as the competitive network model as an explanation of retrieval-induced forgetting effects are explained in more detail in later sections of this chapter.

More recent evidence of support for inhibitory theories as underlying retrieval-induced forgetting using the independent probe method comes from the studies by Levy and colleagues (2007) in their investigation of phonological retrieval-induced forgetting in

first-language attrition. They found that repeatedly recalling names of an object (e.g. snake) in a second language that participants were learning (Spanish) impaired their ability to recall the corresponding native English term, as measured by independent cues such as a cue that rhymes phonologically with the items (e.g. – the term ‘break’ that rhymed with ‘snake’) or a cue that was semantically related (e.g. – ‘venom’). Interestingly, they also found a functional consequence of inhibition, where asymmetry of fluency between the two languages was directly associated with the inhibition of native language words. Thus, participants’ who were less fluent in the second language demonstrated greater inhibition effects for native English terms.

On the other hand, there is evidence using the cue-independent method that suggests it may be interference processes at work to produce the retrieval-induced forgetting effect, instead of inhibitory ones. For example, an attempt at replication of M.C. Anderson and Spellman’s (1995) employing the use of cue-independent procedures was made by Williams and Zacks (2001). Their findings demonstrated a marginal retrieval-induced forgetting effect ($p < .07$) and no evidence for second-order inhibition effects. However, these results may be attributed not to the theoretical issues underlying the findings, but perhaps to the methodology that was employed. The items used in the study varied dramatically in strength (from 2 to 53, averaging 19.1; according to Battig and Montague, 1969) and thus resulted in only a moderate average strength of the category, which consisted of some very strong and very weak exemplars. Due to their competitive strength, only the strong exemplars would be operated upon by inhibitory mechanisms as opposed to the weak exemplars, whose recall is more likely to be facilitated instead as they would not trigger any response competition (M.C. Anderson et al., 1994). In addition, their results could be mediated by output interference effects, as they did not control for output order or perform post-hoc tests to examine if this was the case.

Perfect and colleagues (2004) emphasised the context-specific or cue-dependent nature of retrieval-induced forgetting using a different form of the cue-independent technique. In order to test the inhibitory account of retrieval-induced forgetting, across three experiments, participants were required to associate an item with two potential cues at encoding, but were given practice for only one of the cues in the retrieval practice phase

to induce competition, while either or both the cues were employed at test. The independent cues used (i.e. the second cue, which was the picture of a 'face' in the first two experiments and an 'unrelated word' in the final experiment) were not semantically related to the item, rather their only association to the item was episodic in nature. In the first experiment, the retrieval practice phase was a replication of the traditional paradigm with the use of category-stem cues in the absence of the faces, while the final test was either category-cued, face-cued or jointly category and face cued. The inhibitory account of retrieval-induced forgetting predicts the inhibition of non-retrieved items irrespective of the retrieval cue used, even if the cue is only episodically related. The non-inhibitory account, on the other hand, predicts that retrieval-induced forgetting effects would only occur when the same cue used at retrieval-practice is also employed at the final test and thus, in terms of the experiments conducted, the typical pattern of recall produced by retrieval practice should not occur for the face-cued condition. Findings indicated that retrieval-induced forgetting was entirely cue-dependent, as Rp- items were inhibited only in the category-cued condition and not in the face-cued condition. There was no significant retrieval-induced forgetting effect found even in the joint category and face cued conditions despite only the presence of a face distinguishing between the two conditions. The cue-dependent nature of retrieval-induced forgetting was additionally emphasised in Experiment 2, where when both face and category cues were employed at practice, retrieval-induced forgetting emerged for the joint face and category cued condition. In Experiment 3, faces were substituted by unrelated words as the independent cues to counter the notion that the face cues may not being truly independent due to their possible association to the categories as well as their possible similarity to one another that could cause confusion. Participants, therefore, learned the episodic cue-exemplar association before they learned the category cue-exemplar one. For half of the participants, retrieval practice was given with category cues and for the other half, practice was given with episodic cues. Output interference effects were also accounted for through the use of fragments plus categories at test. However, as with the previous two experiments, results indicated that retrieval-induced forgetting was limited to the cues that were used at retrieval practice. The authors assert that these findings provide evidence against the inhibitory account, which emphasises that inhibitory processes affect the memorial representation of the unpractised item itself leading to the impairment of that

item irrespective of any type of cue used on a later recall test. These studies support the context-specific condition for impairment to occur, where transfer appropriate forgetting is seen when the retrieval conditions most closely match the conditions of the first retrieval competition (Perfect et al., 2004). The authors assert that the semantically related independent cues used at final test in previous studies actually creates similar retrieval competition at the practice and test phases and thus can account for the presence of a retrieval-induced forgetting effect with these semantically related independent cues (Perfect et al., 2004).

Further evidence for the context-specific view in inhibition was provided by Camp and colleagues (2007) with the use of item-specific independent cues. Across four experiments, they established that the retrieval-induced forgetting effect was found only when studied categories were used as cues and were not present when item-specific independent cues for both studied (e.g. rat) and unstudied items (e.g. elephant) were used. The study and retrieval practice phases followed the standard retrieval practice paradigm, where category exemplar pairs were presented for study (e.g. ANIMAL – rat, ANIMAL – horse), followed by retrieval practice of half of the exemplars from half of the categories (e.g. ANIMAL – h____). At the final test phase, however, items were tested using both studied category cues (e.g. ANIMAL – r____) and unstudied independent item-specific cues (e.g. POISON – r____, ZOO – e____). Findings from Experiments 1 (i.e. both studied and unstudied items) and 4B (i.e. only unstudied items) replicated the typical retrieval-induced forgetting effect using the normal studied category cues at test. On the other hand, an absence of the effect was found for studied and unstudied items when item-specific independent cues were employed at test in Experiment 2. No retrieval-induced effects were found in Experiments 3 and 4A for both studied and unstudied items, when covert cuing, output order and integration effects were all accounted for. They explain these results using non-inhibitory theories of interference, which postulate that interference will cause forgetting if the test cue activates competing items (e.g. Perfect et al., 2004; Mensink & Raaijmakers, 1988; cf. Camp et al., 2007). In Experiments 1 and 4B, the practised items were strongly related to the category cues and were likely to be activated even when the cues for the unstudied items were presented, thus blocking retrieval of the unstudied items at test. On the other hand, in Experiments 2

and 4A, the practised items were not related to the cues for unstudied items and therefore blocking of unstudied items and consequent forgetting of those items did not occur (Camp et al., 2007). In addition, interference theories also predict an absence of the retrieval-induced forgetting effect with the use of independent cues, which is consistent with the findings obtained in Experiments 2 and 4A. The authors also propose that the context-specific view of inhibition can explain their results, where item-specific independent cues were responsible for the lack of a match between the context in which inhibition took place (i.e. the retrieval practice phase) and the context in which the activation of the inhibited item is tested and thus, no retrieval-induced forgetting was found in these studies (Camp et al., 2007).

These assertions that the retrieval-induced forgetting effect may reflect non-inhibitory processes are further extended in their studies on the effectiveness of the cue-independent procedure to test inhibitory processes (Camp et al., 2009). A potential problem with the independent probe technique is one of covert cuing, where participants have reported that they make use of the studied cues at test even though independent cues are used to examine retrieval and this resulted in the facilitation of recall and the consequent masking of the retrieval-induced forgetting effect (M.C. Anderson, 2003; M.C. Anderson et al., 2000b). Across four experiments, Camp and colleagues directly tested the effectiveness of the independent probe technique by employing two study phases (one with only the cue and the other with target and cue) before the retrieval practice and final test phases. In Experiment 1, they demonstrated that the additional study of cues led to a facilitation in recall, suggesting that even though independent extralist cues are employed at test, target recall is dependent on accessibility of the study cue at test. Experiment 2 demonstrates the persistence of this facilitation effect even when retrieval time is restricted (e.g. 5 seconds). Experiment 3 demonstrated an absence of this facilitation effect when original study cues are used in the test phase, thereby discounting the notion that better encoding of cue-target pairs following study of cues results in the facilitation of recall. Finally, Experiment 4 demonstrated that the facilitation effect found in the first two experiments generalised to cue-plus-letter stems procedures as well as a longer retention interval between study and test phases (Camp et al., 2009). The authors also point out that they focussed on the effects of restudy of the cue and that in the retrieval practice paradigm,

the cue is used to induce competition and not just re-studied. They assert that covert cuing may not enhance but actually decrease the recall of the target in the retrieval practice paradigm and they support their claim by explaining the results obtained by Camp and colleagues (2005) as a result of covert cuing. Camp and colleagues (2005) found retrieval-induced forgetting effects only for participants who were aware that their memory for the studied items was being tested on an implicit test. Camp and colleagues (2009) assert that unaware participants were unlikely to use retrieval strategies that involved the activation of studied categories as they were unaware that they were generating previously studied items (Camp et al., 2009). They postulate that blocking occurred for aware participants and thus, the effectiveness of the independent probe technique would be questionable if covert cuing leads to blocking.

On the other hand, cue-independent forgetting has also been demonstrated in a different paradigm known as the *Think/No-Think paradigm*, devised by M.C. Anderson and Green (2001) through the adaptation of the Go/No-Go task that requires participants to withhold a motor action response to an external signal (cf. Saunders, 2003). This Think/No-Think task requires participants to not only withhold a dominant response, but also to try and prevent it from entering conscious awareness. In order to override this dominant response, participants endeavour to intentionally suppress these unwanted memories. Results indicated that unwanted items were suppressed not only on the subsequent test, but were also unavailable even when tested with an independent, semantically related cue, thereby providing evidence for an underlying inhibitory process at work. Based on these findings, M.C. Anderson and Green (2001) also postulate that suppression of this unwanted information takes place through executive control that is analogous to our ability to control overt motor responses. They directly infer that conscious awareness of memories is directly controlled through inhibitory neurons and this theory has now inspired a new mathematical model for studying memory (Norman et al., 2007).

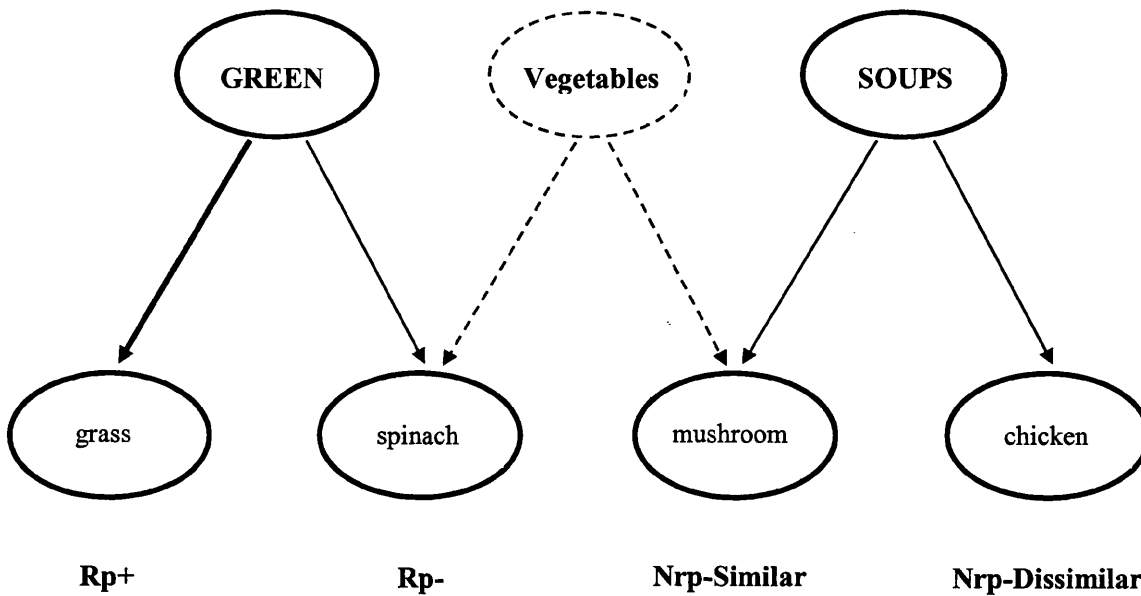
On the other hand, Tomlinson and colleagues (2009) dispute the interpretation of the results obtained by M.C. Anderson and Green (2001) as due to inhibition and assert that these same findings could be understood through interference, specifically recovery interference. They argue that the Think/No-Think task employed by M.C. Anderson and

Green (2001) was based on a single stage to recall, which is not representative of global memory models that include a two-stage model of recall, such as the interference-based Search of Associative Model (SAM), where recall consists of a sampling stage that locates the memory, followed by a recovery stage that retrieves details of the memory (Tomlinson et al., 2009). They attribute cue-independent forgetting to interference in the recovery stage, where the no-think instructions are effective because the cue locates a partial memory (i.e. sampling), but instead of recovering that memory with the original target, an alternative recovery is learned (e.g. sitting quietly) that competes with the original target (Tomlinson et al., 2009). They modified the Think/No-Think task to include a condition where participants are required to hit enter as quickly as possible instead of not thinking. Results from their study demonstrated that an almost identical cue-independent forgetting effect occurred when participants learned to press enter as compared to when they were given no-think instructions, thus providing evidence that cue-independent forgetting in the Think/No-Think paradigm can alternatively be understood through recovery interference (Tomlinson et al., 2009).

1.5.4. Cross-category impairment

Another major finding of M.C. Anderson and Spellman (1995) was that of *cross-category impairment*. Results not only demonstrated a retrieval-induced forgetting effect using the independent probe method, where Rp- items were inhibited, but also demonstrated the inhibition of items from the unpractised category that were similar to items from the practised category (known as *Nrp-Similar items*). More interestingly, the Nrp-Similar items that were similar to the Rp- items were also inhibited. They coined the term '*second-order inhibition*' to denote this phenomenon (see Figure 7 below). Thus, having the misfortune of being similar to an item that was directly inhibited rendered an item vulnerable to retrieval-induced forgetting (cf. Anderson & Spellman, 1995). In cases where second-order inhibition effects have been demonstrated, the original retrieval-induced forgetting effects (i.e. inhibition of unpractised items from the practised category) are popularly referred to as *first-order inhibition effects*.

Figure 7: Second-order inhibition in retrieval-induced forgetting



Note: Items from the unpractised category that are similar (Nrp-Similar) to unpractised items from the practised category (Rp-) are also susceptible to inhibition. In the example above, SOUPS - MUSHROOM shares a great proportion of semantic features with GREEN - SPINACH, which is the competing inhibited item, and thus, MUSHROOM is also inhibited as a consequence of the process. Rp+ = practised item from the practised category, Rp- = unpractised item from the practised category, Nrp-Similar = item from the unpractised category that is semantically related to the practised category, Nrp-Dissimilar = item from the unpractised category that is semantically dissimilar to the practised category.

These second-order inhibition effects cannot be accounted for by non-inhibitory theories, as the Nrp-Similar items do not share a common cue with the Rp- items, thereby indicating that these items should remain unaffected. On the other hand, inhibitory theories may possibly explain this effect as inhibition ‘leaking’ from Rp- items to any related items, thereby acting as a second Rp- group (cf. Saunders, 2003). In order to make certain that non-inhibitory theories could not explain these results, M.C. Anderson and Spellman (1995) replicated these cross-category impairment effects in two additional experiments, thus giving the inhibitory theories more support to their claims. These results could perhaps be accounted for by the cue-overload principle (Watkins, 1975, 1978), where the probability of recalling an item declines with the number of items subsumed by its functional retrieval cue (cf. Watkins, 1975). As the Rp- items could also possibly belong to an implicit category that includes some of the Nrp items, it results in

more items getting associated with a single cue. This did not occur in the control condition as the Rp- and Nrp items did not share a related implicit category. However, M.C. Anderson and Spellman (1995) also tested the basis of this assumption and discovered that prior retrieval practice of Rp+ items was a necessary condition for second-order inhibitory effects to occur (M.C. Anderson & Spellman, 1995; Experiment 3a). Their results revealed the absence of second-order inhibition effects when there was no retrieval practice performed for Rp+ items (even though the same number of Rp- items shared a related category with some of the Nrp items), therefore discounting the cue-overload principle as an explanation for this effect. Another necessary condition for the occurrence of this effect was the shared similarity between Nrp and Rp- items. Further experimentation revealed that Nrp performance was unimpaired by prior retrieval of Rp+ items, if they did not also belong to a shared category with any of the items from the practised category.

As the preparation of semantically related and unrelated items to be used in the investigation of these effects is quite time consuming and complex, the only additional support until date for these cross-category inhibition effects outside of M.C. Anderson's laboratory comes from studies conducted by M.D. MacLeod and Saunders (2005) and Saunders and MacLeod (2006). In the investigation of the link between misinformation effects, using two separate narratives relating to burglaries of two houses (e.g. the Thompson's and the Williams'), M.D. MacLeod and Saunders (2005) not only established first-order inhibition effects (i.e. retrieval-induced forgetting effects) across all experimental conditions, but also provided evidence for cross-category inhibition effects (i.e. the inhibition of unpractised items from the unpractised set that were semantically similar to items from the practised set). In the same way, Saunders and MacLeod (2006) tested for cross-category and second-order inhibition effects using similar materials. Their findings replicated M.C. Anderson's evidence for first-order effects (inhibition of unpractised items from practised sets), second-order effects (inhibition of items from unpractised sets that were semantically related to unpractised items in practised sets) and cross-category inhibition effects (inhibition of items from unpractised sets that were semantically related to practised items in practised sets), thus providing further support to the inhibitory theories of retrieval-induced forgetting.

On the other hand, some researchers argue against inhibition as an explanation for second-order retrieval-induced forgetting effects (Perfect et al., 2004, Camp et al., 2007, 2009). Perfect and colleagues (2004) suggest that in the studies conducted by Anderson and Spellman (1995), the increase in recall of control items (Experiments 2 and 4 vs. Experiment 3; 52% and 54% vs. 48%), rather than the reduced recall of experimental items, may have been the cause for the cross-category retrieval-induced forgetting effects seen. They also argue that the category exemplars used in Anderson and colleagues' study (e.g. GREEN – *artichoke, lettuce and pepper*) could be considered as weak category exemplars, and hence, according to the strength-related competition assumption of the inhibition theory, should not have resulted in retrieval-induced forgetting.

1.5.5. Retrieval-induced forgetting in recognition tests and implicit tests of memory

The inhibitory account of retrieval-induced forgetting can also be further investigated through the use of recognition tests. Non-inhibitory theories believe that the presence of the specific items and cues themselves on the final test resolves strength-dependent retrieval competition and thus eliminate retrieval-induced forgetting effects (Butler et al., 2001). Inhibitory theories, on the other hand, postulate that the memory performance of Rp- items will remain impaired even on tests of recognition as it is the items' memorial representation that inhibited.

Evidence from the literature suggests that some researchers have been unsuccessful in uncovering retrieval-induced forgetting effects when employing recognition in the final test of recall (Koutstaal, Schacter, Johnson, & Galluccio, 1999; Dehli & Brennen, 2009). Koutstaal et al., (1999) failed to find impairment for non-reviewed material as compared to a control. They did find retrieval-induced forgetting effects, however, when participants were tested with category cues, although the basis for this effect cannot be determined as they did not control for output order nor did they perform post hoc calculations to determine the effect of output interference. Another study that did not uncover impairment for unpractised material relative to control groups was Dehli and Brennen (2009), who investigated retrieval-induced forgetting for positive and negative emotionally valenced stimuli using a recognition test. Their findings suggest there was only impairment demonstrated for the studied neutral stimuli but not for the positive and

negative stimuli. These findings could be considered to be in line with the view that retrieval-induced forgetting is an adaptive process and that it might not be beneficial to forget negative information about the world around us (but see motivated forgetting).

On the other hand, several studies have been conducted over the past decade that include the use of recognition tasks to test retrieval-induced forgetting effects and results of many studies have provided support for the inhibitory theories underlying the effect even when recognition tests were used (Gómez-Ariza, Lechuga, & Pelegrina, 2005; Hicks & Starns, 2004; Spitzer & Bäuml, 2007; Starns & Hicks, 2004; Veling & Van Knippenberg, 2004; Ford et al., 2004; Soriano et al., 2009; Spitzer et al., 2009; Matsuda et al., 2010). One of the first studies to provide support for the inhibition account using item-recognition tests across two experiments was by Hicks and Starns (2004). They initially presented participants with a series of words (eight categories consisting of six items each), followed by retrieval practice for half of the words from half of the categories (three items from four categories). In the final test, participants were presented with individual items and were required to either decide if the item was old or new (Experiment 1) or whether the item was studied and practised or studied and not practised (Experiment 2). Their findings indicated that significant retrieval-induced forgetting effects were found for both conditions. More interestingly, participants claimed that more Rp- items were new as compared to the Nrp items, even though they were both presented the same number of times. This supports the inhibitory theories' assertion that inhibition affects the representation of the item in memory. Similarly, Starns and Hicks (2004) also found significant retrieval-induced forgetting effects of false memories using both recognition and recall tests at the final stage.

Further support using recognition tests in the retrieval practice paradigm was given by Ford and colleagues (2004) who examined the existence of retrieval-induced forgetting in 7-year old children using pictures that highlighted objects from the semantic categories of animals, food or vehicles. Participants were then tested over the next several days by answering yes/no questions using either category cues (Experiment 1) or a written recognition-memory test (Experiment 2). Their findings indicated that significant retrieval-induced effects were found in both experiments for the children that were

comparable to the pattern of effects found in young adults. Gómez-Ariza, Lechuga, and Pelegrina (2005) also used recognition tests in their investigation of retrieval-induced forgetting for thematically related and thematically unrelated sentences. The recognition task required participants to decide whether sentences that were presented to them were ones that they had seen earlier (i.e. press 'yes') or were new sentences (i.e. press 'no'). Findings showed that once again significant retrieval-induced forgetting effects were found not only for accuracy times but also for response latency measures.

Spitzer and Bäuml (2007) also demonstrated the presence of impaired recall for unpractised items from a practised category relative to a baseline condition in tests of item-recognition using the remember-know procedure (which requires the participant to make a decision about whether recognition of a previously encountered event is based – 'Remember' response indicating recollection - or not based – 'Know' response indicating familiarity - on remembering of contextual information about the event) and the receiver operating characteristic procedure (in order to determine the relation of true positives to false positives). They explain their findings through a single process analysis which results from the reduced general memory strength of the impaired item. More recently, Spitzer and Bäuml (2009) extend these results from impaired memory for related unpractised items to impaired memory for related unpractised categories (i.e. colours), in which participants were required to recognise a target as a memory of a specific category. This also extends the findings by Ciranni and Shimamura (1999) where colour was used as a grouping factor to examine retrieval-induced forgetting. Combining their current findings with those obtained earlier by Ciranni and Shimamura (1999), it can be said that retrieval practice can lead to impaired memory for episodically related unpractised material.

Soriano and colleagues (2009) explored impairments in memory retrieval for schizophrenic patients using the retrieval practice paradigm and in order to exclude non-inhibitory explanations, such as blocking, they used a recognition test in the final recall phase. As schizophrenic patients usually demonstrate critical impairments in inhibitory control using suppression and selective attention, a lower retrieval-induced forgetting effect found on a recognition task would suggest that inhibitory processes underlie the

effect. Their findings, indeed, demonstrated a reduced retrieval-induced forgetting effect for schizophrenic patients as compared to healthy control individuals.

These results, along with results obtained from the previous studies make it difficult for non-inhibitory theories to account for the retrieval-induced forgetting effects, as they provide evidence against the strength-dependent response competition explanation. On the other hand, the above findings are perfectly in line with active inhibition theories which predict that impairment should be seen on any memory test aimed at accessing individual item representations (i.e. retrieval accessibility).

In addition to explicit cue-independent and recognition tests of memory, implicit memory tests are also employed to examine if retrieval-induced forgetting effects can be attributed to underlying inhibitory processes, as implicit memory tasks in the final phase make no mention of a relationship to the study phase. Participants go through the normal study and practice phases in the retrieval practice paradigm, but instead of being directly asked to probe their memory for these items, participants are tested via other means (e.g. lexical decision tasks, free association, word identification, word fragments, etc). These implicit tests of memory are also based on the principle that if retrieval-induced forgetting is based on inhibition which impairs the memorial representation of the related item, then this effect should be found with any type of test assessing the activation of the inhibited item.

For a long time, it was believed that the inhibitory effect of retrieval-induced forgetting was applicable only in conceptual material and was absent in memory for perceptual tasks. Perfect and colleagues (2002) conducted five studies to examine the effects of retrieval-induced forgetting in both conceptual and perceptual implicit memory tests. Using category generation and matching tasks, they found impairment for unpractised exemplars from the practised set in relation to the control. On the other hand, using stem completion and perceptual identification tasks, no retrieval-induced forgetting effect was found, which led them to conclude that these effects are only restricted to conceptual tasks and does not extend to perceptual memory. Following this study, Tsukimoto et al. (2004) investigated explicit and implicit memory using category-instance pairs.

Participants practised items using cued-fragment recall and at the end of the study were required to recall items on the final test with the aid of category-plus-first letter pairs. Their results demonstrated the typical retrieval-induced forgetting effect only for explicit tasks, but not on implicit tasks, thus suggesting that the item representation in memory may still be unaffected as opposed to its accessibility.

Camp and colleagues (2005) used independent cues to test for retrieval-induced forgetting in implicit memory and found that although the effect was present in these tests, the effect was mediated by the awareness of the participant. If the participant was unaware that the final test was linked to the study phase, the retrieval-induced effect was absent, thus emphasising the role of contextual features in this effect (Perfect et al., 2004). They propose theories of interference to explain their findings indicating that aware participants employed the contextual cues to recall items from the study and practice phases and as the link between the target and the practised items was strengthened during the practice phase, they postulate that the recollection of the practised items interfered with the recollection of the unpractised items from the practised set in the final recall test. Since unaware participants were oblivious to the connection between study and test, this interference did not occur and hence the retrieval-induced forgetting effect was absent. Camp and colleagues (2005) further postulate that the independent cue method popularly used to make a distinction between the inhibitory and interference accounts in retrieval-induced forgetting may be flawed and thus ineffective in its conclusions. They assert that the process of 'covert cuing' (i.e. use of the studied category cue even in its absence or in the presence of an extra-list cue) mediated the resulting retrieval-induced forgetting effect for aware participants, where aware participants may have plausibly used a retrieval strategy that activated the original studied categories (Camp et al., 2009).

The first study to provide support for the inhibitory account of retrieval-induced forgetting using implicit memory tasks was conducted by Veling and van Knippenberg (2004). Using recognition latencies and a lexical decision task across two experiments designed to measure inhibition and to exclude non-inhibitory accounts in retrieval-induced forgetting, they confirmed the presence of a retrieval-induced forgetting effect in the absence of a cue in the final test of memory.

More recently, the assertion by Perfect and colleagues (2002) that retrieval-induced forgetting can only be found on conceptual tests of memory and not in perceptual ones, has been disputed by the findings of Bajo, Gómez-Ariza, Fernandez and Marful (2006). Across three experiments, Bajo and colleagues (2006) used lexical categories (Spanish words that shared the first two letters – such as *Regalo* and *Reserva*) to induce competition in the study and practice phases and test recall using direct and indirect word-fragment completion tests. Findings demonstrated retrieval-induced forgetting effects in all three studies suggesting that for this effect to occur, the testing procedure should make sure that there is appropriate transfer between memorial representation and competition. This indicates that the retrieval practice stage needs to encourage the retrieval of perceptual-lexical information. More recently, in another study using item-specific cues to test a difference in inhibitory processes between young and older individuals, Gómez-Ariza and colleagues (2009) uncovered similar retrieval-induced forgetting effects for both ages, thereby indicating comparable inhibitory efficiency in both young and older adults. Parker and Dagnall (2009) investigated memory for brand names using explicit (i.e. category cued) and implicit tests (i.e. free association) of memory. Their results confirmed the presence of a retrieval-induced forgetting effect of the non-practised brands, thus providing further support to inhibitory theories as the basis of this effect.

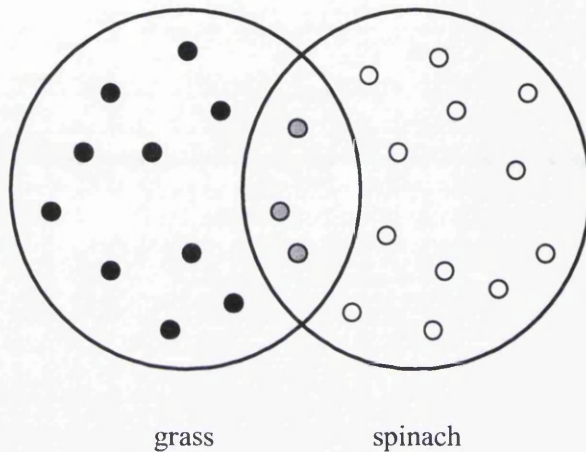
It can be noticed that over the past decade there have been a number of studies that have used explicit recognition, item-specific cues or implicit memory tests have provided support for the possibility of inhibitory theories in retrieval-induced forgetting to be considered, as non-inhibitory theories fail to fully account for these findings. However, what model of inhibition would endeavour to explain these results?

1.5.6. Inhibitory models – Pattern suppression and lateral inhibition

Pattern suppression models have been widely assumed to be the primary mechanism underlying the retrieval-induced forgetting effect (M.C. Anderson & Spellman, 1995). In contrast to the theory of lateral inhibition that views memory representations as being unitary and discrete without internal semantic features, the pattern suppression theory assumes that memory representations are not discrete units but, instead are distributed patterns of semantic features that are acted on by inhibitory or facilitatory processes. The

pattern suppression account postulates that each item in memory consists of semantic features that may be similar to other item representations in memory. Thus, all items in memory are viewed as shared sets of semantic connections based on their similarity. Figure 8 below demonstrates how the pattern suppression model represents items in memory and their internal semantic features.

Figure 8: Item representations in memory in the pattern suppression model



Note: Each item in memory is represented by a large circle and the smaller circles within these large circles represent the internal semantic features of an item. Black circles indicate activation; grey circles indicate shared features that are also activated and white circles indicate the competitor's distinctive features.

In the context of the retrieval practice paradigm all items in a list are related to a particular category and thus, share certain semantic features with one another. In other words, some of the internal semantic features of the unpractised items 'overlap' with those of the practised items due to similarity. Therefore, when an item is activated in memory, the activation of the item's overlapping semantic features present in other items in memory is also triggered. For example, in the study phase, presentation of the cue GREEN would activate the shared features of GRASS and SPINACH to the cue, which in turn, would activate the remaining features of both GRASS and SPINACH. In the retrieval practice phase, only a subset of the items associated with the cue GREEN are selectively re-activated and thus, only the GREEN – GRASS association will be required to be practised. Consequently, a mechanism is required to actively inhibit semantic features

from the competing memory items that would otherwise be reactivated along with the target-specific features. In other words, the retrieval practice process requires the activation of the target item's semantic features (e.g. darkened feature units of GRASS) and the suppression of the features that belong to the competing items (e.g. white feature units of SPINACH). Thus, the process of retrieval practice is regarded as an active process and not a passive consequence of the level of activation in a limited-capacity memory system as postulated by early models of memory. M.C. Anderson (2003) further stated that the retrieval process can be viewed as an executive control mechanism that eliminates or reduces the internal interference from related information. This model can, thus, be viewed as a storage strength model (see new theory of disuse; R.A. Bjork & Bjork, 1992).

The pattern suppression model can account not only for first-order retrieval-induced forgetting effects but also for cross category and second-order impairment, which is considered its advantage over the lateral inhibition model. The lateral inhibition model suggests that the second-order impairment should not be greater than first-order impairment due to notion that the suppression of the Rp- item restricts its ability to suppress related material (Nrp-Similar). This view goes against the findings in the literature, where M.C. Anderson and Spellman (1995) found second-order inhibitory effects that were greater than the first-order inhibitory effects. In contrast, the pattern suppression model, although less computationally developed in comparison, better accounts for the inhibition of items that are unrelated to the target but highly similar to the competing items as suppression reflects the extent of overlapping similar features. For example, as SOUPS - MUSHROOM shares a lot of semantic features with GREEN - SPINACH, which is the competing inhibited item, MUSHROOM is also inhibited as a consequence of the process. In the explanation given by M.C. Anderson and Spellman (1995), if unpractised items from practised categories (Rp- items) are similar to practised items (Rp+ items) in that 35% of their features overlap, then retrieval practice should cause those overlapping features to be highly active while at the same time cause suppression of the remaining 65% of features that do not overlap with the practised items (i.e. 65% of the Rp- item). If, however, an unpractised item from the unpractised category happens to share 95% of its features with the suppressed portion of the unpractised items

(Nrp-Similar item), then this item will be inhibited from future recall as well. Thus, as inhibition is dependent upon the exchange between number of overlapping features that are activated and inhibited, greater impairment could occur in the recall of an unpractised category item (Nrp-Similar item) as compared to a competing unpractised item in the practised category (Rp- item). Further, this process also implies that the retrieval of Nrp-Dissimilar items (e.g. SOUPS – CHICKEN) will not be impaired. In addition, the prediction made by the lateral inhibition model concerning the facilitation of the Nrp-Dissimilar item is not included in the pattern suppression model. Findings once again are inconsistent with the lateral inhibition model and better support the assumptions of the pattern suppression model.

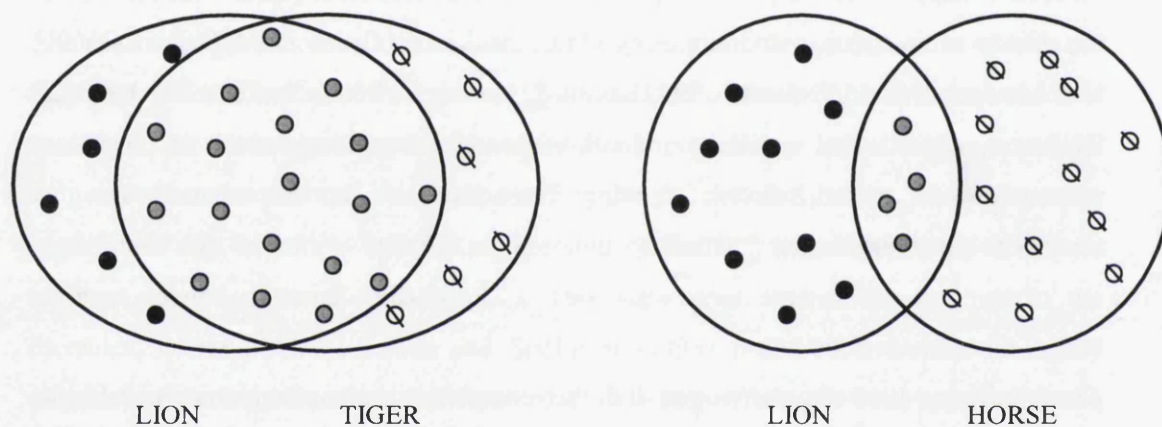
Additional support for the pattern suppression model comes from research in the area of the effects of integration and similarity (M.C. Anderson, Green & McCulloch 2000b; M.C. Anderson & McCulloch, 1999; Bäuml & Hartinger, 2002; Smith & Hunt, 2000). Evidence suggests that similarity induces response competition, which an important assumption of retrieval-induced forgetting. Thus, there are two important factors that need to be considered about the model.

Target-Competitor Similarity

The similarity between the target and the competitor is an important variable in determining the presence of inhibition or the degree to which inhibition takes place (M.C. Anderson et al., 2000b). The model postulates that that during the paradigm's retrieval practice phase, the semantic features of the target will be strengthened and facilitated and this in turn, will result in the facilitation of those similar features in the competing item's pattern as well. In order for the memory representation of the target to be made distinctive, the competitor's dissimilar semantic features will be subject to greater inhibition. If the competitor contains only a few semantic features that are similar to the target, then the inhibition of the competitor's distinctive semantic features would result in impaired recall for that item. On the other hand, if the competitor contains many semantic features similar to the target, then the inhibition of the competitor's distinctive semantic features would not result in the impairment of recall for that item. Thus, inhibition is dependent on the trade-off between the competitor's shared facilitated semantic features

and its suppressed distinctive features (see Figure 9 below). This indicates that an increase in the similarity between target and competitor would reduce retrieval-induced forgetting and conversely, a decrease in the similarity between target and competitor would result in a greater retrieval-induced forgetting effect. It must be noted that in the case of the latter, as the item is unlikely to be a very strong competitor, only a proportion of the competitor's distinctive features will need to be suppressed in order to make the target more distinctive in memory. The competitor itself will still be inhibited as the proportion of features inhibited is still greater than the proportion of features facilitated.

Figure 9: Target – Competitor Similarity: An example of the trade-off between activation and inhibition [using items from the study by Bäuml and Hartinger (2002)]



Note: Each item in memory is represented by a large circle and the smaller circles within these large circles represent the internal semantic features of an item. Black circles indicate activation; grey circles indicate shared features that are also activated, white circles indicate the competitor's distinctive features and white circles with a line through them indicate the competitor's inhibited distinctive features. The framework predicts, the greater the similarity of semantic features between target and competitor, the lower the inhibition. Thus, in the example above, when the features of the practised item LION are activated, the shared semantic features in TIGER and HORSE are also simultaneously activated. As there is a large proportion of overlapping features between LION and TIGER as compared to LION and HORSE, there is greater likelihood of recall for TIGER as compared to HORSE.

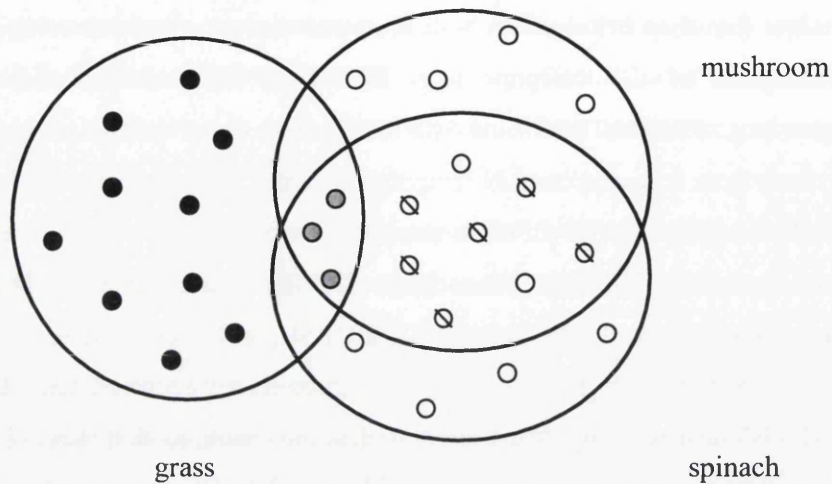
Thus, the pattern suppression model effectively accounts for the results obtained by Bäuml and Hartinger (2002), where retrieval practice caused impairment of items that

were relatively dissimilar to the target items (i.e. they belong to the same category, but not the same sub-category) and no impairment for items that were highly similar to the practised target (i.e. they belonged to both the same category and sub-category). They divided exemplars of the category (e.g. ANIMAL) into similar and dissimilar subcategories (e.g. PREDATORY and HOOFED) and found inhibition only for the competing item from a dissimilar sub-category. (i.e., if LION was used as the practice target from the category ANIMAL, more impairment was seen for the Rp- item HORSE than for the Rp- item TIGER). Thus, since TIGER shares a larger percentage of overlapping features with LION relative to HORSE, a larger number of TIGER's semantic features remained facilitated and less impairment occurred than for that of HORSE, which consisted largely of non-overlapping features that were suppressed, resulting in a larger amount of impairment. This model also accounts for integration effects found by M.C. Anderson and McCulloch (1999), where higher integration between items led to the elimination of a retrieval-induced forgetting effect.

Competitor-Competitor Similarity

In the case where there is more than one item competing with the target, the similarity between competitor and competitor is the second variable that influences the degree of the retrieval-induced forgetting effect that takes place (M.C. Anderson et al., 2000b). As noted before, this model predicts that the distinctive semantic features of the competitors are inhibited in order to reduce interference and increase the discriminability of the target during retrieval practice. The model also implies that in the case of more than one item competing with the target, the similarity between the competitors will influence the degree of inhibition, where highly similar competitors (i.e. competitors that share a great proportion of their unique inhibited semantic features) will be subject to greater retrieval-induced forgetting (see Figure 10 below) as compared to competitors that are less similar in their shared inhibited features.

Figure 10: Competitor-Competitor Similarity



Note: Each item in memory is represented by a large circle and the smaller circles within these large circles represent the internal semantic features of an item. Black circles indicate activation; grey circles indicate shared features that are also activated, white circles indicate the competitor's distinctive features and white circles with a line through them indicate the competitor's inhibited distinctive features. The framework predicts that the greater the shared distinctive inhibited competitor features, the greater the inhibition. Thus, in the example above, when the features of the practised item GRASS are activated, the shared semantic features in SPINACH and MUSHROOM are also simultaneously activated. As there is a large proportion of overlapping features between SPINACH and MUSHROOM that are not shared with GRASS, the competing items SPINACH and MUSHROOM will be inhibited to a greater extent.

Thus according to the pattern suppression model, sharing inhibited features impairs recall performance to a greater degree as compared to when the same number of features are being inhibited in dissimilar competitors. Results of Smith and Hunt (2000) can easily be explained using this framework, where they found significant impairment when similarities between category members are encoded and an elimination of a retrieval-induced forgetting effect when differences between the competing items were encoded.

In conclusion, the pattern suppression model not only accounts for the process of first-order and second-order inhibition that takes place in a retrieval practice paradigm, but can also easily provide explanations for contradictory results like Smith and Hunt (2000) and Bäuml and Hartinger (2002).

1.6. Possible boundary Conditions of Retrieval-induced forgetting

1.6.1. Integration

One variable that has been considered as a possible boundary condition for the retrieval-induced forgetting has been integration of material tested. Integration is the process by which connections are made between items that are related but compete with one another for retrieval to conscious awareness (Smith, Adams & Schorr, 1978). This concept has been advanced as an explanation to the facilitated recall performance of experts as compared to non-experts, who are unable to retrieve as much information, not due to the reduced capacity of knowledge stored in memory, but simply because they might not have integrated the old with the new information effectively (Radvansky & Zacks, 1991; Smith et al., 1978). Therefore, the ability of experts to integrate a higher number of similar information into one concept enables them to reproduce more information due to the reduction or even elimination of interference and competition (see also M.D. MacLeod et al., 2003; Carroll et al., 2007). M.C. Anderson and McCulloch (1999) were the first to examine the effect of integration by encouraging participants to relate each item through similarities to other items as well as the cue. Their findings revealed that there was no typical impairment for unpractised items from the practised category found either for participants who were given instructions to integrate study material or for participants who spontaneously integrated material in this manner. Although non-inhibitory theorists view this as a boundary condition to the inhibitory explanations of retrieval-induced forgetting, the inhibitory model of pattern suppression can easily account for this effect. The process of integration serves to increase the similarity in semantic features of the integrated items. The model uses the target-competitor framework (M.C. Anderson et al., 2000b) to illustrate the effects of increased similarity of semantic features shared by target and competitor, where increased similarity between target and competitor would result in recall of the competing item even as there are more activated features for the competitor as compared to suppressed inhibited ones. Evidence provided by Smith and Hunt (2000), where retrieval-induced forgetting effects persisted despite integration of material appear to contradict these findings, but as explained previously, their results can still be explained by the pattern suppression model of inhibition, where similarity of the inhibited semantic features of competitors to a target results in a greater net inhibitory effect. More recently, Carroll, Campbell-Ratcliffe,

Murnane and Perfect (2007) across two experiments showed that knowledge available to experts was protected against retrieval-induced forgetting effects due to higher integration of conceptual information into the pre-existing framework of their domain knowledge as compared to novices. However, they also demonstrated that a 24-hour interval is sufficient to reduce any forgetting effects to negligible levels (Carroll et al., 2007, Experiment 1). In addition to these studies, evidence from the literature also provides evidence in support for inhibitory processes in retrieval-induced forgetting using the principle of integration (Bäuml & Kuhbandner, 2003; Gómez-Ariza et al., 2005; Migueles et al., 2006; Garcia-Bajos & Migueles, 2009; Garcia-Bajos, Migueles & Anderson, 2009; Chan, 2009).

1.6.2. Similarity

Following the effect of integration, the role of item similarity has been proposed as mediating factor for the occurrence of the retrieval-induced forgetting effect. However, this variable is also accounted for by the inhibitory theory of pattern suppression. For example, the investigation conducted by Bäuml and Hartinger (2002) using different degrees of item similarities in categories and sub-categories in order to test its effect on retrieval-induced forgetting, demonstrated robust retrieval-induced forgetting effects for items that belonged to the same category, but an absence of the effect for items that belonged to the same sub-category. The target-competitor framework within the pattern suppression model (M.C. Anderson et al., 2000b) explains the difference in findings through the trade-off between the competitor's shared facilitated semantic features and its suppressed inhibited ones.

1.6.3. Durability

Retrieval-induced forgetting has been viewed as an adaptive process that allows us to function effectively on a day-to-day basis by reducing interference from irrelevant material during a retrieval event (M.C. Anderson et al., 1994; M.C. Anderson & Spellman, 1995; R.A. Bjork, 1989; Macrae & MacLeod, 1999; M.D. MacLeod & Macrae, 2001). It can be argued that in our daily lives we are more likely receive practice of information after a long interval since its encoding, unlike the testing procedure of the retrieval practice paradigm where participants receive practice immediately after the

study phase. Thus, to investigate into its functionality and usefulness in everyday life, the temporal boundaries of this procedure was first looked into by M.D. MacLeod and Macrae (2001) in an impression formation task using personality traits to describe two hypothetical individuals. They inserted a 24-hour delay between the study phase and the retrieval practice phase and their findings demonstrated a strong retrieval-induced forgetting effect. This was supported by Koutstaal and colleagues (1999) who also found retrieval-induced forgetting effects when there was a two-day interval between study and retrieval practice.

The second aspect of the adaptiveness of the retrieval-induced forgetting effect concerns its durability, as the target information to be retrieved is dynamic depending on the context of the situation. Thus, the inhibitory effects should last only temporarily for it to maintain its view as an adaptive process. With regards to the paradigm, as competition is resolved during the retrieval practice phase, the interval of retention seems to influence the duration of inhibition, where shorter intervals typically produce a strong retrieval-induced forgetting effect (M.C. Anderson et al., 1994; M.C. Anderson et al., 2000a; M.C. Anderson and Spellman, 1995). Evidence from past research indicates that the effect has been found to occur in varying lengths, from immediate tests (Ciranni & Shimamura, 1999; Moulin et al., 2002), through to 20-minute delays (M.C. Anderson et al., 1994; Smith & Hunt, 2000). The effect has been shown to dissipate over a 24-hour retention delay (Saunders et al., 2009; Carroll et al., 2007; M.D. MacLeod & Macrae, 2001; Saunders & MacLeod, 2002) but there is also evidence that pre-delay and post-delay tests maintain the effect over 24-hour and longer delays (Miguelés & García-Bajos, 2007; Storm et al., 2006). This persistence is explained as an effect of the pre-delay test through the contribution of output interference. On the other hand, García-Bajos et al. (2009) still found a retrieval-induced forgetting effect after one week without a pre-test delay. The difference between the findings of the two studies could be attributed to the difference in the materials they used, where Miguelés and García-Bajos, (2007) employed a video sequence of actions and Storm and colleagues used category-exemplar word pairs. On the other hand, García-Bajos and colleagues (2009) have used stereotypical personality traits to investigate person memory and perhaps this difference in materials may have caused the persistence of the retrieval-induced forgetting effect in their test. Their findings

supported the results obtained by Tandoh et al. (2007), where retrieval-induced forgetting was found to persist over varying intervals of ten minutes, one hour and one week. An important fact to note in their findings by García-Bajos and colleagues (2009), was the elimination of output interference as a possible explanation for retrieval-induced forgetting, which suggests that there are other explanations for the persistence of retrieval-induced forgetting over longer intervals.

An interesting study that has recently been conducted by Baran and colleagues (2010) focussed on the effect of sleep on competitive forgetting and has important implications for the durability of the retrieval-induced forgetting effect. They employed a modified version of the retrieval practice paradigm, where they provided feedback during the retrieval practice phase and where performance was measured either following a 12-hour interval containing sleep or wake or after mid-day nap and wake intervals. Polysomnography (PSG) measures were used during the 12-hour sleep intervals in order to directly assess the effect of sleep on forgetting. Overall findings from their study indicate that competitive forgetting (i.e. retrieval-induced forgetting) was significantly greater following the wake interval as compared to the sleep interval and thus, they suggest that sleep may decrease competitive forgetting through an active process of memory consolidation or repair that acts on the competing pairs as well as acts to enhance memory for practised pairs (Baran et al., 2010). Further analysis of the data revealed that REM sleep in particular plays an essential role in the reduction of these forgetting effects. These findings suggest that sleep may be an additional component involved in the dissipation of the effect found in previous studies over 24-hour periods (Saunders et al., 2009; Carroll et al., 2007; M.D. MacLeod & Macrae, 2001; Saunders & MacLeod, 2002).

Another surprising finding regarding the effects of retrieval-induced forgetting came from Storm and colleagues (2008), who examined the effects of relearning forgotten items in comparison to relearning items not previously subject to retrieval-induced forgetting. They tested these effects by making participants undergo a series of retrieval practice and relearning cycles designed to induce and eliminate retrieval-induced forgetting effects repeatedly. Each participant was given two practised and two unpractised categories that were relearned and two practised and two unpractised categories that were not relearned.

The retrieval practice block included extra-list items from the practised categories (i.e. items not studied during the study phase), presented as category-plus-two-letter-stem cues; thus making the original studied items from those categories Rp- items and the items from the unstudied categories Nrp items. The relearning block consisted of representations of each category-exemplar pair from the two practised and two unpractised categories that were to be relearned for a particular participant. In each condition, participants were given a category-plus-one-letter-stem cued-recall final test that followed a 5-minute intervening task. Findings from their study indicated that relearning Rp- items benefitted subsequent recall to a greater extent as compared to relearning Nrp items. Thus, it could be seen that relearning not only eliminated retrieval-induced forgetting effects, but also led to facilitation in recall for these previously forgotten items (Storm et al., 2008). This finding is consistent with the new theory of disuse (R.A. Bjork & Bjork, 1992), which postulates that an item's memorial representation is guided by its storage strength (i.e. depth of establishment and amount of inter-associations with other items) and its retrieval strength (i.e. its accessibility in response to a cue/s) The theory states that "the extent to which an item benefits from relearning is a decreasing function of the accessibility or retrieval strength of that item at the time of relearning" (cf. Storm et al., 2008, p. 234). This finding, thus, indicates that loss of items in memory is not permanent, which is consistent with the adaptive account of retrieval-induced forgetting. On the other hand, while it would be difficult for non-inhibitory theories, such as blocking, to account for the facilitated effect of the Rp- items after relearning, this finding does not really lend support to the inhibitory theory of retrieval-induced forgetting, as the pattern suppression model of inhibition may be viewed as based on storage strength and not retrieval accessibility.

It can be seen from the literature that most of the research conducted into the durability of memory effects to date has mainly focused on inhibition effects. Recently, Chan (2010) examined the durability of memory facilitation effects using the retrieval practice paradigm and his findings demonstrate that memory is facilitated between 20 minutes and 24 hours, but asymptotes between 24 hours and 7 days. Thus, evidence suggests that retrieval-induced forgetting and remembering can persist for varying lengths depending

on the methodology employed and that the effect has the desirable and adaptive feature of not enduring over a very long time.

1.7. Alternative explanations of retrieval-induced forgetting

1.7.1. Strategy Disruption Model

The strategy disruption model, originally put forth by B.H. Basden and colleagues (1977) to explain part-set cuing effects, has recently been proposed by C.M. MacLeod, Dodd, Sheard, Wilson and Bibi (2003) as an alternative explanation for the retrieval-induced forgetting effect. This model is based heavily on the assumption that individuals attempt to encode as well as recall information in a serial order. It states that the presentation of items as cues disrupts the natural serial recall order of items that the original material was studied in, and as a consequence impairs recall performance (D.R. Basden et al., 1977; D.R. Basden and Basden, 1995). With respect to the retrieval practice paradigm, the theory states that the selective retrieval of the practised Rp+ items disrupts the original organisation of material within categories that results in the impairment of Rp- items. As no selective practice of items is present for Nrp categories, no strategy disruption takes place and participants are easily able to recall most items from that category.

Dodd, Castel and Roberts (2006) tested this principle across three experiments by manipulating the order in which the practised items were given (i.e. serial order, every other item and random order). In their first study, they replicated the study by Macrae and MacLeod (2001) using traits describing the two hypothetical individuals (i.e. Bill and John) with the inclusion of the serial order and every other item condition. Their findings provided support for their theory of strategy disruption, as retrieval-induced forgetting effects were found only in the random order condition, the condition most similar to the normal employment of the retrieval practice paradigm. Their results demonstrate the elimination of the retrieval-induced forgetting effect in the other two conditions. In order to establish the basis of their principle, they conducted a second experiment in which participants were explicitly requested to memorise the material presented in the exact order that they were presented. The results once again provided support for their theory by demonstrating the absence of retrieval-induced forgetting in the serial order and every other item condition. In their final experiment, results were replicated even with a

different set of stimuli, related stimuli that is characteristically used in retrieval-induced forgetting studies.

Dodd and colleagues (2006) suggested that their results are supported by other findings in the literature, where integration (M.C. Anderson & McCulloch, 1999) and distinctive processing (Macrae & Roseveare, 2002; Smith & Hunt, 2000) prevents against retrieval strategy disruption and the dissipation of retrieval-induced forgetting effects over time may be accounted for by the restoration of the individual's strategy during that time, rather than to inhibitory processes (Macrae & MacLeod, 2001; cf. Saunders & MacLeod, 2006).

On the other hand, the strategy disruption theory is unable to account for a number of findings in the existing literature. For example, strategy disruption is unlikely to play a role in cue-independent forgetting (M.C. Anderson & Spellman, 1995; M.C. Anderson & Bell, 2001), forgetting effects on item recognition tests (Hicks & Starns, 2004), with visual objects (Ciranni & Shimamura, 1999) and on implicit memory tests (Veling & van Knippenberg, 2004). Besides these effects, the model also cannot explain cross-category and second-order retrieval-induced forgetting effects (M.C. Anderson & Spellman, 1995), as these effects go against the assumption that impairment of recall will occur only for items in categories for which strategy is not disrupted. As evidence from past literature suggests that items from unpractised categories that are related to items in the practised categories also suffer impairment (M.C. Anderson & Spellman, 1995; Saunders & MacLeod, 2006), it may be hasty to discount the role of inhibitory processes in the retrieval-induced forgetting effect just yet.

1.7.2. Transfer-appropriate or context-specific forgetting

The transfer-appropriate account of retrieval-induced forgetting was proposed by Perfect and colleagues (2004) in an attempt to fully explain their findings. In all three experiments, Perfect and colleagues associated each exemplar with a specific, unrelated, and independent item before retrieval practice took place (e.g., *apple* was associated with either an episodic cue such as a *face* or an unrelated item *zinc*, before participants studied FRUIT – *apple*). Later, these episodic and item-specific cues were used in the test phase

of the retrieval-practice paradigm to test memory for the suppressed item (Camp et al., 2007). They found retrieval-induced forgetting by using studied categories as cues (e.g., FRUIT) but not with episodic cues, either singly or jointly, nor with the unrelated words as cues (e.g., *zinc*). They interpreted these findings as a form of transfer-appropriate forgetting, in which forgetting is seen only when there is a close match between the conditions when competition arises (the retrieval-practice phase) and when the items are retrieved (the test phase), which means that forgetting occurs only when memory for studied items is tested with the original study cue (Camp et al., 2007, but see Ciranni & Shimamura, 1999).

This account of forgetting suggests that the episodic representations that are activated during memory studies are context-dependent and that different retrieval cues access different aspects of those events (Perfect et al., 2004). It extends the encoding specificity principle (Tulving & Thomson, 1973) to include the assumptions that retrieval practice promotes encoding and that final recall occurs as a result of the strengthening of associations between the specific retrieval cue and those aspects of the event retrieved. Thus, transfer appropriate forgetting takes place due to a reduction in the association between other items and that specific cue relative to the practised cue (Perfect et al., 2004). In other words, forgetting occurs as a result of overlap between the practice and test phases in terms of context. Their account is similar to the inhibitory account of retrieval-induced forgetting, with particular emphasis on the role of context (i.e. both at the item-level and at the experimental-level) in modulating the process of forgetting and thus, evidence in the literature for the presence of cue-independent forgetting can be attributed to the similarity between the retrieval and practice contexts as well as the functional similarity of the cues (Perfect et al., 2004). The model assumes that in the absence of any other information at test, the most likely responses are those made more recently, as adjacent events share more 'context' as compared to more distant events (cf. Perfect et al., 2004). An interesting point to note is that the model postulates that retrieval itself may not be necessary for the retrieval-induced forgetting effect, rather that the effect may be produced by recall as a contextual cue where participants are contextually cued to reinstate their last attempt at recall from the same cue (i.e. during the practice phase). On the other hand, the model itself has not been outlined in detail and is based on a great

number of assumptions, such as the degree of contextual overlap, effects of strengthening of associations, the decay of those associations over time, etc (Perfect et al., 2004).

1.7.3. Control of Spreading Activation through a competitive network model

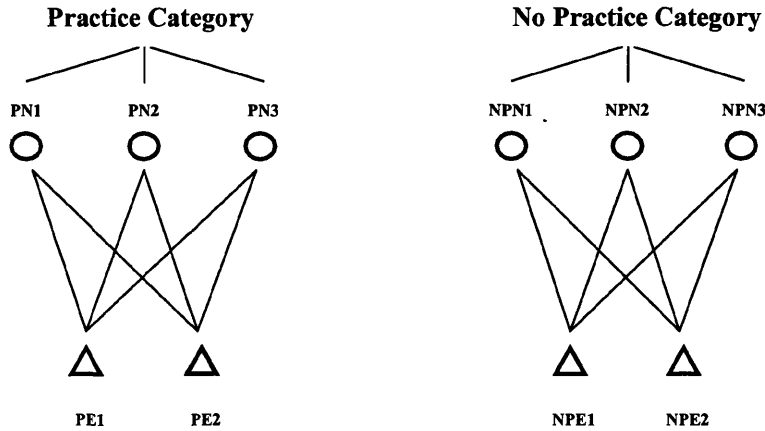
Saunders and MacLeod (2006) proposed an alternative explanation to account for the unintentional retrieval-induced forgetting effects that is in line with the inhibitory account proposed by M.C. Anderson and colleagues (1994), but differs in its interpretation of the underlying mechanism. Whereas M.C. Anderson and colleagues (1994) attribute inhibitory control as operating through the active suppression of the exemplar's representation in memory, Saunders and MacLeod propose an inhibitory control mechanism that limits the spread of activation (Saunders & MacLeod, 2006). A central difference in the inhibitory mechanism proposed by these researchers lies in the location of inhibition, where M.C. Anderson and colleagues believe that inhibition occurs at the exemplar level; Saunders and MacLeod propose inhibition at the level of the category. Their model incorporates both facilitatory and inhibitory effects, where this single model postulates a mechanism that can not only facilitate recall of items through practice (that can be likened to the facilitatory effects of priming on word identification tasks), but also limit the activation of unwanted related items. This model is based on the assumption that activation spreads bi-directionally between super-ordinate and sub-ordinate memories (Underwood, 1965) and in some situations can spread bi-directionally to indirectly associated items (McNamara & Altarriba, 1988). Unwanted items can, thus, be controlled by limiting their activation so they create less interference, and in turn, do not reach the threshold for retrieval. Saunders and MacLeod (2006) operationally defined their model through the use of Oram and MacLeod's competitive network model (2001).

According to Oram and MacLeod's (2001) competitive network model, retrieval practice not only increases connection strength between a particular category cue and an exemplar (Rp+ item), but also simultaneously decreases connection strength between that category cue and associated unpractised exemplar (Rp- item) as a result of partial activation. This implies that the pattern of activating connections between category cues and exemplars can also be applied to the practised Rp+ items; but these items do not suffer in recall performance when novel independent cues are used due to the fact that participants also

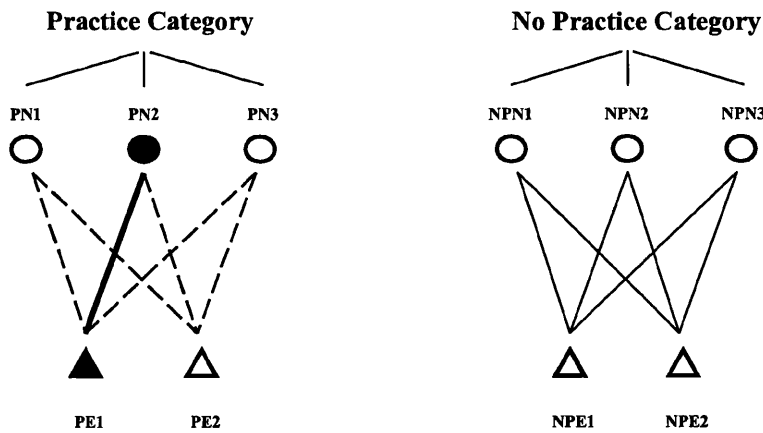
employ episodically defined cues at test (i.e., cues that they have just practised). In other words, use of such episodic cues (*i.e. PN1, PN2 and PN3 denoted in the figure below*) will result in better recall for Rp+ items relative to either Rp- or Nrp items, irrespective of whether independent cues have been employed at test (cf. Saunders and MacLeod, 2006). The connection strengths of Nrp items to their category cue will remain similar to that established during the initial study phase, as the absence of retrieval practice for items in that category implies no partial activation of these items. Thus, this pattern of connection strengths provides explanations for both first-order effects (i.e., retrieval-induced forgetting) and cue-independent forgetting (Oram & MacLeod, 2006; as cited in Saunders and MacLeod, 2006). Figure 11 below illustrates the process of controlled activation that results in retrieval-induced forgetting as a consequence of retrieval practice.

Figure 11: Representation of retrieval-induced forgetting in terms of the control of spreading activation model (Saunders and MacLeod, 2006) based on the competitive model (Oram and MacLeod, 2001)

BEFORE RETRIEVAL PRACTICE



AFTER RETRIEVAL PRACTICE

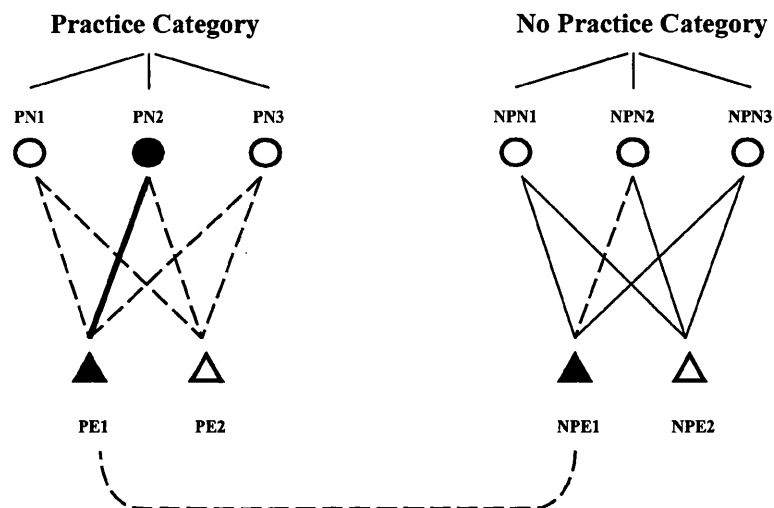


Note: Retrieval-induced forgetting effects, as a result of the partial activation between category memory nodes (i.e. memory neurons) and unpractised exemplars from the practised set due to retrieval practice. PN = Practised set memory node, PE = Practised set exemplar, NPN = Non-practised set memory node and NPE = Non-practised set exemplar. Very bold lines indicate strengthened practised connections between memory node (PN2) and exemplar (PE1). Bold dashed lines indicate partial activation between memory nodes and unpractised exemplar (PN1-PE1, PN1-PE2, PN2-PE2, PN3-PE1, and PN3-PE2). Simple lines indicate connections that are not activated as a result of retrieval practice.

The control of spreading activation model can also account for both cross-category and second-order effects (see Figures 12 and 13 below). Cross-category effects are explained through the decrease in connection strength of the Nrp category cue to the Nrp item that is similar to Rp+ item in the practised set in comparison with the connection strength between the Nrp category cue and other unrelated Nrp items, which occurs as a result of the partial activation induced by selective retrieval practice of the Rp+ item. For example, the retrieval practice cue will activate the memory node (i.e. PN2) for the practised set, which, in turn, will activate the connection between this node (i.e. PN2) and the practised Rp+ item (i.e. PE1) and this activation, in turn, will partially activate any Nrp item (i.e. NPE1) that is related to the Rp+ item (i.e. PE1). As a result, the connection strength will decrease between the unpractised set memory node (i.e. NPN2) and this Nrp-similar (to Rp+) item (i.e. NPE1), relative to the connection between that memory node (i.e. NP2) and the unrelated Nrp item (i.e. NPE2). (Saunders & MacLeod, 2006)

Figure 12: Representation of a cross-category inhibition effect in terms of the control of spreading activation model (Saunders and MacLeod, 2006)

AFTER RETRIEVAL PRACTICE

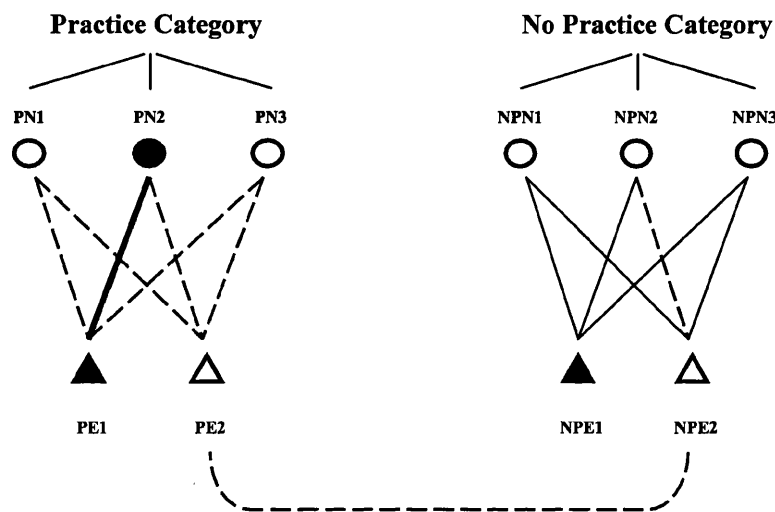


Note: Cross category effects, where the activation connection caused by retrieval practice results not only in the activation of the connection between the memory node and target exemplar, but also in the partial activation between that memory node and unpractised exemplars from the practised set (PE2) as well as unpractised exemplars from the unpractised set that is similar to the practised exemplar (NPE1). PN = Practised set memory node, PE = Practised set exemplar, NPN = Non-practised set memory node and NPE = Non-practised set exemplar. Very bold lines indicate strengthened practised connections between memory node (PN2) and exemplar (PE1). Bold dashed lines indicate partial activation between memory nodes and unpractised exemplar (PN1-PE1, PN1-PE2, PN2-PE2, PN3-PE1, PN3-PE2 and NPN2-NPE1). Simple lines indicate connections that are not activated as a result of retrieval practice.

Second-order effects can similarly be explained by this model (see Figure 13 below), where retrieval practice partially activates the connection between the practised set memory node and the unpractised item in that set, which in turn, partially activates any related item in the unpractised set (Nrp item similar to Rp- item). Similar to cross-category effects, this partial activation will weaken the link to its unpractised memory node related to the connections between that node and the unrelated Nrp item (Saunders and MacLeod, 2006; Oram & MacLeod, 2006; as cited in Saunders and MacLeod, 2006).

Figure 13: Representation of a second-order inhibition effect in terms of the control of spreading activation model (Saunders and MacLeod, 2006)

AFTER RETRIEVAL PRACTICE



Note: Second-order effects, where the activation connection caused by retrieval practice results not only in the activation of the connection between the memory node and target exemplar, but also in the partial activation between that memory node and unpractised exemplars from the practised set (PE2) as well as unpractised exemplars from the unpractised set that is similar to the unpractised exemplar (NPE2). PN = Practised set memory node, PE = Practised set exemplar, NPN = Non-practised set memory node and NPE = Non-practised set exemplar. Very bold lines indicate strengthened practised connections between memory node (PN2) and exemplar (PE1). Bold dashed lines indicate partial activation between memory nodes and unpractised exemplar (PN1-PE1, PN1-PE2, PN2-PE2, PN3-PE1, PN3-PE2 and NPN2-NPE2). Simple lines indicate connections that are not activated as a result of retrieval practice.

It is important to note that this model stresses the notion that retrieval practice cues do not activate the exemplars directly, but instead activate the memory node (i.e. memory neuron) for the practised set, thus accounting for recall performance through activating and strengthening connections between category cues and exemplars via retrieval practice. This model suggests that recall performance is a function of the way in which information is organised and the way in which learning occurs (cf. Saunders & MacLeod, 2006). On the other hand, evidence to support the existence of and to provide validation of this category level inhibitory mechanism in the retrieval-practice paradigm is yet to be uncovered.

1.8. Role of emotion in retrieval-induced forgetting

The two main areas in which research is conducted in order to investigate the role of emotion in modulating retrieval-induced forgetting are the emotional content of the material and the emotional state of the individuals (Bäuml et al., 2010). The emotional content of materials has so far been studied by manipulating the emotional content of to-be-remembered words, pictures and autobiographical memories that were self-generated. Amir, Coles, Brigidi and Foa (2001) were the first to examine retrieval-induced forgetting in memory for positive social, negative social and non-social information using individuals diagnosed with generalised social phobia (GSP) and non-anxious control (NAC) individuals. Using the retrieval-practice paradigm, they found the presence of retrieval-induced forgetting effects for both positive and non-social information in GSP and NAC participants. Interestingly, with regards to negative social information, they only found the effect in NAC participants and not in GSP participants. This observed impairment in inhibition for negative material was in line with the nature of GSP individuals, who exhibit vigilance for negative information and threatening stimuli in their social environment. They postulate that they sustain their social anxiety, as their cognitive processing pattern hinders their learning of and habituation to social information that is negative. Since then, Barnier, Hung and Conway (2004) demonstrated the effects of retrieval-induced forgetting with the use of a modified retrieval practice paradigm for self-generated negative, neutral or positive episodic memories of individuals. Although they found a standard retrieval-induced forgetting effect for all three categories of memories, they also observed that fewer positive memories were recalled as compared to negative ones, which in turn were fewer as compared to neutral memories. In contrast, Moulds and Kandris (2006) investigated the effect of negative material using depressed individuals and found no retrieval-induced forgetting effect for both low and high dysphorics. They attribute the lack of this effect to the distinctiveness of their negative categories, where depressed individuals may interpret some words as symptoms of depression which in turn, would make them more salient (Moulds & Kandris, 2006)

Storm, Bjork and Bjork (2005) explored the role of retrieval-induced forgetting in maintaining and modifying impression using neutral-negative and neutral-positive trait

descriptions of targets. Findings demonstrated that the retrieval practice of neutral traits resulted in the impairment of both negative and positive trait descriptions, but that there was no change in the likeability ratings of these target individuals. Moreover, negative and positive trait impairment was comparable for the male target but there was greater impairment of negative traits for the female target.

More recently, two separate studies were conducted by Kuhbandner, Bäuml and Stiedl (2009) and Dehli and Brennen (2009) investigating the role of negative and emotional stimuli in retrieval-induced forgetting. Kuhbandner and colleagues (2009) demonstrated the persistent effect of retrieval-induced forgetting for negative stimuli, indicating that this effect remains unaffected by the emotionality of material. Further analysis of the data revealed that there was higher recall for negative items that were high in emotional intensity and this increased recall was present with participants that were high in dispositional negative affectivity. On the other hand, Dehli and Brennen (2009) found no such retrieval-induced forgetting effects for negative and positive emotional stimuli measured on tests of recognition. The lack of retrieval-induced forgetting for negative stimuli supports the findings of Amir and colleagues (2001) in generalised social phobics and Moulds and Kandris (2006) in dysphorics. However, the lack of impairment for unpractised positive stimuli has been seen in only one other study till date (see Harris et al., 2010)

Thus, from the above studies we can say that the retrieval-induced forgetting effect persists even with the use of emotional material in the normal population, but that the effect for emotional content varies comparably to that of non-emotional content (Bäuml et al. 2010). The area investigating the effect of varying individual emotional states in retrieval-induced forgetting has recently been looked into by Bäuml and Kuhbandner (2007) by inducing either positive, negative or neutral moods with emotional or non-emotional stimuli (Bäuml et al., 2010). The researchers induced these three mood states prior to retrieval practice by means of presenting emotional and non-emotional pictures to participants and instructing them to let the pictures influence their mood states. Based on previous literature regarding the different mood-induced styles of processing (Clore & Huntsinger, 2007), Bäuml and Kuhbandner hypothesised that positive moods should

create more interference due to relational processing (but see Anderson, Green & McCulloch, 2000) and therefore a retrieval-induced forgetting effect, while negative moods should reduce interference through item-specific distinctive processing and therefore an absence of the effect was predicted for this condition. Results confirmed their predictions with the presence of a retrieval-induced forgetting effect in both positive as well as neutral moods, and the absence of the effect while in a negative mood. They discussed the implications of their results in terms of the effect of repeated questioning on a witness that may be emotional. Very recently, Harris, Sharman, Barnier and Moulds (2010) investigated the effects of varying levels of dysphoria on retrieval-induced forgetting of autobiographical memories that were positive or negative in nature and found retrieval-induced forgetting effects for only negative and not positive autobiographical memories in both low and high dysphoric individuals. These results are inconsistent with most of the previous research, which demonstrate that people in negative moods are more likely to remember negative events. They attribute their failure to find retrieval-induced forgetting effects for positive memories to the assumption that depressed individuals are more motivated to remember positive memories in order to improve their current mood – a mood incongruity bias (Josephson et al., 1996). Thus, evidence shows mixed support for the effect of mood in retrieval-induced forgetting; but it is important to keep in mind that only a small amount of research has been conducted in this area to date and it will take a few more years of research to establish any directional trend in understanding the effects of mood on forgetting.

1.9. Brief overview of the neural Correlates of retrieval-induced forgetting

During the past few years, a few studies have examined the brain neural processes underlying the retrieval-induced forgetting effect (Johansson et al., 2007; Wimber et al., 2008, 2009; Spitzer et al., 2009; Norman et al., 2007; Bäuml et al., 2010). One of the first studies to examine the inhibitory processes underlying retrieval-induced forgetting in the brain was conducted by Conway and Fthenaki (2003), and their results demonstrated that right and left lesions in the frontal cortex of the brain, responsible for conscious thought, affected only intentional and not unintentional inhibition (i.e. directed forgetting vs. retrieval-induced forgetting). On the other hand, right and left lesions in the temporal lobe, responsible for processing of complex stimuli in addition to smell and sound,

resulted in a reduction of the inhibitory effect, indicating that practice did not have much of an effect on these patients.

Other neurological studies have focussed on the neural correlates of retrieval-induced forgetting during the retrieval practice phase and the final recall test (Bäuml et al., 2010). Johansson, Aslan, Bäuml, Gabel and Mecklinger (2007) were the first to employ electrophysiological measures of brain activity (event-related potentials; ERPs) in order to examine the effects of retrieval-induced forgetting in the brain. Their findings provide neurological support to the inhibitory theories in retrieval-induced forgetting as they demonstrate that prefrontal electrophysiological responses showed increased positivity in the selective retrieval practice condition as compared to the relearning condition, which, in turn, led to forgetting in the final recall test for participants in this condition. Johansson and colleagues (2007) contrasted two reprocessing styles in the intermediate phase of the retrieval practice paradigm - retrieval practice vs. relearning. They used relearning as a baseline condition on the basis of results of previous studies demonstrating that only retrieval practice and not relearning induces forgetting of not-reprocessed material and therefore indicating that retrieval-induced forgetting is a recall-specific mechanism that calls upon inhibitory processes to work on non-processed material (Bäuml, 1997, 2002; Ciranni & Shimamura, 1999; M.C. Anderson et al., 2000; M.C. Anderson & Bell, 2001; Bäuml & Aslan, 2004). Their study employed covert retrieval practice, where participants were instructed to silently relearn or covertly retrieve the non-target words in order to steer clear of muscle artifacts in the electrophysiological recordings (Johansson et al., 2007). According to Johansson and colleagues, differential covert retrieval during retrieval practice should be reflected in differential non-target recall in the final test. However, their results demonstrated that although the two participant groups differed significantly in their level of induced forgetting, there was no such difference in non-target recall (between-group comparison of non-target recall showed equal performance, $t(22) < 1$, *ns*, indicating that reprocessing in the intermediate phase was equally beneficial for the 2 groups). Although the authors have taken the ERP difference between relearning and retrieval to reflect the differential involvement of retrieval inhibition, it could be argued that there might be other processing differences between the two reprocessing conditions, where the presentation of word stems in the retrieval condition calls for an

active maintenance of the category cue in working memory, which is not required in the relearning condition where the exemplars are provided intact. However, they argue that this explanation depends on the notion that working memory for the category cue promotes retrieval success and that this increases the probability of inhibition. As the results of their study indicated that there was no difference in non-target recall as a function of the amount of induced forgetting, the authors consider that the retrieval inhibition account easily accounts for their pattern of results (cf. Johansson et al., 2007, p. 1339)

Wimber and colleagues (2008) were the first to use event-related functional magnetic resonance imaging (i.e. fMRI), which provides an image of the change in brain blood flow, in order to map the neural functional processes in retrieval-induced forgetting, in particular aiming to test the inhibitory account against blocking accounts of retrieval-induced forgetting. An influential neural model of controlled memory retrieval postulates that left anterior ventrolateral prefrontal cortex (VLPFC) subserves the controlled retrieval of weak memories, whereas mid-VLPFC subserves the selection of a memory among competing memories (Badre and Wagner, 2007, cf. Wimber et al., 2008, p. 13419). According to this model, if inhibition were responsible for the decreased retrieval of non-practised information it would be reflected in activation of the left anterior VLPFC, which increases control demands as their weakened representations are temporarily less available. On the other hand, increase in activation in mid-VLPFC would indicate that the impairment reflects blocking via competition from practised information, as this account predicts that the recall of unpractised items related to the practised items makes higher demands on the selection processes and are therefore blocked (Wimber et al., 2008). They demonstrated that retrieval practice results in activation in the anterior ventrolateral prefrontal cortex (VLPFC, Brodmann areas - BA45 and BA47), which is essential for controlling the retrieval of weak semantic memorial representations. The results also demonstrated that the highest activation in BA 47 occurred during the recall of impaired unpractised items and normatively weak control items, suggesting that activity in this area is primarily sensitive to the momentary availability of a memory trace (cf. Wimber et al., 2008, p. 13425). Activation in the anterior cingulate cortex (ACC) was also observed and they postulate that these hemodynamic changes in the VLPFC

combined with activity in the ACC were related to the forgetting observed in the final recall task. Wimber and colleagues interpret these findings as reflecting increased demands on controlled retrieval during the final recall of impaired unpractised items, caused by an inhibitory process during retrieval practice that reduced their later memory availability (Wimber et al., 2008, p. 13425)

Thus, both the studies mentioned above provide neural evidence for the suppression account of inhibitory processes as underlying the retrieval-induced forgetting effect (Bäuml et al., 2010). Recently, Spitzer, Hanslmayr, Opitz, Mecklinger and Bäuml (2009) were the first to use measures of electrophysiological activity (i.e. EEG) in addition to ERP measures in order to examine activity underlying recognition of practised and unpractised words (Spitzer et al., 2009). Their findings indicate that recognition of Rp-items could be identified by a reduction in theta power (4-7 Hz) as well as a reduction in occipital gamma power (60-90 Hz) and that facilitation of retrieval practice were reflected by increased positivity in parietal ERP and a stronger decrease in oscillatory alpha power. These results implicate different underlying processes for facilitation and inhibition and are in line with the view that the ACC detects interference from Rp- items and the VLPFC resolves the conflict by strengthening the Rp+ items and inhibiting Rp- ones in memory (Bäuml et al., 2010). On the other hand, it could be argued that these results do not establish cause and effect relationships between recognition of practised and unpractised words and their corresponding increase or decrease in activity in the brain and that it may be difficult to disentangle the two.

To conclude, evidence from the above stated research using fMRI, ERP and EEG measures of brain activity (Johansson et al., 2007; Wimber et al., 2008, 2009; Spitzer et al., 2009) seem to provide support for the item suppression theory of inhibition as the underlying process of retrieval-induced forgetting.

1.10. Generality of Retrieval-induced forgetting

Since its proposition in 1994 by M.C. Anderson and colleagues, there has been an explosion in terms of the research conducted in the area of retrieval-induced forgetting, going beyond word lists and stating of theoretical assumptions through testing for the

effect in various kinds of populations and applying its effect in different contexts. A brief overview of the studies conducted in various areas will be outlined in the section below.

1.10.1. Unusual test materials

As mentioned before, retrieval-induced forgetting has been found to occur even with the use of independent test cues, recognition tests and tests of implicit memory (M.C. Anderson & Spellman, 1995; Ciranni & Shimamura, 1999; Ford et al., 2004; Gómez-Ariza, Lechuga, & Pelegrina, 2005; Hicks & Starns, 2004; Levy et al., 2007; Matsuda et al., 2010; Saunders & MacLeod, 2006; Soriano et al., 2009; Spitzer & Bäuml, 2007; Spitzer et al., 2009; Starns & Hicks, 2004; Veling & Van Knippenberg, 2004). As it is important that this effect is found with stimuli that we encounter in our daily lives, a variety of other stimuli have also been used to examine the presence of the effect.

Ciranni and Shimamura (1999) were the first to examine this effect with the use of visuo-spatial stimuli grouped by colour, shape and location. In their first two studies, using stimuli that were grouped perceptually by colour or shape, they demonstrated that retrieval of items in a certain perceptual group (e.g. colour) impaired later recall of the other unpractised items of the group. In their next two studies, they demonstrated the cue-independent nature of this effect using the same stimuli, where retrieval-induced forgetting occurred even when the cues employed at test matched the original study cues but not the retrieval practice cues. In their final experiment, they demonstrated that retrieval was a necessary condition for this effect to take place and that representation instead would not be enough to induce forgetting (Ciranni & Shimamura, 1999, see also Anderson & Spellman, 1995, but see Camp et al., 2007). Thus, their studies provided impetus to research using different stimuli in order to examine retrieval-induced forgetting.

Koutstaal and colleagues (1999) used more complex visual materials in their studies, where participants initially acted out a set of activities using different objects provided by the experimenter. These participants returned to the laboratory two days later and either completed a set of unrelated tasks or they were asked to try and remember themselves performing tasks that were portrayed by other individuals in photographs shown to them

(i.e. the review condition). Findings demonstrated significant impairment for non-reviewed activities in the final free recall test. Phenix and Campbell (2004) extended the retrieval-induced forgetting effect to include mathematical multiplication operations or number facts. Participants practised a sub-set of simple multiplication problems (e.g. $2 \times 7 = ?$) and later engaged in a true-false product verification task that also measured response latencies and errors. Their findings indicated that multiples of the practised operands that were not practised answers were susceptible to retrieval-induced forgetting effects.

A few years later, Hauer, Wessel, Merckelbach, Roefs, and Dalgleish (2007) were the first to examine the effects of retrieval-induced forgetting by rehearsing either central or peripheral aspects of emotional pictures, while leaving other aspects unrehearsed. However, across two experiments, they failed to find any impairment for the unrehearsed central or peripheral aspects of these emotional pictures during test, indicating that more complex visual and emotional material may protect against retrieval-induced forgetting.

More recently, Saunders and colleagues (2009) investigated the retrieval-induced forgetting effect with the use of mental imagery of semantic word lists (Experiments 1, 2 and 3) as well as more complex episodic materials in the first- and third-person (Experiment 4). Across all four experiments, performance on free and cued-recall tasks demonstrated that mental imagery facilitates memory for visualised items as well as impairs memory for the related but non-visualised information; and this effect occurs irrespective of whether the information is imagined in the first or third person.

1.10.2. Developmental studies

Retrieval-induced forgetting has also been demonstrated in individuals belonging to different age groups. Ford and colleagues (2004) were the first to investigate the likelihood of the forgetting effect in 7-year old children and young adults (Experiment 2) using pictures that highlighted various animals and food. The children received practice for half of these exemplars from half of the categories during the following days and were finally tested on a category-cued recall test (Experiment 1) and a written test of recognition (Experiment 2). Findings demonstrated retrieval-induced forgetting effects on

both tests that were comparable to the effects found in young adults. Zellner and Bäuml (2005) employed the procedures of retrieval-induced forgetting (Experiment 1) and part-list cuing (Experiment 2) to examine inhibition effects in three age groups: first/second graders, fourth graders and young adults. Using the retrieval practice paradigm, the authors adjusted task difficulty between the age groups by adding a cover story for both the children's age groups, reducing the number of items on the list of words (8 items per list as compared to 10 items for young adults) and by making the distracter task for the children's groups shorter and less demanding. Findings indicated comparable effects across all three groups, where not only was a significant facilitation effect found for the practised items, but also the recall of unpractised items was impaired. This was one of the first studies (see also Ford et al., 2004) to show intact inhibition effects in children as young as second graders. They also demonstrated similar effects in all three age groups using the part-list cuing paradigm. These results were in contrast to previous studies conducted using the directed-forgetting paradigm, where first and third graders successfully recalled the previously learned list and forgetting effects were observed only in fifth graders (Bray et al., 1983; Harnishfeger & Pope, 1996) and thus, they undermine the theory of inhibition.

Lechuga and colleagues (2006) demonstrated differences in cognitive development between 8-year olds and 12-year olds employing an updating task (Experiment 1) and a retrieval-practice task (Experiment 2). The updating task required the participant to listen to a series of words and then recall only part of the series based on their judgements regarding the size of objects or animals in the series of words. These judgements play a key role in determining which words should be recalled and which should be intentionally suppressed. The retrieval practice task, on the other hand, resulted in unintentional suppression, as prior retrieval not only increases the probability of retrieving the practised items, but also decreases the probability of retrieving the associated unpractised items from the same practised category. Lechuga and colleagues (2006) found differences between the two age groups only for intentional inhibitory processes and not for unintentional processes in cognition, where 12-year olds were better at intentionally suppressing information as compared to the 8-year olds but there was no difference

between the two when unintentional inhibitory processes were required to resolve competition.

Conroy and Salmon (2006) examined the effect of post-event discussion styles (low, high or no discussion) on 5 to 6-year old children's memory of a staged event ("Visiting the Pirate"). The event contained four scenes, half of which were logically connected (i.e. making the pirate map and finding the treasure) and the other half were arbitrarily connected (i.e. becoming the pirate and winning the key) and all the children participated individually in the staged event. The post-event discussion took place over the next immediate three days after which their memory for the event was tested using free recall, prompted recall and specific questioning. Results indicated that discussion style increased the children's memory in the high discussion condition as compared to the low and no-discussion conditions; however, there was no difference found between these conditions in the impairment of memory for non-discussed information. Findings also demonstrated that a logically structured event protected against impairment for non-discussed information as compared to an arbitrarily structured one. Thus, task structure and post-event discussion play important roles in influencing what is recalled and what information is forgotten.

Aslan and colleagues (2007) demonstrated intact retrieval-induced forgetting in older adults episodic memory using category-exemplar word lists, which challenge the inhibition-deficit account that states that older individuals demonstrate lesser inhibitory effects as compared to younger individuals. They found this inhibitory effect in older individuals using both category-cued free recall (Experiment 1) and in a category-stem independent probe test (Experiment 2), and thus concluded that unintentional inhibitory effects did not suffer due to advanced age of the individuals. Further evidence in support of this claim was given by Hogge, Adam and Collette (2008), where they also demonstrated intact retrieval inhibition in older individuals as compared to younger adults. More recently, Gómez-Ariza and colleagues (2009) using the retrieval practice paradigm and item-specific cues at test, showed comparable inhibitory efficiency in memory for shared-subject sentences in young as well as older individuals. The latest evidence in support of the claim that retrieval-induced forgetting is also demonstrated in

older as compared to younger adults comes from the research conducted by Matsuda and Matsukawa (2010). Using a category-cued recall test, they demonstrated a comparable retrieval-induced forgetting effect in both younger as well as older participants. On the other hand, results from the recognition test suggest that this effect was only observed for older individuals as compared to the younger adults, indicating that the release of inhibition declines with age. Thus, it can be concluded that unintentional forgetting effects develop at an early age and are also intact for older-aged individuals, undermining the inhibitory theory of retrieval-induced forgetting. On the other hand, these results are consistent with the view that retrieval-induced forgetting is an adaptive process and thus is required at all ages to function effectively.

1.10.3. Clinical Populations

Past research has demonstrated the presence of the retrieval-induced forgetting effect in normal subject population. A number of studies have also been conducted using samples from clinical populations in order to examine the conditions under which the effect occurs. Moulin and colleagues (2002) examined retrieval-induced forgetting in patients diagnosed with *Alzheimer's disease*. These patients usually make a high number of intrusion errors (i.e. wrongly recalled non-target words), which have been thought to stem from a deficit in inhibitory processes in these individuals. Using the retrieval practice paradigm and lists of category-exemplar pairs, Moulin and colleagues demonstrated normal levels of inhibition in both category cued recall and category generation tests, indicating that the basis of these intrusion errors made by patients diagnosed with Alzheimer's disease may not be inhibitory in nature or that inhibition is not the only or correct explanation for retrieval-induced forgetting.

Nestor and colleagues (2005) used unrelated (Experiment 1) and related category-exemplar word pairs (Experiment 2) to examine whether impairments in associative memory typical in patients diagnosed with *schizophrenia*, were inhibitory in nature. The categories were taken from Anderson and Spellman (1995) and the 48 category-exemplar pairs (36 experimental, 12 fillers) consisted of both related (e.g., COTTON/LEATHER) and unrelated (e.g., SOUPS/LOUD) categories (Nestor et al., 2005). Findings indicated the expected delayed category-cued recall in both experiments for unrelated category-

exemplar pairs, but the results also demonstrated a significant retrieval-induced forgetting effect indicating that the delayed recall may not be attributable to inhibitory processes. On the other hand, when cross-category inhibition was examined using related categories, although Nrp-similar recall rates dropped substantially, no such predicted cross-category inhibition effects were found to occur for both schizophrenic patients as well as the controls. Further evidence supporting intact retrieval-induced forgetting effects in the associative memory of schizophrenics was provided by AhnAllen and colleagues (2007), who demonstrated retrieval-induced forgetting in both recall and recognition tests. They only found a difference in the demonstration of this effect with regards to the strength of categories, where schizophrenic patients showed retrieval-induced forgetting for both strong and weak categories as compared to the control participants who demonstrated the effect only for strong category exemplar word pairs. On the other hand, Soriano and colleagues (2009) conducted two experiments to test the inhibitory processes exhibited by schizophrenics as compared to normal controls. Results of their first experiment were in line with previous findings in this area, where the use of a category-cued recall test demonstrated similar retrieval-induced forgetting effects in both groups. However, a reduced retrieval-induced forgetting effect was found in schizophrenic patients on a test of recognition which is said to minimise the effect of blocking, thus indicating impaired inhibitory processes in the retrieval process of schizophrenic patients.

More recently, four studies were conducted in order to examine retrieval-induced forgetting in patients with *posttraumatic stress disorders*, *clinical depression* and *attention-deficit hyperactivity disorder*. The development and maintenance of posttraumatic stress disorder (PTSD) is believed to be related to impairment in associative memory processes. Amir and colleagues (2009) investigated the effect of rehearsing threatening and non-threatening information in patients diagnosed with PTSD, as compared to 'trauma-control' individuals (i.e. individuals who reported at least one criterion trauma and scored less than a 5 on the posttraumatic diagnostic scale) and 'non-anxious' control individuals. Findings demonstrated an absence of the retrieval-induced forgetting effect in patients with PTSD and trauma-control individuals as compared to non-anxious controls, indicating that these groups have reduced inhibitory control as compared to normal non-traumatised individuals.

Whitmer and Banich (2010) demonstrated that individuals who possess the tendency to ruminate, whether it is due to anger or depression or it has a more general basis, demonstrate deficits in their inhibitory processes which form the basis for this tendency. Groome and Sterkaj (2010) also demonstrated a relationship between inhibitory deficits and clinical depression. Their findings indicated that although the overall recall scores were comparable between clinically depressed individuals and normal individuals, there was a significantly lower retrieval-induced forgetting effect demonstrated by depressed individuals. The authors conclude that there was a possible causal relationship between retrieval-induced forgetting and depression, as the effect was deficient in clinically depressed individuals (Groome & Sterkaj, 2010). Storm and White (2010) also provided evidence in support for the deficit in inhibitory control in a clinical population by examining retrieval-induced forgetting in individuals diagnosed with Attention Deficit Hyperactivity Disorder (ADHD), a disorder characterised by a deficit in inhibitory control. Their results indicated that both ADHD and non-ADHD individuals demonstrated retrieval-induced forgetting on a final category-cued recall test, but only non-ADHD participants displayed the effect on a final category-plus-stem-cued recall test. Storm postulates that the failure to control for output interference may explain why so many studies have observed normal levels of retrieval-induced forgetting in populations with established inhibitory deficits (e.g., Conway & Fthenaki, 2003; Ford, Keating, & Patel, 2004; Moulin, Perfect, Conway, North, Jones, & James, 2002; Nestor, Piech, Allen, Niznikiewicz, Shenton, & McCarley, 2005; Zellner & Bäuml, 2005), (cf. Storm, 2010)

1.10.4. Drug and Anxiety Arousal

The effects of various drugs have also been examined over the past decade. Edginton and Rusted (2003) were the first to conduct research using drugs in the area of retrieval-induced forgetting. They investigated the effects of nicotine (i.e. usually associated with increased focus and decreased intrusions) and scopolamine (i.e. usually associated with disinhibition) on retrieval-induced forgetting. Their results indicated that nicotine increased inhibition for unpractised exemplars, whereas scopolamine equally reduced overall recall of both practised and unpractised exemplars, which go against the inhibitory theory of retrieval-induced forgetting. Thus, Edginton and Rusted (2003) postulate that

the absence of scopolamine on inhibition in the retrieval-induced forgetting paradigm argues for a more complex subdivision of 'inhibitory' processes, which may be differentially influenced by cholinergic blockade (cf. Edgington & Rusted, 2003, p. 351). Rusted and Alvares (2008) further examined the effects of nicotine and the effects of mood changes on retrieval-induced forgetting and implicates nicotine effects in modulating the processing of information. Their findings provided evidence in support of the results obtained by Edgington and Rusted (2003), which demonstrated a significant increase in the retrieval-induced forgetting effect for non-smoking healthy individuals when they were administered 1.0 mg of nicotine. The current findings also showed that negative arousal induced by an unsolvable anagram did not affect recall, which is consistent with the findings of Bäuml and Kuhbandner (2007) where negative moods were shown to encourage item-specific processing of information that protected against inhibition. Overall, these the results obtained by Rusted and Alvares (2008) indicate that the modulation of episodic memory processes is more influenced by arousal due to nicotine as compared to anxiety. Recently, Koessler and colleagues (2009) demonstrated that psychological stress eliminates retrieval-induced forgetting effects, elevates levels of salivatory cortisol and reduces feelings of well-being. Thus, evidence from past research indicates that arousal induced by drugs or psychological stress has a negative impact on inhibitory processes in the cognitive processing of information.

1.10.5. Autobiographical content

A number of studies have looked into the area of retrieval-induced forgetting using autobiographical content. As previously mentioned, Barnier and colleagues (2004) demonstrated retrieval-induced forgetting for negative, neutral or positive autobiographical memories of individuals, with differences in the number of memories recalled dependent on the emotionality of the memory, where negative memories were better recalled as compared to positive ones. Their finding has implications for differential storage and retrieval processes involved in cognitive processing.

Wessel and Hauer (2006) applied the retrieval practice paradigm across two studies to relatively broad categories of positive and negative autobiographical memories. Participants were told that they would take part in two separate studies each three weeks

apart on emotion and memory, specifically autobiographical memory and memory for visual material, and they later had to generate 12 positive and 12 negative specific autobiographical memories. Three weeks later some of these autobiographical memories were rehearsed using the retrieval practice paradigm. The cover story was given to try and prevent participants from rehearsing the memories during this interval. Findings of both studies indicate the presence of a retrieval-induced forgetting effect, where unpractised autobiographical memories that were related to the practised autobiographical memories were more poorly recalled as compared to those unrelated autobiographical memories. Whereas, Wessel and Hauer claim that retrieval-induced forgetting effects decrease when applied to everyday social settings, Coman, Manier and Hirst (2009) demonstrate comparable effects in real-life settings using recognition tests of autobiographical memories of the September 11th tragic incident that were either practised through interviews (Experiment 1) or shared socially through conversation (Experiment 2). The prevalence of this effect in speakers and listeners even through the simple use of conversations regarding similar experiences with different details has important implications for collective remembering and forgetting of events.

Recently, Harris and colleagues (2010) also employed positive and negative autobiographical memories in the domain of retrieval-induced forgetting in individuals experiencing dysphoria and only found the effect for negative autobiographical memories in both high and low dysphorics. The absence of the effect for positive memories was attributed to the motivation level of dysphoric individuals to improve their current mood by increasing recall for such memories.

1.10.6. Eyewitness scenarios

The area of eyewitness testimonies has been widely researched using the retrieval practice paradigm due to its straightforward applicability to a real-life situation. Shaw, Bjork and Handal (1995) were the first to examine retrieval-induced forgetting using mock eyewitness scenarios due to the similarity between the practice phase and police questioning, where the repeated questioning of witness regarding a case by the police and lawyers could be comparable to the repeated practice questions that participants answer regarding a sub-set of items. They modified the retrieval practice paradigm to include

slides depicting the theft of a wallet at a party instead of the usual paired associates, in order for the results to be more directly applicable. The presentation of the visual slides were followed by a mock interrogation phase (i.e. retrieval practice) where participants were required to repeatedly recall sub-sets of information regarding the theft depicted in the slides. There was also a control condition where participants did not undergo any post event questioning in order to compare the effects of interrogation. Findings demonstrated a significant retrieval-induced forgetting effect in the interrogation condition, where practice of the questions asked during interrogation not only facilitated later recall for those answers but also impaired recall for unpractised related information about the incident. Results of the control condition demonstrated no such practice and retrieval-induced forgetting effects. Although these results seem very significant with regards to its implications about the interrogation process used by police officers, they may suffer from output interference effects as the practised items were more likely to appear in the top positions as compared to the last few positions.

Later, M.D. MacLeod (2002) conducted two studies on eyewitness testimonies that accounted for output interference effects and his findings still demonstrated significant retrieval-induced forgetting effects. Once more, a series of visual slides were presented to participants that depicted two crime scenarios. In the first study, the slides contained items (i.e. electrical and non-electrical items) that had been stolen during two burglaries and participants were asked to imagine that they were police officers investigating these crimes and thus pay close attention to the slides. The second study depicted two women going from door-to-door making bogus charity collections and participants were asked to imagine that they had witnessed the event. Findings from both studies indicated that repeated questioning led to impaired recall for the related but unretrieved responses, and this occurred despite the participants being motivated to remember. M.D. MacLeod's study was also the first to involve the retrieval of details describing an individual. These results had important implications for the validity of eyewitness testimonies regarding incidents or descriptions of suspects.

Saunders and MacLeod (2002) extended the paradigm used by Shaw and colleagues (1995) and M.D. MacLeod (2002) to examine the effects of misinformation, by including

phases that introduced misleading post-event information and the assessment of the misinformation effects. Participants read two narratives describing two burglaries (i.e. Jones's house and Smith's house) with ten items stolen from each house that were located in different parts of the house. Following a distracter task, participants were required to free recall as many stolen items in both burglaries as they could to check for retrieval-induced forgetting. Following this, participants were presented with additional questions that included one erroneous piece of information regarding one of the burglaries (i.e. Rp+, Rp- or Nrp misinformation). Following a distracter task, participants engaged in a forced-choice recognition task (i.e. multiple choice questions for one correct and two erroneous responses) regarding the stolen items. The critical question contained one correct, one erroneous misinformation plus one incorrect response in order to determine the presence of the misinformation effect. Findings demonstrated that only those items that were subject to retrieval-induced forgetting (i.e. Rp- items) were susceptible to misinformation, whereas Rp+ and Nrp items remained resistant to the misinformation effect. In their second study, they demonstrated that this effect lasted only as long as retrieval-induced forgetting persisted (i.e. misinformation effects failed to emerge when retrieval-induced forgetting effects dissipated over 24 hours). M.D. MacLeod and Saunders (2005, 2008) further examine inhibition as the underlying processes governing retrieval-induced forgetting and misinformation effects and point out two principles in interviewing witnesses, suggesting the initial interrogation to be as exhaustive as possible and for sufficient time to lapse between initial retrieval of information and final time of statement in order to counter retrieval-induced forgetting and post-event suggestion effects.

Miguelles and Garcia-Bajos (2007) also examined retrieval-induced forgetting in eyewitness memory, by practicing retrieval of either actions performed or offender characteristics in the crime, which was shown to the participants in the form of a video of a man being mugged while withdrawing money from a cash machine. The effect was tested both immediately and after 24 hours. Findings demonstrate typical retrieval-induced forgetting effect for offender characteristics both immediately as well as 24 hours later. On the other hand, there was no such effects for actions performed at both times of test, indicating that the actions were possibly well integrated with aspects of the event, which protected them from retrieval-induced forgetting.

Saunders and colleagues (2009, Experiment 4) examine the effects of imagination on retrieval-induced forgetting, where participants read two narratives written in the third person (i.e. burglary and car accident) and then practised imagining a sub-set of information either as performing the tasks themselves (i.e. in the first-person) or as viewing someone else as performing them (i.e. in the third-person). Control condition participants were required to answer post-event questions for the same items. Findings demonstrate facilitated recall for the imagined items and impaired recall for the related non-imagined items in both the first-person and third-person conditions. Moreover, this significant retrieval-induced forgetting effect was comparable to that observed in the post-event questioning control condition. On the other hand, recently, Odinot and colleagues (2009) demonstrated findings contrary to the evidence from past research, where despite the presence of practice effects, repeated retrieval practice of partial information did not lead to retrieval-induced forgetting effects. Participants viewed a videotape containing two stories that depicted car accidents and then received practice twice (i.e. after one week or after three weeks) concerning global and specific details of the scene. The final test involved filling out a 30-item open-ended questionnaire about details in the video and rating their confidence level for each item. Results showed that although participants did not demonstrate any retrieval-induced forgetting effects, they found that this retrieval practice translated into higher confidence ratings for both correct and incorrect information.

1.10.7. Person Memory

Retrieval-induced forgetting has been found to occur in person memory and the development and maintenance of impressions (Macrae & MacLeod, 1999; M.D. MacLeod & Macrae, 2001). Macrae and MacLeod (1999, Experiment 1), presented participants with ten positive traits describing each of two target individuals (i.e. Bill and John), following which they received retrieval practice for half of the traits of one of the targets. Results showed a significant retrieval-induced forgetting effect, where participants recalled fewer of the unpractised traits as compared to the traits associated with the other target that was not practised. M.D. MacLeod and Macrae (2001) extended this research to examine the temporal boundary conditions of retrieval-induced forgetting by manipulating the interval times between the different phases of the study. Results

demonstrated an absence of the effect when there was a 24 hour interval between the guided retrieval practice phase and the recall phases, and a reduction of the effect if the 24 hour interval was placed between the study phase and the retrieval practice phase.

Storm and colleagues (2005) examined whether retrieval-induced forgetting of traits could alter metacognitive judgements such as ratings of likeability. Participants were given 4 photographs, each associated with five neutral traits and 5 valenced traits (positive or negative). They were asked to rate the photographs for likeability amongst six other dimensions (e.g. intelligence and attractiveness). Participants then performed retrieval practice on the neutral traits (Rp+ items), thereby making the positive or negative traits Rp- items. They were then asked to complete the ratings of judgement again, before reporting all of the traits associated with the targets that were originally learned. Results demonstrated strong retrieval-induced forgetting effects for both positive and negative traits suggesting that the prior retrieval of neutral traits reduced accessibility of the non-retrieved valenced traits, thus, showing that we are able to alter what we remember about others; however, metacognitive judgements of how likeable the target was unaffected by the presence of retrieval-induced forgetting, indicating that the impressions we form about others do not seem to be based on the accessibility of relevant information in memory. On the other hand, it may be argued that these results could be explained by the anchoring and adjustment heuristic proposed by Tversky and Kahneman (1974), where participants may have relied too heavily on one trait or piece of information and then adjusted their judgements to that piece of information based on additional information. Thus, once an anchor is set, there is usually a bias towards that value (Tversky & Kahneman, 1974). Chapter 2 of this thesis will expand on this concept in more detail.

Macrae and Roseveare (2002) examined retrieval-induced forgetting in self-referent and other-referent processing. Participants were instructed to memorise ten indoor and ten outdoor gifts and were asked to imagine that either they themselves had purchased the gifts (i.e. self-referent processing), or that the gifts had been purchased by their best friend or that the gifts had been purchased by an unspecified other (i.e. other-referent processing). They then received category cued-stem retrieval practice for half of other

items of one category. Following a distracter task, participants were asked to recall all the gifts from each category. In order to assess the presence of any spontaneous distinctive processes that occurred, participants were also required to rate the extent to which they had imagined potential recipients for the gifts during the initial study phase. Findings were in line with the predictions made, where no retrieval-induced forgetting effect emerged for self-referent processing as this is considered to be a distinctive process; and there was a significant retrieval-induced forgetting effect for the two other-referent processing conditions (i.e. best friend and other). Attrill and MacLeod (2004) also examined impression formation for the 'self' and for an 'other' experimental partner to see whether retrieval-induced forgetting affects memory for positive and negative information, relevant either to oneself or to another person. After spending ten minutes at the beginning of the study interacting with a partner, participants were asked to select positive and negative traits that described themselves and separate ones that described their partner. No retrieval-induced forgetting effect was found for positive or negative traits concerning themselves as well as for negative traits describing their partner. However, retrieval-induced forgetting was found only for positive traits describing their experimental partner. Their results are consistent with the findings of Macrae and Roseveare (2002), which show that highly relevant self-information is protected from retrieval inhibition. Negative information about another person, on the other hand, is diagnostic about that individual and thus, forgetting negative information about another individual may not be adaptive for one's survival.

Dunn and Spellman (2003) examined the effects of stereotypical information in retrieval-induced forgetting. They asked participants to learn and associate stereotypical and individuating traits describing hypothetical individuals (Asian-American woman or mother). Results showed that practicing stereotypic information reduced the ability to recall individuating information and that practicing individuating information, in turn, lead to the reduced ability to recall stereotypic information about a target individual. Therefore, retrieval-induced forgetting has also been shown to occur for socially meaningful materials. Quinn and colleagues (2004) further confirmed that the magnitude of retrieval-induced forgetting is influenced by the evaluative consistency within stereotype representation. Participants read consistent and inconsistent (positive and

negative) stereotypic traits associated with two target individuals (David and Susan) whose stereotype label was either known or unknown (Athlete or Feminist) and later received retrieval practice for either half of the target's positive or negative stereotypic traits. Their results demonstrated a typical retrieval-induced forgetting effect that occurred for recall of unpractised stereotypic traits that were inconsistent with the practised traits, but there was no effect for unpractised stereotypic traits that were consistent with the practised items, which were actually facilitated relative to the baseline condition. More recently, Garcia-Bajos and Migueles (2009) looked at the effect of retrieval-induced forgetting on stereotype representation by manipulating the typicality of traits (High, low or control) associated with stereotypes of people in certain professions (Athlete, Scientist) as compared with when the traits were associated with the name of a person (Mikel, Jon). Findings suggest that not only was there an absence of retrieval-induced forgetting for high-typicality traits associated with the stereotype professionals, both immediately and after one week, but also that both high- and low-typicality traits in this condition were facilitated in a one-week recognition task. The high-typicality, low-typicality or control traits associated with a person's name, on the other hand, produced a typical retrieval-induced forgetting effect both immediately and at a one-week interval, as they were treated as independent features of the person and no stereotype was activated.

1.11. Conclusions from retrieval-induced forgetting

To summarise, retrieval-induced forgetting is generally considered to be an adaptive process which allows us to function effectively in our everyday lives, by preventing related but unwanted information from coming to mind in place of target information. Although inhibition as the underlying process of retrieval-induced forgetting is the most popularly accepted theory, various other alternative explanations have been presented in the literature (i.e. non-inhibitory theories, strategy disruption and control of spreading activation). The effect has been widely researched over the past fifteen years and has been found to persist even in tasks of recognition, with independent cues and in tests of implicit memory. Evidence from past research suggests that it can be applied to a variety of contexts, ranging from eyewitness testimonies through emotional and negative materials to how we remember characteristics and actions performed by other individuals.

Chapter 1

This widely established phenomenon is thus, viewed as an effective process for our daily living.

CHAPTER 2

JUDGEMENTS & IMPRESSION FORMATION

Making judgements about other people around us is a part of everyday life and all of us engage in this activity either deliberately, by carefully evaluating the evidence at hand, or in a snap fashion, by intuitively basing our judgements on a few bits of information and preconceived notions. Research in the area of recall and impression formation has found that the manner in which we make these judgements about other people depends on whether the goal is one of impression or memory (Hastie & Park, 1986). The present thesis broadly aims to explore the relationship between availability of memory for trait information associated with other people and impression judgements regarding those people and this relationship is examined in terms of the literature on judgement and decision making as well as the literature on metacognitive judgements. This chapter presents an overview of the literature on judgements and impression formation, specifically focussing on the distinction between memory-based and on-line judgements proposed by Hastie and Park (1986). In order to better understand the mechanism underlying these judgements, the chapter will begin with a brief outline of the literature on the anchoring and adjustment heuristic in the area of judgement and decision-making. It will then go on to describe the existing research on the relationship between recall and impression formation, as the current thesis attempts to elaborate on the effects of forgetting (or lack of it) on impression judgements. This chapter will then cover the meaning, definition and theories underlying metacognitive judgements, as these theories provide an alternate explanatory framework for the impression results obtained in this thesis. As judgements of honesty (i.e. in the sense of implied trustworthiness) were the key measure of impression ratings in the present thesis, a section outlining the research on the relationship between facial appearances and judgements of trustworthiness will be included; and the chapter will conclude with a statement of the main aim of the thesis.

2.1. The Anchoring and Adjustment Heuristic

2.1.1. Meaning and Scope

The anchoring and adjustment heuristic was first put forth by Tversky and Kahneman (1974) in their seminal paper as one of three basic heuristics in intuitive judgement – where availability and representativeness were the other two heuristics. The availability heuristic refers to the tendency to predict the probability of an event based on how easily an example can be brought to mind; whereas the representative heuristic refers to the tendency to judge the likelihood of category membership by how closely an object or event resembles a particular prototype (Tversky & Kahneman, 1974). The anchoring and adjustment heuristic in decision making was originally observed in what is known as the anchoring and adjustment task or paradigm. In their classic study, Tversky and Kahneman asked participants to provide an estimate of the percentage of African countries in the United Nations with reference to randomly generated numbers by a spinning wheel of fortune (rigged to either the numbers 10 or 65). Their results demonstrated that the median estimates of the percentage of African countries in the United Nations were 25 and 45 for groups that received 10 and 65, respectively (cf. Tversky & Kahneman, 1974; p. 1128). This heuristic emphasises the strategy that people intuitively use to estimate probability judgements in uncertain situations, where they begin with information that they already know (i.e. an anchor) and then adjust until they arrive at an acceptable and plausible value (Tversky & Kahneman, 1974). However, adjustment requires mental effort and tends to be insufficient and thus, the final estimate is biased towards the initial anchor. The typical anchoring and adjustment paradigm consists of two stages, where participants are initially required to make a comparative judgement about whether a value is more or less than a given anchor value (e.g. Is Mount Everest taller or shorter than 2,000 / 45,500 feet?), and are subsequently requested to arrive at an absolute estimate value of the target (e.g. What is the actual height of Mount Everest?). The typical result in such a paradigm demonstrates a bias of the absolute estimated value towards the initial anchor value, where the median estimate of participants who received 2,000 feet as their anchor value was 8,000 feet and the median estimate of participants who received 45,500 feet as their anchor value was 42,500 feet (study by Jacowitz & Kahneman, 1995; cf. Epley & Gilovich, 2005, p. 200).

These anchoring effects have been replicated in a variety of settings – general knowledge (e.g. Epley & Gilovich, 2001; Mussweiler & Strack, 1999; Mussweiler & Englich, 2005), probability estimates (Chapman and Johnson, 1999, Experiment 2), legal judgements (Englich & Mussweiler, 2001; Englich et al., 2005, 2006; Hastie et al., 1999), valuation decisions (Mussweiler et al., 2000), forecasting (Critcher & Gilovich, 2008), negotiation (Galinsky & Mussweiler, 2001) self-efficacy (Cervone & Peake, 1986) and many more (cf. Furnham & Boo, 2011, p. 36). Furnham and Boo (2011) point out that the studies conducted in laboratory settings may have questionable generalisability and validity, as participants were university students and the questions used may not be representative of decisions made in daily life. On the other hand, they acknowledge the validity of the robust findings for more “real-world” judgement and decision-making tasks, such as legal judgements, valuations, forecasting, negotiation and self-efficacy.

2.1.2. Underlying mechanisms

The underlying mechanisms of the anchoring effect have been a topic of debate and discussion for the past four decades, and thus far, there are a few accounts that have come into prominence in the literature on judgement and decision-making. The first, and earliest, explanation was put forth by Tversky and Kahneman (1974). They proposed that people arrive at a judgement based on insufficient adjustments from the given anchor value, thus biasing the final estimate toward the anchor value. If the anchor value is presumed to be more extreme than the boundary of the range of plausible values for the question, people adjust the boundary of the range of plausible values in question toward the given anchor value (Strack & Mussweiler, 1997). However, since then, research has demonstrated that the process of adjustment may not account for the strong influence of the effect (see Mussweiler & Strack, 1999; Mussweiler & Englich, 2005). Mussweiler and Strack (1999) proposed the ‘Selective Accessibility Model’ to explain the underlying mechanism of anchoring effects. They suggested that people answer the first comparative question through hypothesis testing, where the anchor value is tried as equal to the correct target value, and is thus considered as a plausible answer (p. 138). This process (i.e. the search for a similar answer) would increase the accessibility of anchor-consistent information and simultaneously decrease the accessibility of anchor-inconsistent information, which would, in turn, bias the absolute value towards the anchor value (as it

was based on the accessible consistent information given for the comparative task). This model is also consistent with models (such as the confirmatory hypothesis testing model) that suggest that anchors increase the consideration of common features and decrease the consideration for distinctive features between the target and the anchor (see Chapman & Johnson, 1994; Jacowitz & Kahneman, 1995; cf. Epley, 2004, p. 244).

Epley and Gilovich (2001, 2005) compared the underlying mechanisms of the anchoring effect to a tuned deck (i.e. a magic trick that has many strategies to obtain the result) and suggest that there are at least two mechanisms underlying the anchoring effect, where selective accessibility is activated for experimentally-provided anchor values and the process of insufficient adjustment accounts for self-generated anchor values (Epley, 2004). According to Epley and Gilovich, experimentally-provided anchors have to be considered by people as the correct target value, even if only for a moment, whereas self-generated anchors are known to be wrong from the beginning. Thus, self-generated anchors do not invoke a confirmatory search, and subsequently, an increased accessibility of anchor-consistent information (Epley & Gilovich, 2001, p. 391). Epley and Gilovich (2001, Experiments 2 and 3) went on to demonstrate that participants serially adjusted from self-generated anchors and that vertical or nodding head movements (up and down fashion) increased participants' willingness to accept values that first come to mind as compared to horizontal or shaking head movements (side to side fashion). The view of differential mechanisms was also supported by their results for no effect of head movements for participants that were given experimentally-provided anchors (Epley & Gilovich, 2001).

A third account of the anchoring effect was proposed by Wegener, Petty, Detweiler-Bedell and Jarvis (2001). Wegener and colleagues (2001, 2010) suggest that anchors can be viewed as cues that indirectly influence information processing, where anchors are 'hints' to reasonable answers during low-elaboration anchoring (i.e. non-thoughtful processing) and activate anchor-consistent information during high-elaboration anchoring (i.e. during effortful thought processing). Thus, this perspective can be seen as a combination of the two theories of anchoring-and-adjustment and selective accessibility in terms of elaborate information processing styles (Furnham & Boo, 2011). Wegener and

colleagues anchoring based their account on research in the area of attitude change. They suggested that the core of the anchoring and attitude change settings are similar in that people are presented with viewpoints (such as messages advocating that people function better with 8, 7, 6, 5, 4, or 3 hours of sleep) that differ from their existing viewpoint and they generate cognitive “arguments” for the adoption of the new viewpoint. When the advocated viewpoint is too extreme (such as a message advocating that people function better with 1 or 0 hours of sleep), people might generate “counterarguments” or even ignore the viewpoint completely (Wegener et al., 2001). Thus, theories of attitude change predict an inverted-U pattern in which attitude change first increases and later decreases as the advocated message extremity increases (cf. Wegener et al., 2001, p. 63-64). They applied the same logic to research on the anchoring effect, suggesting that implausible or extreme anchors should result in a decreased anchoring effect (as compared to moderate or plausible anchors). This prediction contradicts those of the anchor-and-adjust and selective accessibility theories. The anchoring-and-adjustment account predicts that the initial anchor values guide subsequent adjustment. Therefore, increases in the anchor values should result in larger anchoring effects. The selective accessibility model also predicts that extreme anchors lead to larger anchoring effects, as extreme answers would be provided due to activation of anchor-consistent information (Strack & Mussweiler, 1997; Mussweiler & Strack, 1999). In contrast, Mussweiler and Strack (2001a) demonstrated that extreme or implausible anchors produced similar absolute estimates, and they suggested that judges appear to compare the anchor to the boundary value of a distribution of plausible values as a self-set standard in the selective accessibility process, thus combining the adjustment and selective accessibility theories to explain the effects of implausible anchors. Furnham and Boo (2011) point out that although the insufficient adjustment and selective accessibility theories postulate different underlying mechanisms for the anchoring effect, they both suggest that anchor extremity beyond the range of plausible answers does not increase the anchoring effect (cf. Furnham & Boo, 2011, p. 38). Findings from the studies conducted by Wegener and colleagues (2001) indicate that the mediating factor in situations with extreme anchors is the judges’ perception of anchor plausibility and this perspective has given rise to a new area of research in anchoring effects.

2.1.3. *Factors affecting the anchoring effect*

Relevance of the anchor value to the task

Research has demonstrated that anchors that have informational relevance to the task play a role in influencing susceptibility to subsequent anchoring effects (Furnham & Boo, 2011). Hastie and colleagues (1999) demonstrated that the more compensation a plaintiff requested for, the more they got (low anchor - \$15, where median award was 50 million; and high anchor - \$50, where median award was 150 million). They also found an effect of location for plaintiffs, where local plaintiffs were awarded more as compared to geographically remote plaintiffs (Hastie et al., 1999). Marti and Wissler (2000) also demonstrated that award size increased as the plaintiff's request increased, but decreased with the most extreme request. These results are consistent with all three accounts of the anchoring effect, where anchoring effects only occur and vary within the range of plausible answers and where there is no increase for extreme anchors that are outside the boundary range of plausible answers. English and colleagues (2005) demonstrated that the sentencing for rape cases are influenced by the prosecutor's sentencing demand, as the legal system allows the prosecutor to present his assimilation first to the jury, who in turn, use this information as their anchor values. The recommendation of the defence attorney, on the other hand, only partially mediates the impact of the prosecutor's demand on the judge's decision, thus placing the defendant at a distinct disadvantage (English et al., 2005). Thus, the studies mentioned here suggest that the relevance of the anchor value to the task influences the anchoring effect. However, irrelevant anchor values have also been found to produce anchoring effects (spinning wheel - Tversky & Kahneman, 1974; throwing a set of die – English et al., 2006). In addition, Critcher and Gilovich (2008) demonstrated through three studies that environmental incidental anchors also produce anchoring effects. Their first study showed that the number on a line-backer's jersey (i.e. 54 vs. 94) influenced estimates of his performance, where probability estimates regressed on the line-backer's jersey number. Likewise, study 2 demonstrated that the model number of a product (i.e. P17 vs. P97) affected estimates of its proportion of sales in the domestic market and study 3 demonstrated that estimates of spending for a dinner were higher for a restaurant named "Studio 97" as compared to "Studio 17". Studies by English and Mussweiler (2001) and English and colleagues (2006), which tested the difference between the influence of relevant and irrelevant anchor values on the

magnitude of the anchoring effect found no significant differences between the two, suggesting that irrelevant anchors produce similar effects in judgemental decisions as compared to relevant or informational anchors (Furnham & Boo, 2011). Thus, the evidence suggests that both task-relevant and task-irrelevant anchors can influence judgements.

Factors relating to the judge

This section will discuss factors relating to the individual judge that play a role in the anchoring effect, such as mood, knowledge or expertise, motivation and personality (see Furnham & Boo, 2011, for a more comprehensive review). Regarding the effect of mood, there is evidence that people process information differently when they are in a happy mood (through the use of heuristic strategies) as compared to when they are in a sad mood (through more deliberate and efficient strategies) and thus, people who employ superficial heuristic cognitive strategies are more susceptible to judgemental biases (Furnham & Boo, 2011). Research in the area of the anchoring effect, however, has shown that there are smaller anchoring effects for people in a happy or neutral mood as compared to people in a sad mood (Bodenhausen et al., 2000; Englich & Soder, 2009). This is consistent with the selective accessibility or confirmatory search model, which suggests that people who engage in effortful thinking regarding their judgemental anchor would, in turn, elicit anchor-consistent information and would thus, be highly susceptible to the anchoring effect. In their first experiment, Bodenhausen and colleagues (2000) demonstrated that in the low-anchor condition, sad participants gave lower estimates than neutral-mood participants and in the high-anchor condition, sad participants gave higher estimates than neutral-mood participants. In their second experiment, they investigated the emotionality of material for both sad and happy people, on the premise that negative material content will be processed at a deeper level for sad participants as compared to positive material content (see mood-congruency judgemental bias, Bower, 1991). Their findings indicated that this inflated anchoring effect for sad participants generalised across positive, neutral and negative material content domains (Bodenhausen et al., 2000).

Englich and Soder (2009) also investigated the combined effect of mood and expertise on anchoring effects through two studies on legal decision-making (Study 1) and numeric estimates (Study 2). On the basis that the elaborate information processing style of experts may be immune to effects of mood, they predicted that mood would only modulate anchoring effects in non-experts (Englich & Soder, 2009). Study 1 mimicked a legal setting, where participants were either experts (legal professionals) or non-experts (lay people) who were induced with either happy or sad moods through writing out a description of a happy or sad personal incident. Participants acted as trial judges in a shoplifting case and were exposed to either a low (3 months probation) or high (9 months probation) sentencing anchor. As predicted, mood modulated anchoring effects in non-experts, but not in experts. Results showed strong anchoring effects for both happy and sad experts, as well as for sad non-experts. However, happy non-experts remained uninfluenced by the nature of the anchor (Englich & Soder, 2009). In study 2, the same predictions were tested in a different setting. Happy and sad participants had to make numerical estimates for either the height of the Brandenburg gate (i.e. low expertise) or the rent for a student apartment (i.e. high expertise). Findings from this study replicated those obtained in study 1, where mood affected only low level experts and not high level experts (Englich & Soder, 2009). The above findings, taken together, suggest that a happy mood may lead to an elimination of anchoring effects in lay people. Other studies have shown that experts are also susceptible to anchoring effects (Mussweiler et al., 2000; Northcraft & Neale, 1987; Englich & Mussweiler, 2001; Englich et al., 2005, 2006; cf. Furnham & Boo, 2011). Mussweiler and colleagues (2000) demonstrated a robust anchoring effect for car dealers and car mechanics who had more than 5 years experience in the field (i.e. experts). Northcraft and Neale (1987) also demonstrated that real estate pricing estimations provided by estate agents were also assimilated to the anchors. In addition, Englich and colleagues (2005, 2006) were significantly influenced by irrelevant anchors on their sentencing decisions (Furnham & Boo, 2011). In contrast, Wilson and colleagues (1996, Study 1) found no anchoring effects for knowledgeable people, where people who were knowledgeable were not influenced by an arbitrary anchor as they could obviously retrieve the correct answer from memory (Wilson et al., 1996). Thus, further investigation into the effects of mood and expertise on the anchoring effect need to be undertaken for better understanding of its mechanisms (Furnham & Boo, 2011).

Research on the influence of factors such as motivation, incentives and forewarnings on the anchoring effect has been inconclusive. Some studies found a persistent anchoring effect despite any influence of payoffs, incentives or forewarnings (Tversky & Kahneman, 1974; Wilson et al., 1996, Study 5), while other studies have demonstrated lesser anchoring effects when participants were forewarned about insufficient adjustment of self-generated anchors (LeBoeuf & Shafir, 2009; Epley & Gilovich, 2005; see Furnham & Boo, 2011, p. 40). Finally, research into the effect of the participants' personality traits on judgemental anchoring has demonstrated that people low in extraversion and high in conscientiousness, agreeableness (Eroglu & Croxton, 2010) and openness to experience (McElroy & Dowd, 2007) are more susceptible to the anchoring effect. These results can be accounted for by the selective accessibility model, where the above attitudes make the individual more sensitive to anchor cues, thus activating confirmatory search mechanisms (Furnham & Boo, 2011, p. 40).

The aforementioned studies show that the anchoring effect significantly influences judgement and decision-making. Three different, but not conflicting, models or theories have been put forth to account for this anchoring phenomenon; and its robust effects have been demonstrated using a wide variety of stimuli, with different people and across a range of settings. In the area of impression formation and social judgements, the anchoring and adjustment model has been regarded as a mechanism that people spontaneously employ to form judgements as information is encoded in memory (Lopes, 1982, 1987; Hastie & Park, 1986). The next section of this chapter will focus on the relationship between social judgements and memory, specifically on whether (or not) target information available in memory influences future judgements concerning the target and will elaborate on the role that the anchoring and adjustment model plays in this relationship.

2.2. Memory and Impression Judgements

In their seminal paper, Hastie and Park (1986) reviewed the existing experimental findings in the area of memory and social judgements and identified five theoretical models of information processing. They attempted to explain some of the mixed findings in the literature by proposing a distinction between *memory-based* (i.e. where information

is initially retrieved and then used to form a judgement) and *on-line* judgements (i.e. where information is evaluated and integrated as it is being encountered to form a judgement). This section will initially outline the five theoretical information processing models in the area of memory-judgement relationships that contribute to the understanding of memory-based and on-line judgements, followed by a description of the role of memory-based and on-line judgement tasks on final impression judgements as given by Hastie and Park (1986). This section will finally elaborate on the subsequent research, which employed personality traits as a basis for on-line judgements in the area of memory and impression judgements, as this area is most relevant to the current thesis.

2.2.1. Theoretical Information Processing Models

The available memory-judgement models in the social cognition literature postulate the existence of an information-evaluating mechanism called the 'judgement operator', which generates a conclusion on which judgement is based (Hastie & Park, 1986, p. 259). Hastie and Park (1986) outlined five information processing memory-judgement models (see Figure 14 below) that could be classified according to causality into three groups – no-priority independence (i.e. two-memory hypothesis), memory causes judgement (i.e. availability bias) and judgement causes memory (i.e. biased retrieval, biased encoding and incongruity-biased encoding) (cf. Hastie & Park, 1986, p. 259).

The *independence model* proposes that there is no relationship between memory processes and judgements. Thus, the encoding of information into memory and the judgement formed by the judgement operator are two separate and independent processes that take place simultaneously (see Anderson, 1981, Hastie & Park, 1986). The *availability model*, on the other hand, proposes that availability of information in memory is directly related to the final judgement, where information from the external environment is encoded first in working memory and later in long-term memory. During this process, the perceiver is unaware that this information will be required to form a later judgement. At the time when a judgement is explicitly required, the perceiver inputs this information from long-term memory into the judgement operator, which then generates a judgement based on that information. Likewise, when recallability of information is later tested, the information retrieved from long-term memory is employed to generate

information on that test. Thus, a biased judgement will reflect a biased sample of recalled information (Hastie & Park, 1986).

The *biased retrieval model* is the most common process model that proposes that judgement causes memory (Hastie & Park, 1986, p. 260). This model postulates that information is encoded in working memory, and then is simultaneously input to long-term memory as well as operated upon to generate an initial judgement conclusion. When the judgement is explicitly required, the perceiver reports the judgement conclusion (i.e. from either working memory or long-term memory depending on how much time has passed since the encoding of information). At the time of the recall test, when the perceiver searches long-term memory for information, the judgement conclusion biases retrieval access towards judgement-consistent information and thus, the recall test provides evidence from memory that confirms the initial judgement conclusion. The *biased encoding model*, on the other hand, proposes that the information is biased at the point of encoding, instead of retrieval; where information enters working memory and is directly input to the judgement operator, which not only produces an initial judgement, but also uses that judgement to filter subsequent judgement-consistent information into long-term memory. The perceiver, thus, reports the initial judgement when it is explicitly required and as a consequence of this biased encoding process reports the biased judgement-consistent information on the later recall test. Finally, the *incongruity-biased encoding model* proposes a reverse information process to that of the biased-encoding model. It proposes that information enters working memory and is directly input to the judgement operator to produce an initial judgement, which then influences processing of later information. If judgement-inconsistent information is encountered, it is subject to 'special processing' or attached with 'special tags', which enhance its associative links in long-term memory. Thus, when an explicit judgement is required, the perceiver reports the initial judgement conclusion and when memory is tested for evidence, more incongruent information is reported from long-term memory, as this information has an advantage over other information due to its attached special tags or rich associative network (Hastie & Park, 1986, p. 261).

Figure 14: Five Information Processing Models



Although each of the above models postulate a unique information processing style, Hastie and Park (1986) point out that in situations where memory-judgement relationships occur, it is possible that more than one of the above models can account for the final performance (e.g. both encoding and retrieval biases may apply).

2.2.2. Memory-based vs. On-line judgements

To further understand the relationship between memory and social judgements, Hastie and Park (1986) proposed an explanation of the mixed findings in the literature, based on the distinction between the *source of inputs* to the judgement operators, namely memory-based and on-line judgement tasks (Hastie & Park, 1986). *Memory-based judgements* are based on information that is retrieved from long-term memory, where the information is first retrieved and then the judgement operator uses this information to arrive at a final judgement. On the other hand, *on-line judgements* are not based on direct information that is retrieved from memory, but are made by the judgement operator by constantly integrating and updating the new information presented from the external environment. Thus, memory-based judgements assume a direct memory-judgement relationship, whereas on-line judgements assume an indirect one. According to Hastie and Park (1986), this distinction can account for the mixed findings in the literature by predicting the pattern of outcomes based on these two kinds of judgement tasks, where memory-based tasks are accounted for by the availability model and on-line judgement tasks can be explained by one or more of the other four theoretical information processing models described above.

Hastie and Park (1986) identified three examples of on-line judgement tasks in the experimental literature – impression judgements (the presentation of trait adjectives to participants one at a time, where the judgement operator uses these traits to update the impression immediately and continuously); judgements of morality (the presentation of information about a defendant in a legal setting) and probability revision judgements (the presentation of two bookbags containing poker chips of two colours, where random samples from the bag would be informative of which bag had been selected). They suggested that the ‘judgement operator’ in such tasks would most likely take the form of the ‘anchoring and adjustment’ model initially proposed by Lopes (1982, 1987), where

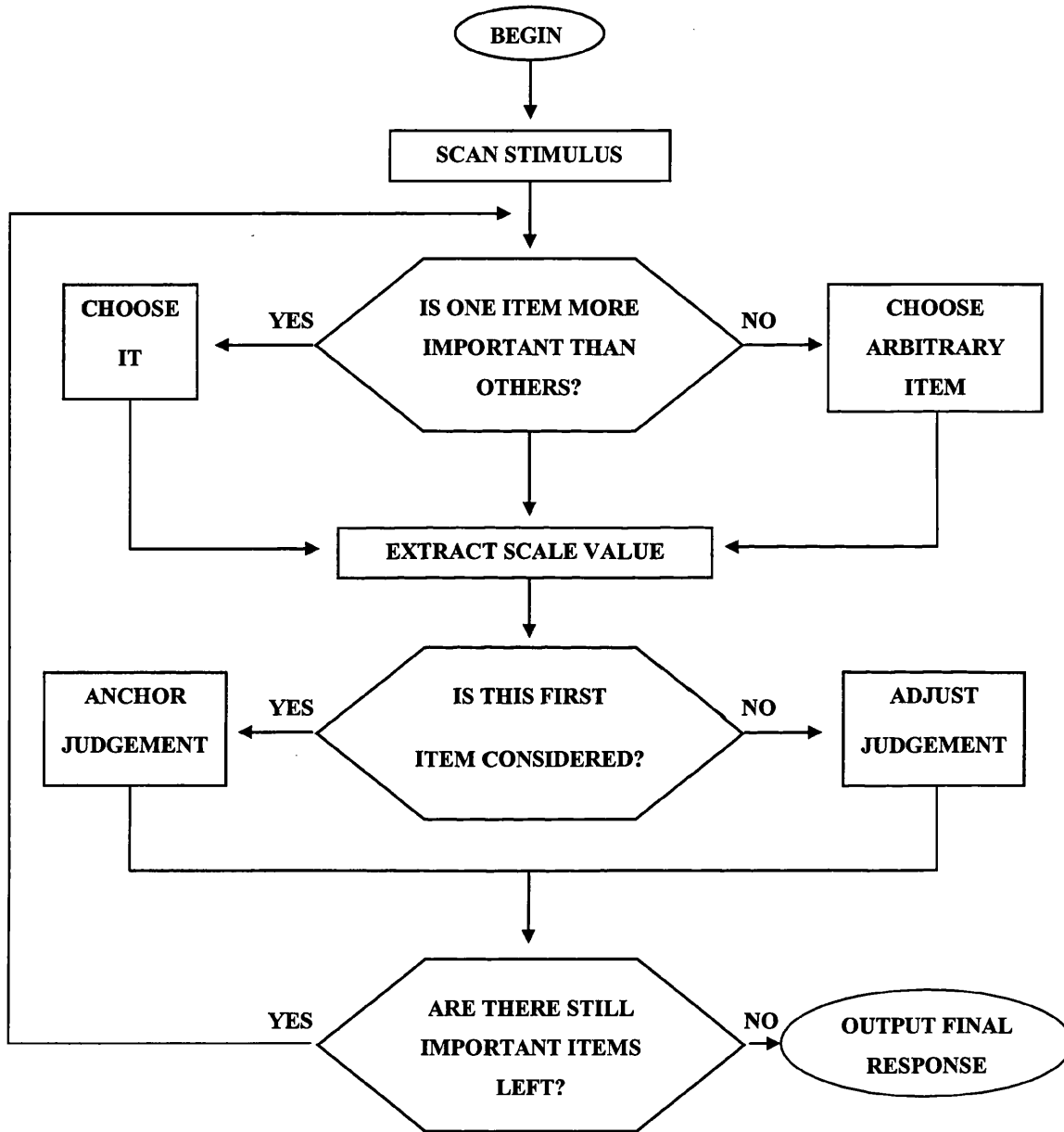
participants who are required to make the judgements revise, on-line, as items of evidence are encountered and input into the judgement operator (cf. Hastie & Park, 1986, p. 261). This model will be briefly elaborated on later in this section. Hastie and Park (1986) also suggested that most social psychological judgements are made on-line (e.g. trait judgements, judgements of causality, attribution judgements in the context of unexpected events, judgements about social goals, and judgements associated with social categories or activities) and are not memory-based.

The distinction between on-line and memory-based judgements was empirically tested in four experiments by manipulating the *time* at which participants were asked to judge a target based on the provided target-descriptive information (Hastie & Park, 1986). They predicted that on-line judgement tasks would not be correlated with recall performance, whereas there would be a high correlation between memory-based tasks and recall performance. Participants were either told that they would have to make the judgement *before* the information was presented (on-line judgement) or were told that they would have to make the judgement only *after* the presentation of the information (memory-based judgement). Results from all four experiments (i.e. judgements of the target's job suitability, gender, exercise, sociability, intelligence, friendliness and likeability) confirmed the predictions of their model, where there were substantial correlations found between memory and judgement measures in the memory-based tasks, but not in the on-line tasks (Hastie & Park, 1986). They suggested that the hypothetical judgement operator is perhaps closest to the anchor-and-adjust operator as proposed by Lopes (1982) and that people only employ this operator for on-line tasks and not for memory-based tasks (Hastie & Park, 1986).

A serial procedural theory of judgement, based on the 'anchoring-and-adjustment' heuristic proposed by Tversky and Kahneman (1974), was introduced by Lopes (1982, 1987) in the area of memory-judgement relationships. According to Lopes (1982), the judgement process consists of scanning, anchoring and adjustment operations in a serial fashion until the judge is satisfied with the integration of information and a final response is given. This process comprises of four basic stages: initial scanning of information, selection of items for processing in order of importance, extraction of scale values on the

judgement dimension and adjustment of a composite value that summarises already-processed components (as cited in Lopes, 1987, p. 167, see Figure 15 below). In the *scanning stage*, the judge assesses the presented information either sequentially or simultaneously. An item is then *selected as an 'anchor point'* chosen either on the basis of its perceived importance (i.e. in relation to category, diagnosticity or presentation order) in the case of many items or in the absence of a choice in the case of only one item being presented. The anchor is then *evaluated relative to the scale of judgement* that may be considered as the initial judgement. After anchoring, the judge chooses another item and then *adjusts the initial value*, by first locating the new item on the scale of judgement relative to the initial judgement and then by adjusting the initial judgement toward the new judgement, usually resulting in the averaging of the values. The judge continues the process of adjustment for each new item until there is no new or important information left to be considered and then produces a final response on the judgement scale provided (Lopes, 1987, pp. 180-182). Thus, this process can be viewed as a series of opinion revisions, where each revision is the weighted average of the previous judgement and the value of the current evidence item (cf. Pennington & Hastie, 1988, p. 523).

Figure 15: Flow diagram of hypothesised model of the judgement process (Lopes, 1987, p. 181)



2.2.3. Other research on memory and impression judgements using personality traits

The difference between on-line and memory-based processing and judgement distinction has important implications not only for memory representations of target information and the relationship between recall and judgements, but also for the nature of evaluations

drawn about other people (McConnell, 2001). The following part of this section will elaborate on the research that has been conducted in the area of evaluative social judgements, specifically focussing on the research that has employed personality traits and corresponding behavioural descriptions in order to investigate the relationship between impression judgements and memory.

Trait and behavioural inferences

A number of studies have been conducted to examine the relationship between information processing styles and behaviour-trait (or trait-behaviour) inferences or judgements. Reimann and Angleitner (1993) investigated the process underlying the derivation of trait inferences from knowledge of limited behavioural information. Study 1 required participants to provide trait ratings immediately after the presentation of behavioural act descriptions for a single target person at a given time (i.e. on-line coding of behaviours) and findings indicated that that these ratings correspond to the prototypicality ratings of the acts on trait concepts. Study 2, on the other hand, presented the behavioural descriptions of all six target persons before the trait ratings (i.e. retrospective memory-based rating task) and findings indicated that the ratings are guided by the conceptual relations among the studied trait concepts. Thus, their findings indicated that the manner in which trait inferences are derived depends on the nature of the task (Reimann & Angleitner, 1993).

Later, Maass and colleagues (2001) sought to examine the underlying processes of inferring traits from behaviours (i.e. inductive inferences) and behaviours from traits (i.e. deductive inferences). In two experiments, participants learned both trait and behavioural descriptions of a target person and then engaged in a recognition task, which consisted of old traits and behaviours, new traits and behaviours, as well as implied traits or behaviours. Findings from both experiments demonstrated a stronger tendency to infer traits from behaviours (i.e. misidentify implied traits as old ones) than vice versa. With regards to the distinction between on-line and memory-based information processing, findings from their second experiment demonstrated support for on-line processes as underlying behaviour-trait inferences, where affirmative response times for implied traits was just as fast as the old traits, suggesting that they were inferred at encoding and are

stored in trait form and thus, were 'recognised' just as fast as those traits that had actually been seen (Maass et al., 2001). In addition, affirmative response times to implied behaviours were reliably slower than those for old behaviours, suggesting that memory-based processes were at work during the recognition task (Maass et al., 2001, p. 400).

Individual versus group target judgements

Research in the area of the memory-judgement relationship has examined whether information processing styles influence impression judgements of groups in the same manner as they influence impression judgements of individuals. Sanbonmatsu, Sherman and Hamilton (1987) examined perceptions of individual and group targets in an illusory correlation paradigm (Hamilton & Sherman, 1996). An illusory correlation usually refers to the formation of an unwarranted or false association between a minority group member and rare or infrequent negative behaviours, or between salient target behaviours and distinctive domains in which the target is observed. Participants read seven desirable and three undesirable statements describing five targets (e.g. A, B, C, D, and E) that they perceived to be either individuals or groups and were instructed to pay particular attention to one of the targets (e.g. Target C). Their findings demonstrated that participants rated the distinctive groups less favourably than others and overestimated the number of undesirable behaviours performed. Their results for individual targets, however, surprisingly showed the opposite pattern (i.e. the distinctive individual was rated as more favourable than others and participants overestimated the number of desirable behaviours performed). Sanbonmatsu and colleagues accounted for this difference by proposing that on-line judgements for the distinctive target increased attention focus on, and as a consequence, increased awareness of more desirable behaviours performed by that target (McConnell et al., 1994; Hamilton & Sherman, 1996, p. 340). McConnell, Sherman and Hamilton (1994) also examined on-line and memory-based processing in the area of individual vs. group impression judgements and on the basis of previous research hypothesised that group and individual targets invoke different information-processing mechanisms. Participants were divided into two conditions (i.e. individual and group target type) and they were randomly assigned to one of three instruction sets – impression-set (i.e. required to form a coherent impression), memory-set (i.e. required to remember each statement) and comprehensibility-set (i.e. required to assess whether or

not a fourth grade child would have difficulty comprehending each statement). Findings demonstrated that impression-set instructions induced on-line judgements and comprehensibility-set instructions induced memory-based judgements regardless of target type (McConnell et al., 1994). With regards to the memory-set instructions, on-line judgements were induced for individual targets, but not for group targets as predicted. Research in the area of illusory correlations was extended by McConnell, Leibold and Sherman (1997), who examined the formation of context-dependent attitudes associated with a target in different contexts (i.e. home vs. work). Two experiments demonstrated that participants formed context-dependent attitudes for both group (Study 1) and individual targets (Study 2) when memory-based judgements (i.e. participants were required to read each statement carefully) as opposed to on-line judgements (i.e. participants were required to form impressions while reading the statements) were encouraged (McConnell et al., 1997).

The differences in impression formation of individual and group targets were further examined by Susskind, Maurer, Thakkar, Hamilton and Sherman (1999). They employed a paradigm that was associated with the person memory literature (e.g. Hamilton & Sherman, 1996) rather than the usual illusory correlation paradigm. According to theories in the person memory literature, perceivers assume a greater amount of unity and coherence in an individual than they assume to exist in members of a group (Asch, 1952, Jones & McGillis, 1976, Wyer & Srull, 1989, Hamilton & Sherman, 1996). As a consequence of this assumed unity, perceivers seek to identify dispositional themes and to resolve inconsistencies in information acquired regarding a target individual. Regarding groups, perceivers do not expect high entitativity (i.e. cohesiveness) among group members and thus, do not engage in this process to the same extent as they do for individuals. In their first experiment, participants read lists of behavioural statements performed by either an individual, a tightly-knit group of friends or persons randomly selected from different dormitories. Half of the participants were required to repeat aloud the behavioural descriptions twice and measures from a trait judgement task, a recall task and judgements of the target's perceived unity were taken from all participants. Findings from this experiment demonstrated that participants in the individual target conditions made stronger (more extreme), faster and more confident trait judgements, as compared

to those in the group target conditions, thus providing support for the view that people infer dispositional traits on-line, as this information was acquired to a greater extent for individual than for group targets (Susskind et al., 1999). In experiment 2, participants were initially provided with an expectation about an individual or a group and then read a series of consistent and inconsistent behavioural descriptive statements. Participants were required to continue or extend these statements, which were then coded to determine causality. Results of this study demonstrated confirmation for the hypothesis that participants would spontaneously generate more causal continuations for inconsistent behaviours performed by an individual as compared to a group target, presumably because perceivers do not expect the same degree of consistency to exist among group members as compared to individuals (Susskind et al., 1999).

Factors influencing social information processing in impression formation

Research in the area of impression judgements and social information processing has also focussed on the different factors that influence impression formation. In order to examine a developmental model of impression formation, Sherman and Klein (1994) investigated the changes in mental representations of people as a function of their *level of experience with the targets*, in terms of the amount of knowledge regarding the behaviour of target individuals. Their research was based on the model proposed by Klein and Loftus (1990), which postulates that impressions are represented by behavioural exemplars during the early stages of learning, but become abstractions or summary representations as behavioural information accumulates. In two experiments, Sherman and Klein (1994) presented participants with either a relatively small or large amount of behavioural information regarding a target and then administered an initial task (i.e. a 'describes' task, where the participant decides whether a trait is consistent with their impression of the target or a 'define' task, where participants generate a definition for the trait) and a target task (i.e. a 'recall' task, where participants retrieve a specific behavioural incident in which the target manifested the trait). Their results provided support for Klein and Loftus' (1990) model of impression formation, where at low levels of experience impressions were represented by behavioural exemplars and these were transformed to abstractions as experience increased. They demonstrated that impressions became more accessible as experience grew, thus indicating the continued evolution of impressions after abstraction.

Thus, in terms of the debate between memory-based and on-line processing, these findings indicated that although impression formation is an on-line process that occurs during the encoding of behavioural information, the retrieval and subsequent use of behavioural exemplars can influence the formation and updating of impression judgements.

Research has also demonstrated that the way in which we view other people's dispositional traits as fixed or malleable influences the manner in which we process social information in impression formation. McConnell (2001) examined the implications of implicit theory for on-line and memory-based information processing. Implicit theories explore people's views regarding the *malleability of personality traits*, where traits are seen as static and fixed by entity theorists, but incremental theorists view the same as dynamic and malleable. In their first experiment, participants were required to first complete an implicit theory questionnaire and then to read carefully a series of behavioural descriptions associated with two target individuals (i.e. Jim and Bob). Participants were instructed to carefully read the statements as they would be questioned about the information later, thus, encouraging memory-based information processing. Following this and a filler task, participants had to recall as many behavioural statements as they could and then provide measures of frequency estimates (i.e. number of undesirable behaviours) and likeability estimates (i.e. desirability of targets). Findings indicated that entity theorists demonstrated higher recall and stronger primacy effects in recall than incremental theorists, thus providing support for an on-line information processing style for entity theorists. Moreover, only incremental theorists demonstrated an evaluative bias between the two objectively equivalent targets, thus demonstrating support for a memory-based information processing style (McConnell, 2001). Their second experiment manipulated participants into adopting either an entity implicit theory or an incremental theory by varying the outcomes of research presented to participants (i.e. experts in the field argued for and against the malleability of personality traits). The findings of this study provided additional support to the outcome obtained in the first experiment, where incremental theorists recalled less early information and revealed positive memory-judgement correlations as compared to entity theorists (McConnell, 2001).

Another factor that has been found to influence social information processing in impression formation is the '*need to evaluate*'. Tormala and Petty (2001) demonstrated that the '*need to evaluate*' influenced the way in which information was processed. Results from two studies using recall-attitude measures (Studies 1 and 2) and recognition latencies (Study 2) demonstrated that individuals with a high need to evaluate employed an on-line information processing style to form attitudes; whereas individuals with a low need to evaluate formed attitudes in a more memory-based fashion (Tormala & Petty, 2001). Further experimentation in the area of attitudes and social information processing was conducted by Bizer and colleagues (2006), who examined whether type of information processing influences the strength of attitudes in terms of durability and impact on the basis of accessibility and certainty. Results of three experiments demonstrated that the initial on-line attitudes formed were held with greater certainty as compared to memory-based attitudes (Experiment 1), were more correlated with an individual's evaluative preferences (e.g. time spent with target) as compared to memory-based attitudes (Experiment 2) and were more predictive of behavioural intentions in comparison with memory-based attitudes (Experiment 3) and these effects were independent of any accessibility or extremity differences across conditions. Thus, Bizer and colleagues demonstrated that the effects of information processing style on attitude strength appear to be real and durable beyond the initial reporting of the attitude itself (Bizer et al., 2006).

More recently, Lerouge and Smeesters (2008) demonstrated that *priming traits after the encoding process* also led to assimilation effects on later target judgements under memory-based processing conditions (as opposed to on-line processing conditions). Priming usually influences the encoding of information and hence most of the effects seen in the literature demonstrate assimilation effects towards the prime that had been administered before the encoding process (e.g. Higgins et al., 1977; Srull & Wyer, 1979; as cited in Lerouge & Smeesters, 2008, p. 429). On the other hand, based on the literature on the different styles of information processing described above, on-line processing should be less affected by related primed information as compared to memory-based information processing, as memory-based processing would encourage selective accessibility of previously encoded information congruent with the primed information.

In three experiments, Lerouge and Smeesters (2008) demonstrated that assimilation effects do occur when person information is encoded through memory-based processing (Experiment 1), but that this effect will occur only when the primed information is related to the trait category (Experiment 2) and finally, that this effect can be explained by higher accessibility of previously encoded person information congruent with the primed trait (Experiment 3; Lerouge & Smeesters, 2008).

The aforementioned literature suggests that on-line versus memory-based information processing affects subsequent recall and impression judgements differently. On-line judgements are more common in tasks that instruct people to form an impression of the target before the presentation of target information, lead to the spontaneous evaluation of the target, are recalled quicker, have stronger primacy effects in recall and are not very related to explicit recall from memory. Memory-based judgements, on the other hand, are more common when the person is unaware that a later target judgement based on the provided target information will be elicited, lead to evaluation of the target based on target information retrieved from long-term memory, and are directly related to explicit recall of target information from memory. In addition, the mechanism underlying on-line processing is assumed to be one of anchoring-and adjustment (as proposed by Lopes, 1982), where judgements are evaluated and revised on-line by comparing values of the anchor to the new information values encoded. The next section will outline the meaning and theories of a different kind of judgement (that is metacognitive in nature), as these theories will be useful in providing additional explanations for the impression judgements obtained in this thesis.

2.3. Metacognitive Judgements

Storm, Bjork and Bjork (2005) attempted to relate retrieval-induced forgetting of valenced traits in person memory to impression judgements of likeability based on recall memory for those traits. They reasoned that if retrieval-induced forgetting altered the memory representations of others, then impressions based on those representations would be altered accordingly. They accounted for this prediction by relating it to the interpretation of feeling-of-knowing judgements in the literature of metacognitive judgements, where it has been found that fluency of access to a target item influences

judgements about that item (Koriat, 1995, 1998; as cited in Storm et al., 2005, p. 536). As the present thesis is an extension of the research conducted by Storm and colleagues (2005), the current section will attempt to briefly illustrate the area of metacognitive judgements by initially outlining the definitions and meaning of metacognition, and then describing the main types of metacognitive judgements in the literature. This section will finally elaborate on the bases of metacognitive judgements, as these theories will be employed as an additional framework to account for the impression results obtained in this thesis.

2.3.1. Definitions and Meaning of Metacognition

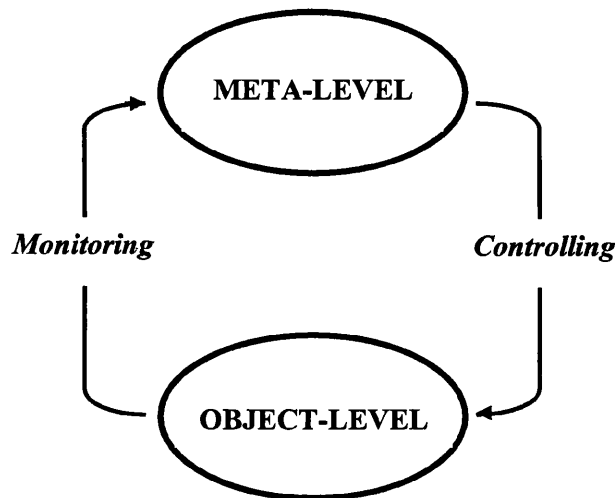
There are many definitions of the term 'metacognition' that differ slightly from each other depending on the area of research covered. For instance, John Flavell coined the term 'metacognition' and proposed its first definition: "One's knowledge concerning one's own cognitive processes and products or anything related to them..." (Flavell, 1976; p. 232). Nelson (1996) referred to metacognition as the cognition of cognition, which includes the knowledge and regulation of one's cognitive processes. According to Koriat (2007), metacognition refers to the study of how people self-reflect on their cognitive and memory processes (i.e. monitoring) and how they employ this knowledge to regulate their behaviour as well as how information is processed (i.e. control). This definition is widely accepted today by cognitive researchers in the area of metacognition, as they mainly focus on how individuals monitor and control their knowledge and thinking processes.

Metacognition is usually conceptualised as a "higher-order cognition regarding cognition" (Veenman et al., 2006), which looks after and regulates the cognitive system. It is difficult to separate the two as they are closely interrelated processes that draw upon each other's resources for effective functioning. Metacognitive processes cannot always be overtly recognised during cognitive processes and there is much debate in the literature as to whether these processes operate on a conscious level (Nelson, 1996; Schnotz, 1992) or on a level just below consciousness (Baker, 1994; Veenman et al., 2006). The definition of metacognition assumes that these processes are deliberate, intentional and therefore involve conscious awareness (Diana & Reder, 2004). On the other hand, the automaticity of these metacognitive processes is demonstrated through the less conscious

continuous checks for errors that run alongside cognitive processes and the system is alerted only when errors are detected and are therefore brought into consciousness (Koriat et al., 2004; Koriat, 2007). The difference between conscious and automatic metacognitive processes is more philosophical in nature relating to a contrast between self-determination versus externally controlled behaviour (cf. Veenman et al., 2006).

Drawing from the work of Flavell (1971), Nelson and Narens (1990) conceptualised a framework for metacognition, which views cognitive processes as occurring at two interrelated levels: the object-level and the meta-level (see Figure 16 below). The fundamental cognitive operations that relate to how we acquire knowledge such as acquisition, retention and retrieval occur at the object-level, while cognitive processes at the meta-level employ information from the object-level to exert control over these object-level cognitive processes in a top-down manner.

Figure 16: Two-level view of metacognition (Nelson and Narens, 1990)



Note: This figure illustrates the flow of information between the two levels of metacognition, where object-level cognitive processes are monitored by the meta-level metacognitive processes, which in turn exerts control or influence over object-level cognitive processes.

The links between the two levels through which information flows constitute two operations in this model: metacognitive monitoring and metacognitive control. Nelson and Narens (1990) explain the structure of this model by likening it to the use of a

telephone handset. Listening through a telephone handset is considered to be analogous to the manner in which information regarding the changes in state of object-level cognitive processes is transmitted to the meta-level. For example, in the context of learning, the learner's subjective assessments of the degree of learning before, during and after study would constitute the operation of metacognitive monitoring (Winne, 1996). Speaking into a telephone handset, on the other hand, is analogous to the manner in which the meta-level cognitive processes modify the object-level processes, by initiating, continuing or terminating an action (Nelson & Narens, 1990). Extending from the above example, metacognitive control entails acting on the information obtained by metacognitive monitoring in order to regulate the progress of learning (Winne, 2001). Thus, information about the current state of the system aids the effective regulation of the system.

2.3.2. Main Types of Metacognitive Judgements

Judgements are the outcome of metacognitive monitoring of processes and products. For example, when a student monitors how easy a task was to learn, he or she makes a subjective decision about whether the current task was easy or difficult. Several metacognitive judgements have been employed to examine the concept of metacognition. Some of these include ease-of-learning judgements, judgements of comprehension; remember/know judgements, output monitoring, olfactory metacognition and source monitoring (Koriat, 2007). Most of current empirical work on metacognition concerns three main types of judgements: *judgements of learning (JOLs)* that are obtained after the study of each item, *feeling-of-knowing (FOK)* judgements that are obtained following retrieval failure of an item and *confidence judgements* that are obtained after retrieval or selection of a response to determine the subjective confidence in the 'correctness' of the answer.

JOLs are assessments that people make about how well they have learned particular information – that is, predictions about how likely they will be to remember a target item when later given a cue (cf. Son & Metcalfe, 2005). The accuracy of these judgements aid in the selection of the appropriate strategy to control subsequent study and this accuracy is measured by comparing the individual's JOLs to his or her actual recall performance on the test. JOLs include *ease-of-learning judgements* (Leonesio & Nelson, 1990;

Underwood, 1966) made before a study trial in order to predict rate of learning, *paired-associate JOLs* (Arbuckle & Cuddy, 1969; Leonesio & Nelson, 1990) made at the time of study where participants are required to determine the retrievability of the target either when both cue and target are presented or when only the cue is presented, in order to predict later memory performance, *ease-of-recognition judgements* (Begg, Duft, Lalonde, Melnick & Sanvito, 1989) in order to predict the likelihood of later recognition and *free-recall JOLs* (Groninger, 1979; Mazzoni, Cornoldi & Marchitelli, 1990) in order to predict the likelihood of later recall (cf. Schwartz, 1994). Nelson and Dunlosky (1991) were the first to demonstrate that JOLs were accurate estimations of the amount of learning by delaying the time of judgement from immediately after study until a short while later. According to them, this period of delay played a crucial role in determining highly accurate JOLs.

FOKs are obtained at the time of retrieval failure in order to predict the likelihood of future recall or recognition. These judgements are believed to stem from the monitoring of one's knowledge and this, in turn, can exert control over future behaviour. For example, if a student has a strong feeling of knowing regarding the retrieval of a specific item, then he or she may choose to spend more time attempting to successfully retrieve the target item in the future. The validity of these FOK judgements is evaluated by comparing them to performance on the future recall or recognition test (Koriat, 2007). It must be noted here that FOKs are different to tip-of-the-tongue (TOT) judgements, where although they are both obtained at the time of retrieval, FOKs concern likelihood of retrieval and TOTs concern timing of retrieval. Finally, while both JOLs and FOKs are prospective predictions concerning future cognitive performance, confidence judgements are retrospective in nature. These judgements are obtained following retrieval and reflect the expected probability regarding the 'correctness' of a produced memory (Koriat, 2007).

2.3.3. Bases of Metacognitive Judgements

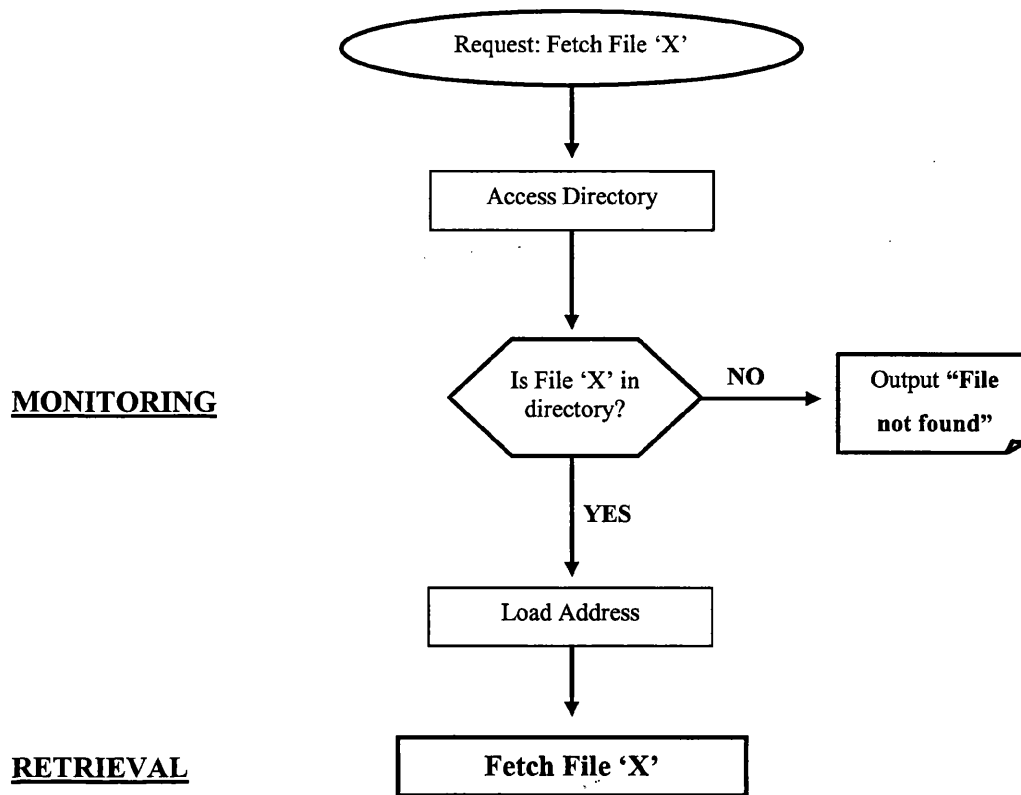
An essential topic of concern in the area of metacognition has been the investigation into the sources of metacognitive judgements. Evidence from the literature suggests two main

viewpoints regarding the bases of metacognitive judgements: *direct-access or trace-access account* and *cue-utilisation or inferential account* (Koriat, 2007)

Trace-access account

The “direct-access” or the “trace-access” account (Hart, 1965; 1967) implies the existence of a specialised monitoring mechanism that directly accesses target representations in memory and the outcome of this process results in ‘feeling of knowing’ judgements (Koriat, 2000). As the strength of a memory trace is responsible for subjectively or objectively ‘knowing’ information, this direct-access account provides a simple explanation for the accuracy of FOK judgements in the prediction of memory performance (Koriat, 2000). This approach assumes a two-stage monitoring and retrieval process, where individuals first ascertain the availability of the target in memory and then attempt to retrieve it (Metcalf & Shimamura, 1994, p. 115). This functioning of this model can be viewed as analogous to information processing in computer systems (see Figure 17 below). Thus, when an individual is requested to retrieve an item (i.e. analogous to requesting file ‘X’), he or she first ascertains that the item is available in memory (i.e. analogous to consulting the directory listing) and only then begins to retrieve the target item from memory (i.e. analogous to accessing the file itself). The functional advantage of possessing such an internal monitor is reflected in the conservation of time and effort in the search for information unavailable in memory (Metcalf & Shimamura, 1994, p. 120).

Figure 17: Illustration of the analogy of the Direct-Access Model of Metacognitive Judgements to a computer system



Note: In the above figure, retrieving a file in a computerised system is compared to the way in which our memory searches for and retrieves a target item. Taken from Metcalfe & Shimamura (1994, p. 120)

Thus, a positive FOK drives the search process and a negative FOK discourages the search process (Reder, 1988, Nelson & Narens, 1990). It follows that a strong FOK is given if an individual can access features of a searched-for target and a weak FOK is given when only a few features of the target were accessible (Son & Schwartz, 2002, p. 19). The strongest support for the trace access view is seen to come from the accuracy of FOK judgements in predicting correct target recall or recognition (Metcalfe & Shimamura, 1994, p. 121). With regards to JOLs obtained during study, the trace access account proposes that learners can directly access the memory trace and monitor its increase in strength during learning, thus enabling the learner to decide when the memory trace has reached a desirable value and consequently to decide when to stop the learning process (Koriat, 2007).

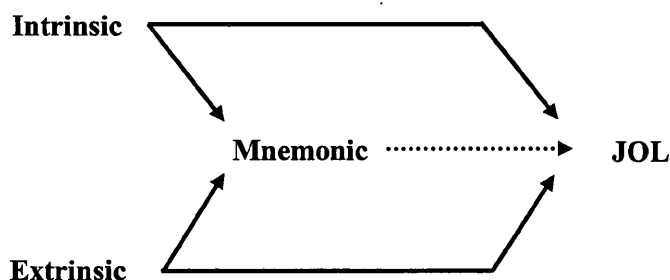
Cue-utilisation or Inferential Account

Another explanation of metacognitive judgements that has gained popularity in recent years is the inferential account. According to this view, metacognitive judgements are based on a variety of cues and heuristics that predict memory performance and the accuracy of the predictions are dependent upon the validity of the cues that it rests upon (Koriat, 2007). Thus, in making metacognitive judgements, individuals do not monitor directly the strength of the target item's memory trace, but employ various other cues that are predictive of future memory performance, such as general memory efficacy, situational characteristics like number of study trials and encoding strategies, type of expected memory test, previous task-specific experience, perceived relative difficulty of study items, etc (Koriat, 1997).

According to Koriat (1997), these factors can be classified into three categories of cues: *intrinsic*, *extrinsic* and *mnemonic cues*. Intrinsic cues refer to the internal attributes of an item that predict the item's pre-experimental ease or difficulty of learning. For example, JOLs are higher for both concrete and common words as they are processed with greater fluency and have higher recallability as compared to abstract words (Begg et al., 1989; cited in Koriat & Levy-Sadot, 1999). Extrinsic cues include the conditions of learning, such as number of times an item has been studied, presentation time, type of repetition, etc.; as well as the learner's encoding strategies, such as level of processing and interactive imagery (Koriat, 1997). While both intrinsic and extrinsic cues exert influence on JOLs through the explicit application of a particular rule or theory (e.g. trigram words vs. non-sense trigrams or four vs. one study trial(s) have better future recallability), mnemonic cues are internal indicators of the extent of learning (Koriat, 1997). Mnemonic cues can be viewed as the unique experiences that accompany information processing, such as accessibility of information, ease with which information comes to mind, cue familiarity, ease of processing of a presented item, memory for its ease of acquisition and memory for the outcome of previous recall attempts (cf. Koriat, 1997). The intrinsic and extrinsic cues that exert direct influence on metacognitive judgements consist of a logical and analytical process that draws on learner's beliefs, knowledge and theories. Subjective mnemonic cues that indirectly influence metacognitive judgements, on the other hand, consist of a non-analytical process that employs global heuristics to

form these metacognitive judgements (Koriat, 1997, 2007). Therefore, the inferential cue-utilisation view has been further categorised into *analytical information-based* (or theory-based) and *non-analytical, experience-based* metacognitive judgements (see Figure 18 below) (Koriat & Levy-Sadot, 1999; Koriat, 2007).

Figure 18: A schematic model of the effects of intrinsic, extrinsic and mnemonic cues on JOLs



Note: Thick dark arrows depict analytical theory-based or information-based inferences, whereas the dotted arrow indicates non-analytical experience-based heuristics. Taken from Koriat (1997)

Besides intrinsic and extrinsic cues, another factor that plays a role in inferential theory-based metacognitive judgements is an individual's perceived *self-efficacy* (Bandura, 1977, see Koriat, 2007). In other words, an individual's preconceived notions concerning his or her domain-specific skills influences that individual's predictions regarding assessment of task performance. For example, if students believe that they excel in a particular domain (e.g. abstract reasoning), then they tend to overestimate their predictions of task performance based on this notion, rather than base their judgements on the specific experience of taking the test (Ehrlinger & Dunning, 2003). This view has been supported by evidence from past research. For example, Perfect (2002, 2004) demonstrated that eyewitnesses' confidence in their recall performance may be based in part on their own preconceived beliefs regarding their own competence in the domain knowledge tested.

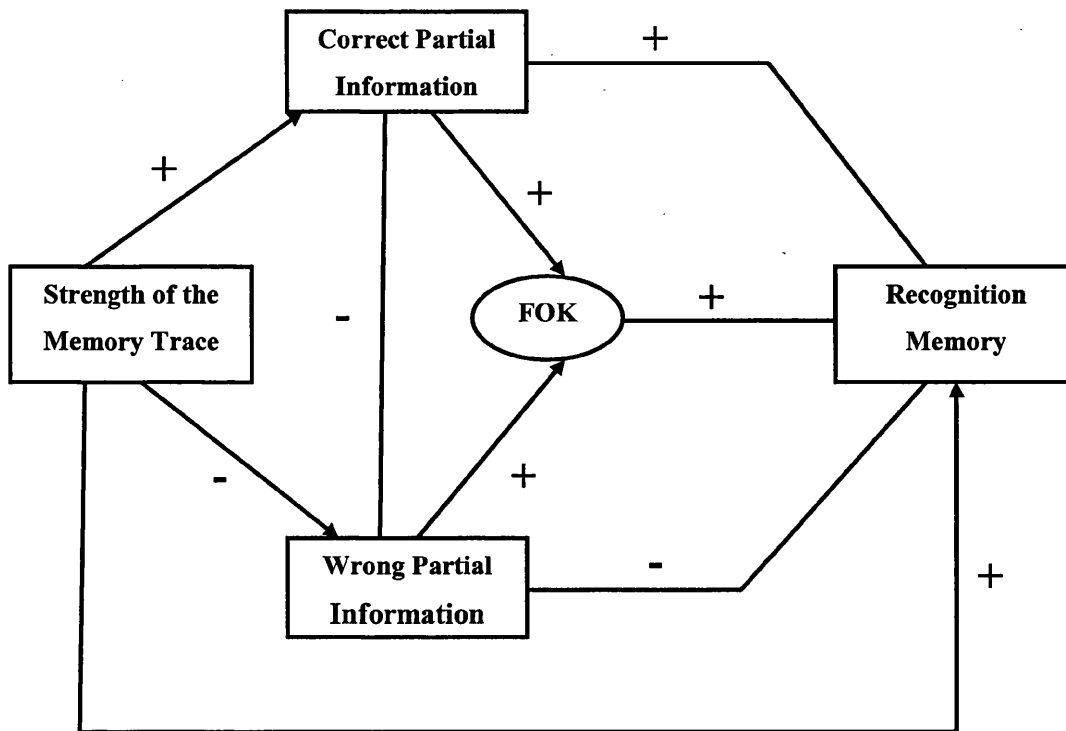
With regards to the experience-based theory of metacognitive judgements, several mnemonic cues have been put forward as determinants of JOLs, FOKs and subjective

confidence judgements (Koriat, 1997). These cues differ from the information-based cues in that they rely on quality of processing rather than the content of domain-specific knowledge and beliefs (Koriat, 2007). Experience-based JOLs are based on ease of encoding at learning or the ease with which information is retrieved, which are available during the process of learning and these are assumed to create a sheer subjective feeling of knowing.

On the other hand, three main heuristic-based accounts have been put forth to explain experience-based FOK judgements (Koriat, 2007). Reder (1987) proposed the *cue-familiarity account* (see Metcalfe & Shimamura, 1994) to explain FOK judgements as being based on the familiarity of the cue itself, where a quick pre-retrieval FOK is automatically made in response to the familiarity of the terms of a memory question in order to assess the existence of the sought-after answer in memory (Koriat, 2007). Evidence in support of this view comes from research findings that demonstrate enhanced FOK judgements for advance priming of cues, but not by priming the target (Reder, 1987, 1988; Reder & Ritter, 1992; Schwartz & Metcalfe, 1992, Metcalfe et al., 1993).

Koriat (1993) put forth a second account of FOK, known as the *accessibility account*, which is based on the overall accessibility of pertinent information regarding the solicited target (Koriat, 1993; cf. Koriat, 2007). This account assumes that the cues for FOKs are present in the retrieval process itself, where monitoring follows retrieval and thus can determine whether the target exists in memory. During this process, a variety of partial clues such as fragments of the target, semantic attributes and other episodic information come to mind and create a subjective feeling of knowing. In contrast to the trace-access model which implies dissociation between monitoring and retrieval, the accessibility account assumes a single retrieval-and-monitoring process (cf. Metcalfe & Shimamura, 1994, p. 124). An important assumption is that individuals do not have direct access to the accuracy of the partial information that comes to mind and hence, both correct and wrong partial clues contribute to FOK (Koriat, 2007). Koriat (1993) proposed an accessibility model (see Figure 19 below) to illustrate the process by which FOK judgements are made.

Figure 19: An Accessibility Model of the Feeling-of-Knowing judgement – Koriat (1993)



Note: The positive and negative correlations are denoted by plus and minus signs respectively.

The model assumes that when searching memory for a target item, a variety of clues come to mind that either emanate from the target proper (i.e. correct partial information) or from different sources (i.e. wrong partial information). The model also expects positive correlations between memory trace strength, correct partial information and recognition memory, whereas all should be negatively correlated with wrong partial information. Accessibility depends on the amount of information retrieved as well as the intensity (such as its ease of access, persistence, etc) and accessibility is perceived to increase with increasing accessibility of both correct and wrong partial information (cf. Metcalfe & Shimamura, 1994, p. 131). Thus, the dependence of FOK on the accessibility of correct partial information is responsible for its success in predicting correct recognition, whereas its dependence on the accessibility of wrong partial information is responsible for its inaccuracy (Koriat, 1993). Therefore, this model can account for both accurate and inaccurate FOK judgements that occur in research findings. Greater proportion of accurate FOK findings can be explained by a memory target as giving rise to more correct

as compared to wrong partial information as well as the greater intensity with which correct partial information comes to mind. Schwartz and Smith (1997) provided evidence in support of this model, when they demonstrated that the probability of reporting a TOT state about the name of a fictitious animal increased with the amount of information provided about that animal, even when the amount of information did not contribute to the probability of recalling the name of the animal. In addition, FOK judgements following a *commission error* (producing a wrong answer) are higher than following an *omission error* (Koriat, 1995; Krinsky & Nelson, 1985; Nelson & Narens, 1990), suggesting that FOK judgements are sensitive to the mere accessibility of information (cf. Koriat, 2007, p. 299).

The third account of FOK metacognitive judgements postulates a combination of familiarity and accessibility heuristics (Koriat, 2007). It assumes that familiarity effects occur early in FOK judgements and accessibility effects occur later and only when cue familiarity is high enough to encourage the search in memory (Koriat, & Levy-Sadot, 2001; Vernon & Usher, 2003; Koriat, 2007). Thus, this account assumes that familiarity, in addition to affecting FOK judgements directly, also serves as a gating mechanism: When familiarity is high, participants probe their memory for the answer, and then the amount of information accessible affects memory performance. When familiarity is low, the effects of potential accessibility on FOK are more limited (cf. Koriat, 2007, p. 300)

Subjective confidence judgements are also believed to stem from mnemonic cues that arise from the selection and retrieval process. Thus, higher confidence ratings are given to those responses that are retrieved quicker, irrespective of whether they are correct or not (Nelson & Narens, 1990). Kelley and Lindsay (1993) also provided evidence in support for this view by manipulating retrieval fluency through priming of correct and incorrect but plausible answers. Priming served to increase the speed and probabilities of that information being recalled and also increased confidence ratings for those answers (Koriat, 2007). According to Koriat (2000), these *noetic* (i.e. subjective) feelings and judgements *unconsciously* and automatically stem from heuristics that rely on mnemonic cues (Koriat, 2007).

Koriat and Levy-Sadot (1999) outlined the difference between information-based and experience based metacognitive judgements along three dimensions: *mediation*, *content* and *phenomenal quality*. First, in an information-based process, judgements stem from the explicit knowledge and beliefs that is conscious; whereas in an experience-based process, judgements arise from implicit feelings that are unconscious and automatic. Second, in an information-based process, the basis of the judgement lies in domain-specific content; whereas in an experience-based process only a subjective feeling state is consciously available. Third, in an information-based process, the processing of information and subsequent behaviour takes place in a controlled and deliberate manner; whereas in an experience-based process, the metacognitive judgement is basically intuitive and automatic (Koriat & Levy-Sadot, 1999, p. 485). Although both the analytic and non-analytic processes have been distinguished from each other, it is important to understand that they presumably work together in order to influence and shape metacognitive judgement (Koriat & Levy-Sadot, 1999).

Although metacognitive judgements have primarily been researched in the areas of developmental and educational psychology; in recent years, the investigation of metacognition has also gained popularity in the areas of social psychology and judgement and decision-making (Koriat, 2007). Social psychologists emphasise the role of subjective feelings and beliefs and have addressed issues such as social evaluative judgements (Winkielman, Schwarz, Fazendeiro & Reber, 2003), and social identification and categorisation of in-groups and out-groups (Yzerbyt, Lories & Dardenne, 1998). Many social psychological theories have stemmed from metacognitive processes, such as Bem's self-perception theory (Bem, 1972), theories of attribution (Jones et al., 1972; Ross, 1977) and dual-process theories (Chaiken & Trope, 1999) (see Koriat, 2002, p 266). Metacognitive research in the area of judgement and decision-making has mainly focused on the calibration of probability judgements (Lichtenstein, Fischhoff & Phillips, 1982; Winman & Juslin, 2005; see Koriat, 2007). In addition, Tversky and Kahneman (1973) have contributed greatly to the field of metacognition through its use of the availability heuristic and research on biases (see Koriat, 2002, p. 265).

The next section of this chapter will focus on the research in the area of facial appearances and judgements of trustworthiness, as target facial pictures (associated with valenced personality traits) were frequently employed to obtain impression judgement ratings of honesty.

2.4. Judgements of Honesty

The research in the present thesis employs negatively and positively-associated male and female facial pictures (Experiments 1, 2A, 2B, and 4) of targets and requires participants to make judgement ratings of honesty (to imply trustworthiness) based on their impressions formed of the target pictures and their accompanying traits. Honesty judgements were chosen based on research in the area of face perception, where findings demonstrate a highly reliable correlation between facial appearance and judgements of honesty and trustworthiness. This section will briefly outline the main research conducted in this area of judgements of trustworthiness and facial appearances, stressing on its development, reliability, pervasiveness and applicability.

Research conducted over the past century has demonstrated that people draw trait inferences from the facial appearances of other people (Hollingworth, 1922; Secord, 1958; Shepherd, 1989; Macrae et al., 2005; Winston et al., 2002; Willis & Todorov, 2006; O'Doherty et al., 2003; Engell et al., 2007, Said et al., 2009; Todorov et al., in press) and these facial appearance-based trait inferences have been shown to often influence the course of social interactions. For example, DeBruine (2005) demonstrated that facial self-resemblance increases perceptions of trustworthiness of opposite-sex faces, while Perrett and colleagues (1998) demonstrated that masculine faces are generally perceived to be less trustworthy than feminine faces (Todorov et al., in press). More recently, Engell and colleagues (2010) found that behaviourally adapting to angry or happy (but not fearful) facial expressions causes trustworthiness evaluations of subsequently rated neutral faces to increase or decrease, respectively. Other research that has examined the relationship between emotional expressions and perceptions of trustworthiness have found that trustworthy faces who expressed happiness were perceived as happier than untrustworthy faces, and untrustworthy faces who expressed anger were perceived as angrier than trustworthy faces. Moreover, the changes from high to low trustworthiness increased

intensity of perceived anger, but decreased the intensity of perceived happiness (Oosterhof & Todorov, 2009).

Other research in the area of trait inferences and facial appearances has demonstrated that baby-faced appearances correlate with perceptions of honesty, intelligence, assertiveness, approachability and other evaluations (Montepare & Zebrowitz, 1998) and that appearance-based judgements of honesty were also reliably related to people's willingness to deceive others, where individuals whose faces were thought to look honest were less likely to volunteer to participate in experiments involving deception of others than were individuals whose faces were thought to look dishonest (Bond et al., 1994). On the other hand, another study has failed to find a relationship between judgements of honesty and observationally assessed honesty (Zebrowitz et al., 1996).

A number of studies have focussed on the developmental formation of these face-trustworthiness judgements. Willis and Todorov (2006) studied the personality traits of trustworthiness, attractiveness, likeability, competence and aggressiveness and found that there was a high correlation between judgements made after 100 ms exposure to faces and judgements made in the absence of time constraints, with the highest correlation being for trustworthiness. Thus, these judgements are fast, unreflective, effortless "system 1" processes in contrast to slow, deliberate, effortful "system 2" processes. They also found that additional exposure time increases confidence in judgements and that those judgements are already anchored on the initial inference (Willis & Todorov, 2006). Porter and colleagues (2008) later demonstrated further support for the results of Willis and Todorov with no difference found between accuracy of the trustworthy judgements being formed after 100 ms and those formed after 30 seconds. Moreover, participants judged the trustworthiness of the targets above chance even after only a 100 ms facial exposure, although it must be noted that the inaccuracy rate was 40%. More recently, Todorov and colleagues (2009, Experiment 2) demonstrated that judgements of trustworthiness made from 33 ms are correlated above-chance with time-unconstrained trustworthiness judgements and improves with additional exposure until an exposure of 167 ms after which it plateaus. Through another interesting study using a computer model of face-trustworthiness and subliminal primes (Experiment 3), they demonstrated that people

involuntarily judge trustworthiness from facial appearances. They presented extremely trustworthy or untrustworthy versions of faces for 20 ms, which were immediately masked by the neutral version of the face (presented for 50 ms) and the participant had to judge the latter face. Findings demonstrated that neutral faces were perceived as more trustworthy when they were preceded by trustworthy primes as compared to untrustworthy primes. Thus, detection of face-trustworthiness occurs even at presentation levels that are below the threshold of objective awareness (Todorov et al., 2009)

Over the past 15 years, there have been more than a few studies that have focussed on judgements of trustworthiness in the cognitive neuroscience research on social judgements from faces (Adolphs et al., 1998; Winston et al., 2002; Engell et al., 2007; Todorov & Engell, 2008; Todorov & Duchaine, 2008; Said et al., 2009). Findings have implicated the amygdala as playing an important role in perceptions of trustworthiness (Adolphs et al., 1998, by comparing judgements given by bilateral amygdala damage patients). Recent research by Todorov and Duchaine (2008) has also demonstrated that developmental prosopagnosics are able to make normal trustworthiness judgements, suggesting that the two systems underlying face evaluation and facial identity are somewhat differentiated.

Findings from fMRI studies have confirmed the role of the amygdala in face-trustworthiness perceptions, where activation in the amygdala decreased with face-trustworthiness in the linear fashion (Winston et al., 2002; Engell et al., 2002). Engell and colleagues (2007) further demonstrated that face properties that signal untrustworthiness influence face categorisation by the amygdala. Recent research has also found a non-linear amygdala response to face-trustworthiness, where responses to extremely trustworthy and untrustworthy faces were larger than the responses to faces in the rest of the continuum (Said et al., 2009; Todorov et al., 2008a). Thus, although it can be seen that the amygdala plays a role in detecting trustworthiness from faces, it is unclear as to when and under what conditions the response will be linear or non-linear (Todorov et al., in press).

Todorov and colleagues (2008b) also demonstrated that specific trait inferences can be represented within a two-dimensional space defined by valence/trustworthiness (i.e. characterised by the person's intentions to potentially harm) and power/dominance (i.e. characterised by the capacity of the person to carry out these intentions); thus, suggesting that the amygdala may be more involved in general valence evaluations (to make approach/avoidance responses), rather than specific trait evaluations of trustworthiness from facial appearances. Oosterhof and Todorov (2008) provided additional support for two-dimensional representations of specific trait inferences by demonstrating that judgements of threat could be represented as a linear combination of untrustworthiness and dominance.

Recently, Rudoy and Paller (2009) demonstrated that there are different neural processes for perceptual and memory-based information, where facial pictures are processed quicker than trait memory-based information. Their use of materials and procedure is quite similar to those in Experiments 2A and 2B in the current thesis (which examined the dynamics of forgetting effects for face-trait consistency and inconsistency in terms of valence). Rudoy and Paller presented participants with consensus-based trustworthy and untrustworthy faces associated with positive or negative personality traits (either consistent or inconsistent) and participants were required to judge the target's trustworthiness of pictures that were later presented without the associated trait description. Findings demonstrated that when people were forced to make ratings quickly, the influence of memory declined as compared to when there was no time limit imposed. Their findings also demonstrated support for the differentiation in neural processing for perceptual and memory-based information and suggested that face-trustworthiness is processed quicker and can influence behaviour sooner than memory-based information. These different neural processing pathways may be likened to the general models of judgement, as proposed by Tversky and Kahneman (1974), where faster on-line judgements exert more influence on final judgements unless there are strong reasons to incorporate slower memory-based information (cf. Beer et al., 2010). However, the assertion that faster perceptual information processing strongly influences final judgements of trustworthiness, as compared to memory-based information processing, cannot be validated as there are no studies that have yet manipulated memory-based

information (Beer et al., 2010). Further, Rudoy and Paller (2009) demonstrated individual differences in processing styles, where some individuals preferred to base their judgements on personality trait information and others more on faces while making judgements of trustworthiness.

Thus, from the above research it can be seen that trait judgements of honesty and trustworthiness made from facial appearances, although quick and involuntary, are highly reliable and correlated with each other. These judgements of trustworthiness have also been shown to have a significant real-world impact, where political election outcomes (Ballew and Todorov 2007), choice in investment partners (van't Wout & Sanfey, 2008) and sentencing in criminal trials (Blair et al 2004) can be predicted by evaluations of faces along trait dimensions (Engell et al., 2010).

2.5. Main Aim of the Thesis

The present research extends from the research conducted by Storm and colleagues (2005), who sought to determine whether retrieval-induced forgetting of a target's associated valenced information does occur and if so, whether it would influence metacognitive judgements concerning that target, such as likeability. Their results demonstrated that although retrieval-induced forgetting effects were found for both positive and negative trait information associated with a target, these forgetting effects did not influence metacognitive judgements relating to that target, suggesting that the impressions we form about others do not seem to be based on accessibility of relevant information in memory. The research conducted in the area of judgement and decision-making also indicates that tasks with impression goals lead people to form impression judgements of targets spontaneously 'on-line' as target information is received and findings from this area of research have repeatedly demonstrated that there is no (or very little) relationship between memory and these on-line judgements (Hastie & Park, 1986). The current thesis aims to investigate deeper into the relationship (or lack of it) between memory and social judgements. The following five empirical chapters will examine the effects of retrieval-induced forgetting of valenced traits (associated with the target's facial pictures in some experiments) on judgement ratings of honesty (besides attractiveness and likeability) through manipulation of variables such as target number, gender and

associated valence in order to examine the prevalence, adaptiveness, underlying processes and social consequences of the effect.

CHAPTER 3

RETRIEVAL-INDUCED FORGETTING AND IMPRESSION FORMATION

3.1. Introduction

All of us realise the importance of understanding the social world we live in, as the different people we come across influence our lives to a certain extent. We interact with different people on a daily basis and in the process, either consciously or unconsciously, form impressions about them. Social psychologists have long been involved in research surrounding how we make social decisions and judgements and how we perceive and remember people in everyday life. In most cases, it would seem reasonable that we base these formations on memories of our past experiences and interactions; and thus, we make social judgements using what is recallable about a certain individual, group or interaction. In other words, remembering positive traits about an individual would create a favourable impression of that individual, whilst remembering negative traits instead should lead to an unfavourable impression of that individual.

The current chapter provides a further investigation into the role of retrieval-induced forgetting (i.e. the forgetting of related but unwanted memories) in impression formation. In the context of social judgements and impression formation, the continuous retrieval of positive (or negative) information regarding a given individual might impair our ability to recall the related negative (or positive) information, and thus, may possibly modify our impression of that individual (Storm et al., 2005). On the other hand, previous research in the area of recall and impression formation has demonstrated that tasks with impression goals usually elicit spontaneous on-line processing of target information (possibly via anchoring-and-adjustment that occurs as information is presented) and these judgements have little or no relationship with information available in memory (Hastie & Park, 1986).

Retrieval-induced forgetting has been found to occur in impression formation whereby newly learned traits about target individuals are susceptible to forgetting (Macrae & MacLeod, 1999; M.D. MacLeod & Macrae, 2001). For example, in their first experiment, Macrae & MacLeod (1999), presented participants with 10 positive traits describing each of two target individuals (*John* or *Bill*), following which they received retrieval practice for 5 of the traits of one of the targets. Findings demonstrated that a significant retrieval-induced forgetting effect occurred, whereby participants recalled fewer of the unpracticed traits as compared to the traits associated with the other target that was not practiced. Macrae and MacLeod (1999) also extended this finding to situations where persons were highly motivated to remember the presented material (e.g. a mock geography examination testing made-up factual information for 2 fictitious islands – *Tok* and *Bilu*) in their second experiment. Their final experiment examined the extent to which retrieval-induced forgetting is moderated by the amount of retrieval practice that perceivers experience, by varying the amount of retrieval practice (e.g. either once, three times or six times). Their results demonstrated that although retrieval practice facilitated memory for Rp+ items, this enhanced memorability had little impact on the magnitude of retrieval-induced forgetting (Macrae & MacLeod, 1999). Employing the same procedure and materials used in their first experiment (positive traits describing 2 target individuals), M.D. MacLeod and Macrae (2001) investigated the boundary conditions of retrieval-induced forgetting by manipulating the interval times between the different phases of the study. Results showed that when there was a 24-hour interval between the guided retrieval practice phase and the recall phases, retrieval-induced forgetting failed to emerge. On the other hand, if the 24-hour interval was placed between the study phase and the retrieval practice phase, the retrieval-induced forgetting effect was not eliminated but reduced. However, an important point regarding their research on retrieval-induced forgetting and impression formation is that they did not assess the participant's evaluative judgements regarding the targets nor did they look to see if these judgements were in any way modified by the occurrence of this forgetting effect.

In another relevant study, Dunn and Spellman (2003) asked participants to learn and associate stereotypical and individuating traits describing hypothetical individuals (*Asian-American woman* or *mother*). Results showed that practicing stereotypic information

reduced the ability to recall individuating information and that practicing individuating information, in turn, lead to the reduced ability to recall stereotypic information about a target individual. Therefore, retrieval-induced forgetting has also been shown to occur for socially meaningful materials. However, these experiments did not probe into the evaluative assessments that the participants made of the target individuals and what kind of effect (if any) did retrieval practice have on these judgements.

Attrill and MacLeod (2004) also examined impression formation for the 'self' and for an 'other' experimental partner to see whether retrieval-induced forgetting affects memory for positive and negative information, relevant either to oneself or to another person. After spending ten minutes at the beginning of the study interacting with a partner, participants were asked to select positive and negative traits that described themselves and positive and negative traits that described their partner. When retrieval practice was given to traits concerning themselves no retrieval-induced forgetting effect was found for positive or negative traits. When retrieval practice was given for the traits associated with their experimental partner, retrieval-induced forgetting was found for positive traits, but not for negative traits. Storm and colleagues (2005) liken the process of assigning negative traits (as compared to positive traits) to another person to that of forming self-references which is a very distinctive process. This explanation would be consistent with the findings of M.D. MacLeod and Roseveare (2002), which show that highly relevant self-information is protected from retrieval inhibition. However, another explanation could be that because negative information is diagnostic about an individual and because retrieval-induced forgetting is viewed as an adaptive process, forgetting negative information about another individual may not be adaptive for one's survival.

More recently, Storm and colleagues (2005) examined whether retrieval-induced forgetting of traits could alter metacognitive judgements such as ratings of likeability. Participants were given 4 photographs, each associated with five neutral traits and 5 valenced traits (positive or negative). They were asked to rate the photographs for likeability amongst six other dimensions such as intelligence and attractiveness. Participants then performed retrieval practice on the neutral traits (Rp+ items), thereby making the positive or negative traits Rp- items. They were then asked to complete the

ratings of judgement again, before reporting all of the traits associated with the targets that were originally learned. Basically, Storm and colleagues examined whether initiating retrieval-induced forgetting for positive traits would make the target less likeable and whether initiating retrieval-induced forgetting for negative traits would make the target more likeable. Results demonstrated strong retrieval-induced forgetting effects for both positive and negative traits, suggesting that the prior retrieval of neutral traits reduced accessibility of the non-retrieved valenced traits, thus, showing that we are able to alter what we remember about others. Storm and colleagues then examined whether this reduced accessibility affected likeability ratings for each target. If metacognitive judgements are based on the ability to remember valenced information about other individuals, then we would expect to see targets become more likeable when negative traits are subject to retrieval-induced forgetting, while targets may become less likeable when positive traits are subject to retrieval-induced forgetting. Results indicated that the metacognitive judgement of how likeable the target was, however, unaffected by the presence of retrieval-induced forgetting; that is, targets remained as likeable or dislikeable across the two rating measures irrespective of whether positive or negative traits were subject to retrieval-induced forgetting. Thus, in terms of the metacognitive literature, this finding suggests that the impression we form about others does not seem to be based on the accessibility of relevant information in memory. The impression findings obtained by Storm and colleagues (2005) are consistent with research findings in the area of judgement and decision-making, where people may employ the anchoring-and-adjustment heuristic to spontaneously form impression judgements of others. These spontaneous (or 'on-line') judgements are different from memory-based judgements, where people process target information with different goals (e.g. grammar, comprehensibility analyses, etc) and only use target information available in memory at a later time when impression judgements are required to be formed (Hastie & Park, 1986).

In terms of the adaptive account of retrieval-induced forgetting, this forgetting effect is viewed as an adaptive process, and the above findings of Storm and colleagues (2005) challenge this belief. It can be argued that forgetting negative information about another person, information that may provide cues regarding the individual's reliability and trustworthiness, may not be adaptive (Attrill & MacLeod, 2004) and so retrieval-induced

forgetting for negative traits should be less likely to occur. However, Storm and colleagues (2005) found strong retrieval-induced forgetting effects for negative traits across all 3 studies. To explain these effects, they proposed the negativity bias account (Fiske, 1980; Rozin & Royzman, 2001) where the dominance and salience of negative information as compared to positive information in impression formation studies is explained by arguing that combinations of negative and positive entities yield evaluations that are even more negative than one would predict (Rozin & Royzman, 2001). In their research on retrieval-induced forgetting, M.C. Anderson and colleagues (1994) demonstrated that it is the strong or more dominant information that has been found to be most susceptible to retrieval-induced forgetting.

Thus, the inhibitory account of retrieval-induced forgetting may also explain the findings of Storm and colleagues (M.C. Anderson et al, 1994; M.C. Anderson & Spellman, 1995; M.D. MacLeod & Saunders, 2005; Saunders & MacLeod, 2006; Veling & van Knippenberg, 2004). Anderson and colleagues (1994), using varying degrees of associative strong and weak category-exemplar pairs (Fruit – Orange), demonstrated that due to retrieval competition, it is the strong exemplars that are most likely to be subject to retrieval-induced forgetting as compared to the weak exemplars. Based on these results, a negativity bias in person memory and impression formation should facilitate forgetting of negative information due to competition created by retrieval.

Predictions

The current experiment is an investigation into the effect of retrieval-induced forgetting on metacognitive judgements about target individuals, specifically the trustworthiness of any given studied individual, using the paradigm set out by Storm and colleagues (2005). Participants were presented with photographs of 4 target individuals and were asked to rate them on honesty and attractiveness before and after they received retrieval practice, either for the neutral traits or for an unrelated category. Based on the findings obtained by Storm and colleagues, as well as on research findings in the area of recall and impression formation, the following predictions were made. First, fewer valenced information (both positive and negative traits – Rp- items) whose neutral counterparts were subject to retrieval practice were expected to be recalled as compared to those whose neutral

counterparts had not been subject to retrieval practice (Nrp items). Second, no shift in the affective impression of a given studied individual (in terms of honesty) was expected related to the extent that both positive and negative information about that individual was impaired as a consequence of retrieval-induced forgetting. In other words, altering what we are able to retrieve about another person should not influence our already formed impressions of that person.

3.2. Method

Participants and Design

Forty six undergraduate and postgraduate students (24 females and 22 males; ages ranging from 19 to 38 with a mean age of 25.64) from Swansea University, U.K., participated in this study for a payment of £5. All participants were fluent English speakers and equal proportions of male and female participants were randomly assigned to each counterbalanced experimental condition. The experiment had a 2 (Valence: Positive and Negative) x 3 (Practice Status: practised items from the practised category [Rp+], non-practised items from the practised category [Rp-], and non-practised items from the non-practised category [Nrp]) x 2 (Target: Male or Female) mixed design with repeated measures on the latter two factors.

Stimulus Materials

Participants were presented with four photographs chosen from the Psychological Image Collection at Stirling University (<http://pics.psych.stir.ac.uk>). Two photographs were male and two were female (see Appendix I). Participants were given the same instructions as those used in Storm and colleagues (2005) and were told that they were going to learn traits describing 4 individuals and in the process they should form impressions about them. Participants were told that previous participants had interacted with the targets on a previous occasion and had used the to-be-learned traits to describe the targets. Participants were also told that they might have to play a game with one of the targets and that the more they remembered about that target, the better they would do in that game.

The traits used to describe the targets were neutral and valenced traits that had been standardised (Storm, Bjork & Bjork, 2005). These were drawn from N.H. Anderson's

(1968) likeability norms (see Appendix II). Twenty neutral traits were chosen which had a mean likeability rating of 301.4 (forgetful, emotional, choosy, dependent, proud, average, talkative, critical, blunt, aggressive, cautious, bold, quiet, shy, moderate, lucky, excitable, persuasive, timid, bashful). Ten negative traits were chosen which had a mean likeability rating of 77.6 (phony, rude, jealous, greedy, annoying, conceited, nosey, mean, selfish, shallow) and ten positive traits were chosen which had a mean likeability rating of 515.5 (trustful, helpful, honest, kind, happy, humourous, clever, gentle, loyal, friendly). Each target had 10 traits assigned to them: either neutral-positive or neutral-negative. Two of the targets (1 male and 1 female) were characterised by five neutral and five positive or five neutral and five negative traits respectively for half of the participants, while the sets of neutral and valenced traits associated with the same targets were interchanged for the other half of the participants. The set of traits associated with the remaining 2 targets (1 male and 1 female) received non relevant retrieval practice (i.e. names of fruits). Thus, the Rp+ items were the neutral items associated with the targets whose traits received retrieval practice and the valenced traits associated with the same targets were the Rp- items. The Nrp items were the 10 traits of the other 2 targets.

Procedure

Following instructions, the experiment began and consisted of four main phases for each target individual in turn: a study phase, a retrieval practice phase, a distracter phase and a recall phase, all within a ten minute block allocated to a given target (see Figure 20 below).

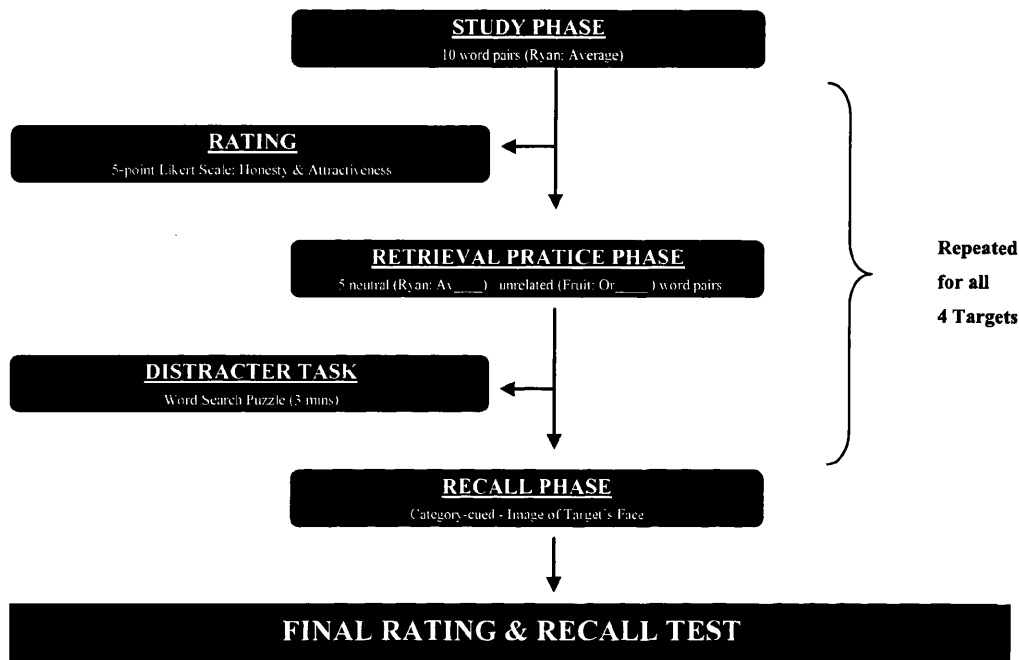
In the study phase, participants read 10 word pairs that appeared underneath a target's picture (e.g., Ryan: Average). The neutral and valenced traits associated with a given target were presented in a random and interleaved order. Each word pair was displayed for 5 seconds. After all of the traits were presented to participants, they had to rate the target on honesty and attractiveness using a 5-point Likert scale, whereby 1 indicated that the target was very honest and 5 indicated that the target was very dishonest. As honesty was the measure of interest, it was placed first to exclude any possible ordering effects and the other rating judgement of attractiveness was incorporated to try to limit the

participant's ability to remember his or her honesty ratings when a post-study rating task was to be administered.

In the retrieval practice phase, participants received retrieval practice for neutral traits of 2 targets (e.g. Ryan: Av___), while for the other 2 targets, participants received retrieval practice for an unrelated category (e.g. Fruit: Or___), thus creating Rp- and Nrp conditions, respectively, for the unpractised valenced traits. When the target's neutral traits were practised, the associated positive and negative traits were considered to be Rp-items, while when an unrelated category was practised, the valenced traits were considered as Nrp items. This phase was followed by a 3 minute distracter task (i.e., word search puzzle) in the absence of the target's picture. No participant completed the distracter task in the allocated time.

In the recall phase, the target's face and name were placed in front of the participant and the participant had one minute to recall as many traits describing the target as possible. This process was repeated for each of the 4 targets. Subjects were then informed that they did not have to meet any of the individuals. They had to, however, rate each of the individuals again in order to see whether impression changes might be salient and then engage in a surprise, final free recall test in order to see whether any retrieval-induced forgetting effects would persist after a short delay. Participants were then debriefed, thanked for their effort and participation, paid five pounds and escorted outside the laboratory.

Figure 20: Outline of Experimental Procedure



Note: Only slight variations of this basic procedure were employed for the subsequent studies presented in this thesis

3.3. Results

3.3.1. Recall Performance:

Retrieval Practice Performance

The retrieval practice success rate for neutral traits during the retrieval practice phase was 85% ($M = 8.52$, $SE = .22$).

Initial Recall Performance:

An analysis of the data revealed the anticipated effect of item type on recall performance, where the proportion of neutral traits recalled correctly was greater when given retrieval practice ($M = .72$, $SE = .03$) as compared to when not given retrieval practice ($M = .33$, $SE = .03$). Results of a paired samples t-test conducted confirmed that the difference was indeed significant [$t(91) = 13.327$, $p < .001$, $\eta^2 = .661$], thus demonstrating the recollective benefits of retrieval practice.

The mean correct cued-recall proportions for positive and negative traits as a function of whether they had been associated with a male or female target and whether the target's neutral traits had or had not been given retrieval practice (i.e. their status as Rp- or Nrp items) on the initial recall test are shown in Table 1.

Table 1: Mean correct trait-recall proportions (and standard errors) in relation to trait valence, item type, and target gender on the initial recall test.

Target	Item Type	Trait Valence	
		Positive	Negative
Male	Rp-	.38 (.05)	.27 (.04)
	Nrp	.64 (.05)	.47 (.05)
	<i>Difference</i>	<i>-0.26</i>	<i>-0.20</i>
Female	Rp-	.23 (.05)	.34 (.04)
	Nrp	.51 (.06)	.49 (.05)
	<i>Difference</i>	<i>-0.28</i>	<i>-0.15</i>

Note: Rp- = unpractised valenced traits from the practised categories, Nrp = unpractised valenced traits from the unpractised categories, Difference = retrieval-induced forgetting effect.

The data summarised in this table were analysed using a 2 (Trait Valence: Positive vs. Negative) x 2 (Target Gender: Male vs. Female) x 2 (Item Type: Rp- vs. Nrp) mixed design ANOVA, with trait valence the only between subjects variable. The gender of the participant was also included as an additional variable in a separate ANOVA, but no

significant differences between male and female participants were obtained. Thus, all results reported in this present section combine across male and female participants.

A significant main effect of item type (i.e. a retrieval-induced forgetting effect) was observed, with Rp- items ($M = .31, SE = .02$) (whether positive or negative traits and whether associated with a male or female target) being recalled significantly less well than their Nrp counterparts ($M = .53, SE = .03$) [$F(1, 44) = 40.699, p < .001, \eta^2 = .216$]. In other words, the selective retrieval of neutral traits significantly impaired the participant's ability to recall competing positive or negative traits on a later cued recall test.

A significant interaction effect was also found between valence and target gender [$F(1, 44) = 13.725, p = .001, \eta^2 = .045$]. Follow up independent samples t-tests demonstrated that the effect of valence was significant for male targets [$t(44) = 3.374, p < .01, \eta^2 = .198$], but not for female targets [$t(44) = .814, ns, \eta^2 = .015$]. Thus, for male targets, there is evidence that positive traits ($M = .51, SE = .03$) are better remembered as compared to negative traits ($M = .37, SE = .03$), whereas for female targets the difference was not significant (positive $M = .41, SE = .03$; negative $M = .37, SE = .04$).

However, the analyses of the data did not reveal any significant main effect of target gender [$F(1, 44) = 2.447, ns, \eta^2 = .008$]. There was also no significant main effect of valence [$F(1, 44) = 1.447, ns, \eta^2 = .003$]. There was also no significant interaction between item type and valence [$F(1, 44) = 2.595, ns, \eta^2 = .014$], between item type and target gender [$F(1, 44) = .142, ns, \eta^2 = .001$] nor between item type, target gender and valence [$F(1, 44) = .351, ns, \eta^2 = .003$].

Final Recall Performance:

An analysis of the data from the surprise final recall test revealed a persistent effect of item type on recall performance, where the proportion of neutral traits recalled correctly was greater when given retrieval practice ($M = .37, SE = .03$) as compared to when not given retrieval practice ($M = .17, SE = .02$). A paired samples t-test confirmed that the difference was significant as expected [$t(91) = 6.666, p < .001, \eta^2 = .328$], thus

demonstrating the recollective advantages of retrieval practice over a short delayed period.

The mean correct cued-recall proportions for positive and negative traits as a function of whether they had been associated with a male or female target and whether the target's neutral traits had or had not been given retrieval practice (i.e. their status as Rp- or Nrp items) on the final recall test are shown in Table 2.

Table 2: Mean correct trait-recall proportions (and standard errors) in relation to trait valence, item type, and target gender in the final recall test.

Target	Item Type	Trait Valence	
		Positive	Negative
Male	Rp-	.28 (.04)	.06 (.02)
	Nrp	.37 (.05)	.32 (.06)
	<i>Difference</i>	<i>-0.09</i>	<i>-0.26</i>
Female	Rp-	.17 (.04)	.23 (.04)
	Nrp	.39 (.07)	.29 (.05)
	<i>Difference</i>	<i>-0.22</i>	<i>-0.06</i>

Note: Rp- = unpractised valenced traits from the practised categories, Nrp = unpractised valenced traits from the unpractised categories, Difference = retrieval-induced forgetting effect.

The data summarised in this table were analysed using a 2 (Trait Valence: Positive vs. Negative) x 2 (Target Gender: Male vs. Female) x 2 (Item Type: Rp- vs. Nrp) mixed design ANOVA, with trait valence the only between subjects variable.

A significant main effect of item type (i.e. a retrieval-induced forgetting effect) was observed, with Rp- items ($M = .18$, $SE = .02$) (whether positive or negative traits and whether associated with a male or female target) being recalled significantly less well than their Nrp counterparts ($M = .34$, $SE = .03$) [$F(1, 44) = 24.933$, $p < .001$, $\eta^2 = .139$], demonstrating that the selective retrieval of neutral traits significantly impaired the participant's ability to recall competing positive or negative traits on a later cued recall test.

A significant interaction effect was also seen between the three variables - item type, target gender and trait valence [$F(1, 44) = 6.405$, $p < .05$, $\eta^2 = .048$]. Further analyses in the form of nested two-way ANOVAs were conducted to better explore the pattern of interaction between these three variables.

A 2 (Item Type: Rp- vs. Nrp) x 2 (Target Gender: Male vs. Female) interaction was analysed at both levels of trait valence (i.e. Positive and Negative). For positive traits, results of a two-way within-subjects ANOVA revealed a significant main effect of item type [$F(1, 22) = 11.748$, $p < .01$, $\eta^2 = .148$], where selective retrieval of neutral traits significantly impaired the participant's ability to recall competing positive traits on a later category-cued recall test. However, there was no significant main effect of target gender [$F(1, 22) = 1.382$, *ns*, $\eta^2 = .015$], nor was there a significant interaction effect between item type and target gender [$F(1, 22) = 1.474$, *ns*, $\eta^2 = .020$]. For negative traits, results of a two-way within-subjects ANOVA revealed a significant main effect of item type [$F(1, 22) = 13.4141$, $p = .001$, $\eta^2 = .130$], where selective retrieval of neutral traits significantly impaired the participant's ability to recall competing negative traits on a later category-cued recall test. There was also a significant main effect of target gender [$F(1, 22) = 4.290$, $p = .05$, $\eta^2 = .035$], where recall was significantly lower for male targets ($M = .19$, $SE = .03$) as compared to female targets ($M = .27$, $SE = .03$) on a later category-cued recall test. The data also revealed a significant interaction effect between

item type and target gender [$F(1, 22) = 5.393, p < .05, \eta^2 = .087$]. Follow up paired samples t-tests were carried out to see where the differences lay. Results demonstrated that the effect of item type was significant for male targets [$t(22) = -4.197, p < .001, \eta^2 = .445$] but not for female targets [$t(22) = -.942, ns, \eta^2 = .445$]. Thus, for negatively associated male targets, there is evidence that Rp- traits ($M = .06, SE = .02$) are not remembered as well as Nrp traits ($M = .32, SE = .05$), whereas there is no significant difference between Rp- ($M = .23, SE = .04$) and Nrp traits ($M = .29, SE = .05$) for negatively associated female targets.

There was also a significant interaction found between trait valence and target gender [$F(1, 44) = 5.061, p < .05, \eta^2 = .024$]. Follow up independent samples t-tests were performed to see where the differences lay. Results demonstrated that the effect of valence was significant for male targets [$t(44) = 3.059, p < .01, \eta^2 = .175$] but not for female targets [$t(44) = .478, ns, \eta^2 = .005$]. Thus, for male targets, there is evidence that positive traits ($M = .33, SE = .03$) are better remembered as compared to negative traits ($M = .19, SE = .03$), whereas for female targets the difference was not significant (positive $M = .28, SE = .04$; negative $M = .25, SE = .03$).

On the other hand, analyses of the data did not reveal any significant main effect of target gender [$F(1, 44) = .232, ns, \eta^2 = .001$]. There was also no significant main effect of valence [$F(1, 44) = .251, ns, \eta^2 = .015$]. There were also no significant interactions between item type and target gender [$F(1, 44) = .785, ns, \eta^2 = .006$] nor between item type and trait valence [$F(1, 44) = .022, ns, \eta^2 = .000$].

Additional Analyses

As recall performance of participants was measured using a free recall task, it may be said that the retrieval-induced forgetting effect found in this research may not be due to inhibition but may rather be attributed to the operation of output interference instead, where the recollection of the first items on a recall test may interfere with the subsequent recall of related items (Roediger & Schmidt, 1980; Tulving and Arbuckle, 1963). In other words, prior retrieval practice may have led participants to retrieve the highly accessible

practised Rp+ neutral traits first, which could then have resulted in the decreased recall performance for the associated unpractised Rp- valenced traits due to interference.

To examine whether this was the case, output interference was calculated using the method proposed by Macrae and MacLeod (1999), where participants were given a score reflecting the extent to which they began their recall sequences with either Rp+ or Rp- items. This was achieved by subtracting the average recall position of Rp+ items from the average recall position of Rp- items for each participant. All participants were then split into two equal halves, with the bottom half representing the early Rp- group (i.e., participants who began their recall sequences with Rp- items) and the top half representing the early Rp+ group (i.e., participants who began their recall sequences with Rp+ items), and the inhibition scores of these two groups were then compared statistically (Macrae & MacLeod, 1999). If output interference was indeed the cause of this effect, then the retrieval-induced forgetting effect should have occurred only for participants who initially retrieved Rp+ neutral traits in the recall tests. Findings indicate that in the initial recall test, the inhibition scores for positive traits were actually lower for the early Rp+ group ($M = -.18$, $SE = .05$) as compared to the early Rp- group ($M = -.36$, $SE = .08$) and this difference reached significance [$t(22) = 2.179$, $p < .05$, $\eta^2 = .178$]. Similar differences were found between the early Rp+ and early Rp- groups for negative traits in the initial test ($M_s = -.10$ vs. $-.24$, $SEs = .05$ vs. $.06$) [$t(22) = 1.642$, ns , $\eta^2 = .109$], for positive traits in the final test ($M_s = -.09$ vs. $-.22$, $SEs = .07$ vs. $.05$) [$t(22) = 1.391$, ns , $\eta^2 = .081$], and for negative traits in the final test ($M_s = -.10$ vs. $-.22$, $SEs = .06$ vs. $.05$) [$t(22) = 1.481$, ns , $\eta^2 = .091$]. Thus, the findings demonstrate that in both the initial and the final recall tests, the early recall Rp+ group, in reality, produced smaller inhibitory effects as compared to the early Rp- groups for both positive and negative traits, which is consistent with the results obtained by Macrae and MacLeod (1999). The current results, thus, provide some evidence against non-inhibitory processes, such as output interference, as an explanation of the retrieval-induced forgetting effect for valenced traits on the initial recall tests.

It could be argued that the above method proposed by Macrae and McLeod (1999) may be inappropriate to test for output interference effects in a free recall task, as it uses a

median split to divide the data and this procedure may result in the loss of some data. Thus, following a scatter plot analyses of the raw data of the participants' output interference scores and inhibition scores, simple linear regression analyses were performed for the positive and negative groups in both the initial and final tests of recall in order to determine the effect of output interference on inhibition. Results for positive traits in the initial test demonstrated that output interference significantly predicted inhibition scores on that test, $\beta = .38$, $t(45) = 2.707$, $p = .01$. However, it can be seen that although the proportion of variance in inhibition scores explained by output interference reached significance, it was only around 12% (adjusted R^2), where $R^2 = .14$, $SE = .30$, $F(1, 45) = 7.328$, $p = .01$. Likewise, results for negative traits in the initial test demonstrated that output interference significantly predicted inhibition scores on that test, $\beta = .38$, $t(45) = 2.757$, $p < .01$. Once again, it can be seen that although the proportion of variance in inhibition scores explained by output interference reached significance, it was only around 13% (adjusted R^2), where $R^2 = .15$, $SE = .27$, $F(1, 45) = 7.600$, $p < .01$. On the other hand, output interference did not significantly predict inhibition scores on the final tests for both positive, $\beta = .21$, $t(45) = 1.434$, *ns*, where $R^2 = .05$, $SE = .29$, $F(1, 45) = 2.057$, *ns*; and negative traits $\beta = .19$, $t(45) = 1.248$, *ns*, where $R^2 = .03$, $SE = .28$, $F(1, 45) = 1.557$, *ns*. Unlike the results using the method proposed by Macrae & McLeod (1999), the results from the regression analyses provide some evidence for non-inhibitory processes, such as output interference, as an explanation of the retrieval-induced forgetting effect for valenced traits on the initial recall tests. However, the results of the final tests for valenced traits were in line with those obtained previously using the method proposed by Macrae & McLeod (1999).

3.3.2. Impression Ratings:

Honesty Ratings:

The mean honesty ratings obtained as a function of (a) whether the target was male or female, (b) had been presented as a positive or negative target, (c) whether the associated neutral traits had or had not been given retrieval practice, and (d) the point in the experiment at which they were made (initial and final) are shown below in Table 3.

Table 3: Means (and standard errors) of honesty ratings in relation to sex of target, trait valence and item type obtained pre and post retrieval practice.

Trait Valence	Targets		Time of Rating	
			Initial	Final
	Item Type			
Positive	Male	Rp-	2.35 (.13)	2.30 (.15)
		Nrp	2.00 (.20)	2.13 (.22)
	Female	Rp-	2.13 (.14)	2.48 (.21)
		Nrp	1.87 (.17)	2.00 (.15)
Negative	Male	Rp-	3.35 (.20)	3.57 (.20)
		Nrp	3.74 (.17)	4.00 (.11)
	Female	Rp-	3.43 (.15)	3.52 (.19)
		Nrp	3.17 (.24)	3.04 (.24)

Note: Rp- = unpractised valenced traits from the practised categories, Nrp = unpractised valenced traits from the unpractised categories.

The resulting ANOVA was a 2 (Trait Valence: Positive vs. Negative) x 2 (Target Gender: Male vs. Female) x 2 (Item Type: Rp- vs. Nrp) x 2 (Time of Rating: Initial vs. Final) mixed-design ANOVA, with trait valence being the only between subjects variable.

Results revealed a significant main effect of target gender, with male targets ($M = 2.93$, $SE = .08$) being considered as less trustworthy as compared to female targets ($M = 2.71$, $SE = .09$) [$F(1, 44) = 3.916$, $p = .05$, $\eta^2 = .020$]. A significant main effect of time of rating can also be seen, where targets were considered as becoming less trustworthy from the initial time of rating ($M = 2.76$, $SE = .06$) to the final time of rating ($M = 2.88$, $SE = .07$) [$F(1, 44) = 5.796$, $p < .05$, $\eta^2 = .006$]. There was also a significant main effect of valence, with positively associated targets ($M = 2.16$, $SE = .09$) being considered as more trustworthy as compared to negatively associated targets ($M = 3.48$, $SE = .09$) [$F(1, 44) = 113.476$, $p < .001$, $\eta^2 = .009$].

A marginal significant interaction effect was found between item type and target gender [$F(1, 44) = 3.339$, $p = .07$, $\eta^2 = .020$] suggesting a relationship between ratings of male and female targets and whether the associated neutral traits had or had not been given retrieval practice. Follow up paired samples t-tests were conducted to see where the differences lay. Results demonstrated that the effect of item type was significant for female targets [$t(45) = 2.361$, $p < .05$, $\eta^2 = .110$], but not for male targets [$t(45) = -.428$, ns , $\eta^2 = .004$]. Thus, for female targets, there is evidence that Rp- targets ($M = 2.89$, $SE = .14$) were rated as less trustworthy as compared to Nrp targets ($M = 2.52$, $SE = .15$), whereas for male targets, the difference was not significant (Rp- $M = 2.89$, $SE = .14$; Nrp $M = 2.97$, $SE = .18$).

On the other hand, the data also shows that there was no significant main effect found for item type [$F(1, 44) = 1.716$, ns , $\eta^2 = .009$]. There were also no significant interactions found between item type and time of rating [$F(1,44) = .234$, ns , $\eta^2 = .000$], between item type and trait valence [$F(1,44) = 2.263$, ns , $\eta^2 = .011$], between target gender and valence [$F(1,44) = 1.698$, ns , $\eta^2 = .009$], between time of rating and trait valence [$F(1,44) = .099$, ns , $\eta^2 = .000$], between time of rating and target gender [$F(1,44) = .071$, ns , $\eta^2 = .000$], between item type, target gender and trait valence [$F(1,44) = 1.909$, ns , $\eta^2 =$

.011], between item type, time of rating and trait valence [$F(1,44) = .084$, *ns*, $\eta^2 = .000$], between item type, time of rating and target gender [$F(1,44) = 2.912$, *ns*, $\eta^2 = .003$], between trait valence, target gender and time of rating [$F(1,44) = 3.480$, *ns*, $\eta^2 = .005$] and finally between item type, time of rating, target gender and valence [$F(1,44) = .116$, *ns*, $\eta^2 = .000$].

To summarise the main results of this experiment, it can be seen that there were strong practice effects in both the initial and final tests of recall. Large retrieval-induced forgetting effects were also demonstrated in the initial and final tests of recall. Significant interaction effects were also found between trait valence and target gender in both the initial and recall tests, where positive traits were significantly better recalled than negative traits when associated with male targets. There was a significant three-way interaction between item type, target gender and trait valence in the final recall test and further analyses revealed that Rp- traits are not remembered as well as Nrp traits for negatively associated male targets. The recall data was also analysed for output interference effects, as the experiment employed a free recall measure. Using the method given by Macrae and MacLeod (1999), the findings demonstrated that there were no significant output interference effects in both the initial and the final recall tests, and that the early recall Rp+ group actually produced smaller inhibitory effects as compared to the early Rp- groups for both positive and negative traits. On the other hand, using scatter plots and subsequent regression analyses of the raw data, it can be seen that output interference significantly predicted inhibition for positive and negative traits on the initial recall test, but no such prediction could be made for positive and negative traits on the final recall test. It must be noted that even though the proportion of variance in inhibition scores explained by output interference reached significance, it was only around 12% for positive traits and 13% for negative traits on the initial recall test. Finally, the results from the honesty rating judgements revealed no effect of retrieval-induced forgetting as expected. However, the data revealed relatively small main effects of target gender, time of rating and trait valence.

3.4. Discussion

The results of the current experiment provide mixed support for Storm and colleagues (2005) findings concerning retrieval-induced forgetting of valenced traits and metacognitive judgements. Consistent with Storm and colleagues findings is that significant retrieval-induced forgetting was found for male positive and negative traits, and for female positive and negative traits in the initial recall test. Current results show that there is an increased magnitude of the retrieval-induced forgetting effect for positive traits as compared to negative traits, and can be explained as due to their increased strength (i.e. overall higher positive Nrp means as compared to negative Nrp means). This is consistent with the inhibitory account of retrieval-induced forgetting (M.C. Anderson et al, 1994; M.C. Anderson & Spellman, 1995; M.D. MacLeod & Saunders, 2005; Saunders & MacLeod, 2006; Veling & van Knippenberg, 2004). According to the inhibitory account of retrieval-induced forgetting it is the strong items which are most prone to retrieval-induced forgetting as it is these items that are most likely to come to mind during retrieval practice (M.C. Anderson et al., 1994). It is necessary to suppress these strong items in order to retrieve the desired items from memory. In the current experiment the strongest items appear to be the positive traits and, therefore, it is these items that are most susceptible to retrieval-induced forgetting since they are the ones that are most likely to come to mind during retrieval practice. Results from the additional analyses, using the method proposed by Macrae and MacLeod (199), conducted to test if non-inhibitory processes may underlie the retrieval-induced effects produced in the current experiment also provide support for the inhibitory account of retrieval-induced forgetting, where the retrieval-induced forgetting effect occurred to a greater extent in the early Rp- group as compared to the early Rp+ group. These findings, thus, demonstrate that inhibitory processes may form the basis of the retrieval-induced forgetting of valenced traits that occurred. On the other hand, results from the regression analyses demonstrate some evidence for output interference as significantly predicting retrieval-induced forgetting of positive and negative traits in the initial recall test, although the proportion of variance accounted for by output interference was quite small (positive - 12% and negative - 13%). Thus, these results provide some evidence against the inhibitory explanation of retrieval-induced forgetting of valenced information in this study.

One finding which is inconsistent with Storm and colleagues is the lowest amount of retrieval-induced forgetting of negative female traits in the final recall test. In fact, it is these items that Storm and colleagues found were most susceptible to retrieval-induced forgetting. However, results of the current experiment show the lowest mean recall for Nrp negative traits associated with female targets ($M = .29$), which suggests that these female negative traits may not have been strong enough to compete for retrieval, and in turn, not strong enough to initiate strong retrieval-induced forgetting effects as compared to the other Nrp items. Thus, when negative items for female targets are Rp- items they are unlikely to be strong competitors and there is no need for retrieval-induced forgetting to be initiated. The overall reduced retrieval-induced forgetting effect for negative traits as compared to that for positive traits may be explained by the adaptive account of forgetting (Attrill & MacLeod, 2004), which predicts that retrieval-induced forgetting would fail to emerge in conditions whereby it would be not adaptive to forget traits about individuals. This account would thus expect negative traits about other individuals not be susceptible to retrieval-induced forgetting as they are indicators of possible future threatening or unpleasant behaviours and experiences.

It must be noted that the recall performance findings are also consistent with a context dependent forgetting account of retrieval-induced forgetting (Perfect et al., 2004), which suggests that there is overlap in the contexts present during retrieval practice and at final test. Thus, the cues used during the final test are not functionally different to the cues used during retrieval practice. As the cues used during retrieval practice and final test were the target's name and picture, there is, therefore, a high degree of overlap in testing contexts. Participants may have employed the retrieval practice context during the final test to guide their memory.

With regards to the impression judgements, Storm and colleagues (2005) fail to find any effect of retrieval-induced forgetting on subsequent ratings, which suggest that the suppression of positive and negative traits had no impact on participants' impression ratings; targets were rated as likeable (or not likeable) irrespective of whether retrieval-induced forgetting was active (or not active). The findings of the current experiment also do not demonstrate any effect of retrieval-induced forgetting on honesty ratings as

expected. On the other hand, an overall significant shift in honesty ratings of both male and female targets being rated as less trustworthy from initial to final times of rating by participants was found, although this effect size is quite small ($\eta^2 = .006$). However, this shift in ratings could be explained as merely a time of testing effect and not as related to retrieval-induced forgetting of the target's valenced information.

Previous research has shown that impressions are abstractions that once formed tend not to be malleable even when explicit recall of the original information changes (Klein, Loftus & Plog, 1992; Klein, Loftus & Kihlstrom, 1996; Klein, Chan & Loftus, 1999). Research in the directed-forgetting paradigm (E.L. Bjork & Bjork, 1996, 2003; Johnson & Anderson, 2004) suggests that impressions formed are resistant to change in spite of forgetting the memories on which they were based. This implies that even when we do not remember positive or negative information about people, our already formed judgements and impressions about them do not change. In terms of the metacognitive literature, the current impression findings may be explained by the inferential model of metacognitive judgements, which suggests that rule of thumb judgements that are based on overall accessibility (i.e. correct and wrong partial information as well as the intensity with which this information is retrieved), and not direct availability are employed to make impression judgements about a target. The current results, however, could be better explained by the proposed anchoring-and-adjustment heuristic processes in the formation of on-line judgements (Lopes, 1982; Hastie & Park, 1986), where a person spontaneously scans, selects important target items and then anchors and adjusts this value, thereby integrating new target information in a serial fashion until a final judgement can be made. As these on-line judgements have been found to have little or no relationship with information in memory, the honesty ratings given by participants in the current experiment may have been formed on-line (through revision and integration), rather than be based on availability of target information in memory.

THE ADAPTIVE NATURE OF RETRIEVAL-INDUCED FORGETTING IN REMEMBERING OTHERS

4.1. Introduction

Retrieval-induced forgetting has long since been viewed as an adaptive component of the memory system, as it reduces the amount of interruption to our ongoing cognitive processes by actively inhibiting unwanted and irrelevant memories, and thus enables us to continue with our daily activities (M.C. Anderson et al., 1994; R.A. Bjork, 1998; Macrae & MacLeod, 1999; M.D. MacLeod & Macrae, 2001; M.D. MacLeod et al., 2003). Since we interact with others on a daily basis, it is essential that we understand how availability and accessibility of information regarding others enable us to perceive, interpret and respond to people and experiences in our social world. The current research therefore explores the role of retrieval inhibition in the processing of person-specific information; more specifically, it considers the implications of retrieval-induced forgetting of negative traits associated with honest and dishonest target individuals in terms of how we make evaluative judgements concerning the target individuals.

Previous research by Macrae and MacLeod (1999) in the area of retrieval-induced forgetting and impression formation demonstrated the occurrence of retrieval-induced forgetting for positive traits, which were studied in relation to two fictitious male characters. However, these results were limited in two ways. Firstly, the results showed the effects of retrieval inhibition of only positive information about others, since the authors presented only positive traits to their participants. Secondly, the authors did not take an affective measure of impression ratings of the target individuals in question and

thus, overlooked any effects that retrieval inhibition might have had on the formation and maintenance of social judgements.

Evidence from person perception research suggests that there may be differences in the way in which people process differently valenced information about others. For example, negative information is particularly informative with regards to a person's future behaviour (Skowronski & Carlston, 1989). Research on automatic vigilance has shown that people tend to notice and pay more attention to negative and inconsistent information as compared to positive information about others (Wentura et al., 2000). In the same way, inconsistent or negative information about other people tends not to easily be forgotten, as negative out-of-role behaviour may be considered as highly diagnostic for determining the underlying personality characteristics of others. Thus, it makes adaptive sense for us *not* to forget negative information about people that we are likely to interact with in our social world and as retrieval-induced forgetting is viewed as an adaptive process, negative traits about other individuals should be invulnerable to the effects of retrieval-induced forgetting.

Attrill and MacLeod (2004) also examined impression formation for the 'self' and for an 'other' experimental partner to see whether retrieval-induced forgetting affects memory for positive and negative information, relevant either to oneself or to another person. In their study, participants were presented with categories of positive and negative traits, which they judged in relation to a newly acquainted target other, followed by retrieval practice on subsets of both positive and negative traits subjectively considered to describe that target other. Results demonstrated a significant retrieval-induced forgetting effect for positive but not for negative traits on a final recall task. The absence of forgetting for negative information likely resulted from the flexible goal-directed manner in which retrieval-induced forgetting operates (c.f., Macrae & MacLeod, 1999); that is, if negative information gives the social perceiver an indication of what to expect with regards to a target other's future behaviour, the goal-directed nature of active forgetting likely rendered that material invulnerable to retrieval-induced forgetting (Attrill & MacLeod, 2004).

More recently, Storm and colleagues (2005) examined whether retrieval-induced forgetting of traits could alter metacognitive judgements such as ratings of likeability. Using the retrieval practice paradigm, Storm and colleagues examined whether initiating retrieval-induced forgetting of positive traits would make the target less likeable and whether initiating retrieval-induced forgetting of negative traits would make the target more likeable. Results demonstrated strong retrieval-induced forgetting effects for both positive and negative traits suggesting that the prior retrieval of neutral traits reduced accessibility of the non-retrieved valenced traits, thus, showing that we are able to alter what we remember about others.

The above findings challenge the belief that retrieval-induced forgetting is an adaptive mechanism as they found strong inhibition effects for negative traits, information relating to an individual's reliability and trustworthiness, across all 3 experiments. To explain these effects, they proposed the negativity bias account (Fiske, 1980; Rozin & Royzman, 2001), where research in the area of impression formation has demonstrated that negative information about others stands out more than positive information and that the amalgamation of the two usually results in extreme negative target evaluations (Rozin & Royzman, 2001). This is also consistent with the inhibitory account of retrieval-induced forgetting (M.C. Anderson et al., 1994), which proposes that it is the stronger and more dominant, and not the weak, exemplars that are most susceptible to retrieval-induced forgetting (M.C. Anderson et al, 1994; M.C. Anderson & Spellman, 1995; M.D. MacLeod & Saunders, 2005; Saunders & MacLeod, 2006; Veling & van Knippenberg, 2004). Based on these results, a negativity bias in person memory and impression formation should facilitate forgetting of negative information due to competition created by retrieval.

The results obtained by Storm and colleagues (2005) also demonstrated that the ratings of likeability did not change across the two rating measures, even though there was a reduced ability to recall valenced information about the target persons, which suggests that the metacognitive judgements we make about others on a daily basis do not seem to be based on the availability of relevant information in memory. The results of Experiment 1 in the current thesis also found no relationship between information available in

memory and subsequent judgements of honesty concerning target individuals. Findings demonstrated that even though there were significant retrieval-induced forgetting effects of a target's associated positive and negative trait information, this forgetting of valenced information was not related to any shift in the impression formed of that target. The results of the previous experiment also demonstrated stronger retrieval-induced forgetting effects of positive, as compared to negative target information, which was explained as consistent with the adaptive account of retrieval-induced forgetting.

Predictions

The following two experiments are an investigation into the adaptive nature of retrieval-induced forgetting; specifically whether or not negative information related to target individuals is susceptible to retrieval-induced forgetting. As in Experiment 1, using the paradigm set out by Storm and colleagues (2005), participants were presented with photographs of two target individuals (an honest and dishonest female target in Experiment 2A and an honest and dishonest male target in Experiment 2B) and each target had associated neutral and negative traits. Ratings of honesty and attractiveness were taken before the study phase and then finally at the end of the study to confirm that there was no shift in the impression formed about the given studied target individuals. Thus, based on research findings in the literature, as well as the findings in Experiment 1, the following general predictions were made, where fewer negative traits (Rp- items) whose neutral counterparts were subject to retrieval practice were expected to be recalled as compared to those whose neutral counterparts had not been subject to retrieval practice (Nrp items) and that there would not be a shift in the affective impression of a given studied individual (in terms of honesty), i.e. retrieval-induced forgetting of negative traits should not make a target individual appear to be more honest or trustworthy.

EXPERIMENT 2A - THE RETRIEVAL-INDUCED FORGETTING EFFECT OF NEGATIVE TRAITS ASSOCIATED WITH HONEST AND DISHONEST FEMALE TARGETS

4.2. Method

Participants and Design

One hundred and eight undergraduate and postgraduate students (54 females and 54 males; ages ranging from 18 to 36 with a mean age of 23.3) from Swansea University, U.K., participated in this study for psychology subject pool credit or a payment of £2. All participants were fluent English speakers and equal proportions of male and female participants were randomly assigned to each counterbalanced experimental condition. The experiment had a 2 (Target Honesty: Honest vs. Dishonest) x 3 (Practice Status: practised items from the practised category [Rp+], non-practised items from the practised category [Rp-], and non-practised items from the non-practised category [Nrp]) within subjects design.

Stimulus Materials

The stimuli used in the main studies were facial pictures of 2 male and 2 female targets. To determine the target stimuli to be used in the study, stimuli that would be considered generally honest or dishonest, a pilot study was conducted (see Appendix III). Twenty-eight targets (14 male and 14 female) were chosen from the Psychological Image Collection at Stirling University (<http://pics.psych.stir.ac.uk>). Using a web-based rating application, data was collected from 30 participants. Participants were shown the targets in a random order and were asked to rate each one on a 5-point Likert scale for attractiveness and honesty. The 2 targets rated most honest and most dishonest from each set (male and female) were selected as the target items to be used in the study.

The stimuli used in the this study were only the facial pictures of two female targets (see Appendix III) which were originally determined on the basis of honesty and attractiveness ratings given by participants in an earlier pilot study. The female target rated as most honest and the female target rated as most dishonest in the pilot study were used, as judgement ratings of honesty was the topic in question. Once again, the traits used to

describe the targets were neutral and valenced traits that had been standardised and these were drawn from N.H. Anderson's (1968) likeability norms. Some of the traits used in Experiment 1 had been changed and replaced with different traits in order to better describe the dimension of honesty and to allow for re-employment of some of the previous subject pool of participants. Ten neutral traits were chosen which had a mean likeability rating of 303.9 (tense, casual, ordinary, proud, average, blunt, cautious, quiet, moderate, and timid) and ten negative traits were chosen which had a mean likeability rating of 59.7 (liar, rude, malicious, greedy, insincere, conceited, cruel, mean, selfish, and spiteful) (see Appendix IV). Each target had 10 traits assigned to them: five neutral and five negative traits. The assignment of traits attached to the targets was fully counterbalanced across targets and participants. Thus, the Rp+ items were the neutral items associated with the target whose traits received retrieval practice and the negative traits associated with the same target were the Rp- items. The Nrp items were the unpractised negative traits of the other target.

Procedure

As in the first experiment, participants were given the same instructions as those used in Storm and colleagues (2005) and were told that they were going to learn traits describing 2 individuals and in the process they should form impressions about them. Again, they were told that other participants had interacted with these individuals in a prior study and had used the to-be-learned traits to describe these individuals. They were also told that they might have to play a game with one of the individuals at the end of the study and that the more they remembered about that individual, the better they would do in the game. After the instructions, the experiment began and consisted of three main phases for each target individual in turn: a study phase, a retrieval practice phase and a recall phase, all within a ten minute block allocated to a given target.

The procedure used for this experiment differed slightly from the previous one in terms of the administration time of the first ratings measure. This was taken before the study phase (instead of just after the study phase and preceding the retrieval practice phase as done in Experiment 1), as previous research into face-trustworthiness has demonstrated that people make reliable trustworthiness judgements about a target after only 100 ms of facial

exposure (Willis & Todorov, 2006). Participants were shown the target's picture and name and were asked to rate the target on the two dimensions of honesty and attractiveness, using a 5-point Likert scale, whereby 1 indicated that the target was very honest and 5 indicated that the target was very dishonest. In the study phase, participants read 10 word pairs that appeared underneath a target's picture (e.g., Jane: Average). The neutral and valenced traits associated with a given target were presented in a random and interleaved order. Each word pair was displayed for 5 seconds. After all of the traits were presented to participants, they had to rate the target on honesty and attractiveness using a 5-point Likert scale. As honesty was the measure of interest, it was placed first to exclude any possible ordering effects and the other rating judgement of attractiveness was incorporated to try and limit the participant's ability to remember his or her honesty ratings when a post-study rating task was to be administered.

In the retrieval practice phase, participants received retrieval practice for neutral traits of one of the targets (e.g. Jane: Av___), while for the other target, participants received retrieval practice for an unrelated category (e.g. Fruit: Or___), thus creating Rp- and Nrp conditions, respectively, for the unpractised valenced traits. When the target's neutral traits were practised, the associated negative traits were considered to be Rp- items, while when an unrelated category was practised, the valenced traits were considered as Nrp items. This phase was followed by a 3 minute distracter task (i.e., word search puzzle) in the absence of the target's picture. No participant completed the distracter task in the allocated time.

In the recall phase, the target's face and name were placed in front of the participant and the participant had one minute to recall as many traits describing the target as possible. This process was repeated for both the targets. Subjects were then informed that they did not have to meet any of the individuals. They had to, however, rate each of the individuals again in order to see whether impression changes might be salient and then engage in a surprise final category-cued recall test in order to see whether any retrieval-induced forgetting effects would persist after a delay. Participants were then debriefed, thanked for their effort and participation, paid two pounds or were given psychology subject pool credits and escorted outside the laboratory.

4.3. Results

4.3.1. Recall Performance:

Retrieval Practice Performance

The retrieval practice success rate for neutral traits during the retrieval practice phase was 80% ($M = 4.02$, $SE = .09$).

Initial Recall Performance:

An analysis of the data revealed the anticipated effect of item type on recall performance, where the proportion of neutral traits recalled correctly was greater when given retrieval practice ($M = .65$, $SE = .02$) than when not given retrieval practice ($M = .37$, $SE = .02$). Results of a paired t-test analysis confirmed that the difference was indeed significant [$t(107) = 8.823$, $p < .001$, $\eta^2 = .421$], thus demonstrating the recollective advantages of retrieval practice.

The mean correct cued-recall proportions for negative traits as a function of whether they had been associated with an honest or dishonest target and whether the target's neutral traits had or had not been given retrieval practice (i.e. their status as Rp- or Nrp items) on the initial recall test are shown in Table 4.

Table 4: Experiment 2A – Female Targets: Mean correct trait-recall proportions (and standard errors) in relation to item type and target honesty (honest or dishonest) on the initial recall test.

Item Type	Honest Target	Dishonest Target
Rp-	.36 (.02)	.37 (.03)
Nrp	.44 (.03)	.47 (.03)
Difference	-0.08	-0.10

Note: *Rp-* = unpractised valenced traits from the practised categories, *Nrp* = unpractised valenced traits from the unpractised categories, *Difference* = retrieval-induced forgetting effect.

The data summarised in this table were analysed using a 2 (Target Honesty: Honest vs. Dishonest) x 2 (Item Type: Rp- vs. Nrp) within subjects ANOVA.

A significant retrieval-induced forgetting effect was observed, with Rp- items (whether negative traits were associated with both an honest or dishonest female target) being recalled significantly less well ($M = .37$, $SE = .02$) than their Nrp counterparts ($M = .45$, $SE = .02$) [$F(1, 53) = 7.526$, $p < .01$, $\eta^2 = .054$]. In other words, the selective retrieval of neutral traits significantly impaired the participant's ability to recall competing negative traits on a later category-cued recall test.

On the other hand, the analyses of data did not reveal any significant main effect of target honesty [$F(1, 53) = 1.000, ns, \eta^2 = .004$]. There was also no significant interaction found between item type and target honesty [$F(1, 53) = .096, ns, \eta^2 = .001$].

Final Recall Performance:

An analyses of the data from the surprise final recall test at the end of the study revealed a persistent effect of item type on recall performance, where the proportion of neutral traits recalled correctly was larger when given retrieval practice ($M = .44, SE = .03$) than when not given retrieval practice ($M = .23, SE = .02$). Once more, results of a paired samples t-test confirmed that the difference was significant as expected [$t(107) = 6.520, p < .001, \eta^2 = .284$], thus yet again demonstrating the recollective advantages of retrieval practice over a short delayed period.

The mean correct cued-recall proportions for negative traits as a function of whether they had been associated with an honest or dishonest target and whether the target's neutral traits had or had not been given retrieval practice (i.e. their status as Rp- or Nrp items) on the final recall test are shown in Table 5.

Table 5: Experiment 2A – Female Targets: Mean correct trait-recall proportions (and standard errors) in relation to item type and target honesty (honest or dishonest) on the final recall test.

Item Type	Honest Target	Dishonest Target
Rp-	.21 (.03)	.24 (.03)
Nrp	.31 (.03)	.38 (.03)
Difference	-0.10	-0.14

Note: *Rp-* = unpractised valenced traits from the practised categories, *Nrp* = unpractised valenced traits from the unpractised categories, *Difference* = retrieval-induced forgetting effect.

The data summarised in this table were as before analysed using a 2 (Target Honesty: Honest vs. Dishonest) x 2 (Item Type: *Rp-* vs. *Nrp*) within subjects ANOVA.

Once again a significant retrieval-induced forgetting effect was observed, with *Rp-* items (whether negative traits were associated with both, an honest or a dishonest female target) being recalled significantly less well ($M = .23$, $SE = .02$) than their *Nrp* counterparts ($M = .34$, $SE = .02$) [$F(1, 53) = 13.046$, $p = .001$, $\eta^2 = .099$]. Thus, even after a short delayed period of time, the selective retrieval of neutral traits significantly impaired the participant's ability to recall competing negative traits. The analyses of data also revealed a significant main effect of target honesty [$F(1, 53) = 4.336$, $p < .05$, $\eta^2 = .019$], suggesting that there was significantly higher recall of negative traits associated with the

dishonest female target ($M = .31, SE = .02$) as compared to the recall of negative traits associated with the honest female target ($M = .26, SE = .02$).

On the other hand, there was no significant interaction found between item type and target honesty [$F(1, 53) = .329, ns, \eta^2 = .002$].

Additional Analyses

In order to rule out the alternative explanation to inhibitory processes as underlying the retrieval-induced effects found in the current experiment, an output interference score was calculated for each participant (Macrae & MacLeod, 1999). Output interference refers to the decreased retrieval performance of items on a free recall task due to interference caused as a consequence of the recall of the first items on that task (Roediger & Schmidt, 1980; Tulving & Arbuckle, 1963). Thus, in terms of the current research, prior retrieval practice for both honest and dishonest targets may have led participants to retrieve the highly accessible practised Rp+ neutral traits first, which could then have resulted in the decreased recall performance for the associated unpractised Rp- negative traits due to interference. If output interference was indeed the cause of this effect, then the retrieval-induced forgetting effect should only have occurred for participants who initially retrieved Rp+ neutral traits in the recall tests. Results of paired samples t-tests conducted between the inhibition scores of the early Rp+ group and early Rp- group showed that there was no difference between the two groups. Findings indicate that in the initial recall test, the inhibition scores for dishonest targets were actually lower for the early Rp+ group ($M = -.05, SE = .04$) as compared to the early Rp- group ($M = -.07, SE = .07$) [$t(26) = .303, ns, \eta^2 = .004$]. Similar differences were found between the early Rp+ and early Rp- groups for honest targets in the initial test ($M_s = -.10$ vs. $-.12$; $SE_s = .06$ vs. $.05$) [$t(26) = .184, ns, \eta^2 = .001$], for dishonest targets in the final test ($M_s = .02$ vs. $-.16$; $SE_s = .05$ vs. $.06$) [$t(26) = 2.324, p < .05, \eta^2 = .172$], and for honest targets in the final test ($M_s = -.05$ vs. $-.29$; $SE_s = .06$ vs. $.06$) [$t(26) = 2.866, p < .01, \eta^2 = .240$], with significant differences between mean scores in the final recall tasks. Thus, it can be seen that the mean inhibition scores for the early Rp+ group were actually lower than those obtained for the early Rp- scores, which is in the opposite predicted direction. These results, once again, are not only consistent with those of Macrae and MacLeod (1999) but also provide

evidence against non-inhibitory processes, such as output interference, as an explanation of the retrieval-induced forgetting effect for valenced traits that occurs in the above findings.

As explained previously in Experiment 1, it could be argued that the above method proposed by Macrae and McLeod (1999) may be inappropriate to test for output interference effects in a free recall task, as it uses a median split to divide the data and this procedure may result in the loss of some data. Thus, following a scatter plot analyses of the raw data of the participants' output interference scores and inhibition scores, simple linear regression analyses were performed on scores for the dishonest and honest female targets in both the initial and final tests of recall to determine the effect of output interference on inhibition. Results demonstrated that output interference did not significantly predict inhibition scores on the initial tests for both dishonest, $\beta = .03$, $t(53) = .192$, *ns*, where $R^2 = .001$, $SE = .30$, $F(1, 53) = .037$, *ns*, and honest targets $\beta = .05$, $t(53) = .373$, *ns*, where $R^2 = .003$, $SE = .30$, $F(1, 53) = .139$, *ns*; as well as on the final test for dishonest targets $\beta = .03$, $t(53) = .218$, *ns*, where $R^2 = .001$, $SE = .32$, $F(1, 53) = .047$, *ns*. On the other hand, output interference significantly predicted inhibition scores on the final test for honest targets, $\beta = .36$, $t(53) = 2.807$, $p = .007$. However, it can be seen that although the proportion of variance in inhibition scores explained by output interference reached significance, it was only 11.5% (adjusted R^2), where $R^2 = .132$, $SE = .30$, $F(1, 53) = 7.877$, $p = .007$. Unlike the results using the method proposed by Macrae & McLeod (1999), the results from the regression analyses provide some evidence for non-inhibitory processes, such as output interference, as an explanation of inhibition for honest targets on the final recall test. However, the rest of the results for dishonest and honest targets on the initial test and for dishonest targets on the final tests were in line with those obtained previously using the method proposed by Macrae & McLeod (1999).

4.3.2. Impression Ratings:

Honesty Ratings:

The mean honesty ratings obtained as a function of (a) whether the target was honest or dishonest, (b) whether the associated neutral traits had or had not been given retrieval practice, and (c) the point in the experiment at which they were made (Initial: before the

study phase, or Final: immediately after the final category-cued recall test) are shown below in Table 6.

Table 6: Experiment 2A – Female Targets: Means (and standard errors) of honesty ratings in relation item type and target honesty (honest or dishonest) obtained pre and post retrieval practice.

Targets	Time of Rating		
	Item Type	Initial	Final
Honest	Rp-	2.74 (.11)	2.89 (.11)
	Nrp	2.37 (.09)	3.02 (.14)
Dishonest	Rp-	3.00 (.10)	3.46 (.11)
	Nrp	3.46 (.10)	3.56 (.12)

Note: Rp- = unpractised valenced traits from the practised categories, Nrp = unpractised valenced traits from the unpractised categories.

The resulting ANOVA was a 2 (Target Honesty: Honest vs. Dishonest) x 2 (Item Type: Rp- vs. Nrp) x 2 (Time of Rating: Initial vs. Final) within subjects ANOVA.

Results revealed a significant main effect of target honesty [$F(1, 53) = 39.690, p < .001, \eta^2 = .134$], where honest targets ($M = 2.75, SE = .07$) were rated as more trustworthy compared to dishonest targets ($M = 3.37, SE = .07$). There was also a significant main effect of time of rating [$F(1, 53) = 24.869, p < .001, \eta^2 = .040$], where there was a significant shift in ratings for both honest and dishonest targets, from being rated as average in terms of trustworthiness on the initial rating ($M = 2.89, SE = .06$) to being rated as less trustworthy on the final honesty ratings ($M = 3.23, SE = .06$).

The analyses of data also revealed a significant interaction effect between time of rating, target honesty and item type [$F(1, 53) = 11.527, p < .001, \eta^2 = .017$]. Further analyses in the form of nested two-way ANOVAs were conducted to better explore the pattern of interaction between these three variables.

A 2 (Item Type: Rp- vs. Nrp) x 2 (Time of Rating: Initial vs. Final) interaction was analysed at both levels of target honesty (i.e. Honest and Dishonest). For honest targets, results of a two-way within subjects ANOVA revealed no significant main effect of item type [$F(1, 53) = .856, ns, \eta^2 = .007$]. On the other hand, there was a significant main effect of time of rating [$F(1, 53) = 17.660, p < .001, \eta^2 = .077$], where honest targets were rated as becoming less trustworthy from the initial ($M = 2.56, SE = .08$) to final times of rating ($M = 2.95, SE = .09$). There was also a significant interaction between item type and time of rating [$F(1, 53) = 7.492, p < .01, \eta^2 = .030$]. Follow up paired samples t-tests demonstrated there was a significant effect of time of rating on Nrp targets [$t(53) = -4.393, p < .001, \eta^2 = .267$], but not on Rp- targets [$t(53) = -1.306, ns, \eta^2 = .031$]. Thus, there is evidence that Nrp honest targets were rated as significantly less trustworthy from initial ($M = 2.37, SE = .09$) to final times of rating ($M = 3.02, SE = .14$); whereas there was no significant difference between these two times of rating for Rp-honest targets (initial $M = 2.74, SE = .11$; final $M = 2.89, SE = .11$). For dishonest targets, results of a two-way within subjects ANOVA revealed a significant main effect of item type [$F(1, 53) = 4.476, p < .05, \eta^2 = .042$], where Rp- targets ($M = 3.23, SE = .08$) were rated as significantly more trustworthy as compared to Nrp targets ($M = 3.51, SE = .10$). There was also a significant main effect of time of rating [$F(1, 53) = 10.352, p < .01, \eta^2 = .042$], where dishonest targets were rated as becoming less trustworthy from the initial (M

= 3.23, $SE = .08$) to final times of rating ($M = 3.51$, $SE = .08$). There was also a significant interaction between item type and time of rating [$F(1, 53) = 5.561$, $p < .05$, $\eta^2 = .019$]. Follow up paired samples t-tests demonstrated there was a significant effect of time of rating on Rp- targets [$t(53) = -3.675$, $p = .001$, $\eta^2 = .203$], but not on Nrp targets [$t(53) = -.868$, ns , $\eta^2 = .014$]. Thus, there is evidence that Rp- dishonest targets were rated as significantly less trustworthy from initial ($M = 3.00$, $SE = .10$) to final times of rating ($M = 3.46$, $SE = .11$); whereas there was no significant difference between these two times of rating for Nrp dishonest targets (initial $M = 3.46$, $SE = .11$; final $M = 3.56$, $SE = .12$).

A significant interaction effect was found between item type and target honesty [$F(1, 53) = 5.295$, $p < .05$, $\eta^2 = .014$] suggesting a relationship between ratings of honest and dishonest targets and whether the associated neutral traits had or had not been given retrieval practice. Follow up paired samples t-tests revealed a significant difference in honesty ratings between Rp- ($M = 3.23$, $SE = .08$) and Nrp dishonest targets ($M = 3.51$, $SE = .10$), [$t(53) = -2.116$, $p < .05$, $\eta^2 = .078$], suggesting that the dishonest female targets that received retrieval practice of the associated neutral traits were viewed as being more trustworthy as compared to the dishonest targets that did not receive retrieval practice of their associated neutral traits. On the other hand, there was no significant difference found in honesty ratings between Rp- ($M = 2.81$, $SE = .09$) and Nrp honest female targets ($M = 2.69$, $SE = .10$), [$t(53) = .925$, ns , $\eta^2 = .016$].

On the other hand, the analyses of data revealed no significant effect of item type [$F(1, 53) = .645$, ns , $\eta^2 = .002$]. There were also no significant interaction effects between item type and time of rating [$F(1, 53) = .334$, ns , $\eta^2 = .000$], and between time of rating and target honesty [$F(1, 53) = 1.000$, ns , $\eta^2 = .001$].

To summarise the key findings in Experiment 2A (honest and dishonest female targets), there were strong practice effects accompanied by retrieval-induced forgetting effects in both the initial as well as the final tests of recall. There was a significant main effect of target honesty in the final recall test, where recall was significantly higher for the dishonest target as compared to the honest target. The recall data for both the initial and

final recall tests were also analysed for output interference effects. Using the method proposed by Macrae and MacLeod (1999) it can be seen that the mean inhibition scores for the early Rp+ group were actually lower than those obtained for the early Rp- scores for the honest and dishonest targets in both the initial and final tests of recall, which provided evidence against output interference as an explanation of the retrieval-induced forgetting effect for valenced traits that occurs in the above findings. Results from the regression analyses confirmed the previous pattern of findings for dishonest and honest targets on the initial test and for dishonest targets on the final recall test, but did provide some evidence for output interference as an explanation of inhibition for honest targets on the final recall test. It must be noted that although the interaction reached significance, only 11.5% of the variance in inhibition scores can be explained by output interference on this test. Findings from the honesty ratings revealed a significant main effect of target honesty, where honest targets were rated as more trustworthy than dishonest targets. There was also a significant main effect of time of rating, where ratings for both honest and dishonest targets significantly shifted towards them being rated as less trustworthy from initial to the final times of rating. A significant three-way interaction effect between time of rating, target honesty and item type revealed that Nrp honest targets and Rp-dishonest targets were rated as significantly less trustworthy from initial to final times of rating. Finally, a significant interaction effect between item type and target honesty demonstrated that Rp- dishonest female targets were rated as more trustworthy than Nrp dishonest targets.

EXPERIMENT 2B – THE RETRIEVAL-INDUCED FORGETTING EFFECT OF NEGATIVE TRAITS ASSOCIATED WITH HONEST AND DISHONEST MALE TARGETS

The results from Experiment 2A once again confirm that judgements of honesty about a target person are not really based on information that is available in our memory about the target person. The results also replicate those obtained in Experiment 1, where there was an overall significant shift in honesty ratings towards rating both target types being rated as less trustworthy from initial to final times of rating. The current experiment is an extension of the previous experiment, using male targets instead of female targets, in order to see whether gender of target influences the retrieval-induced effect of negative target information in any manner.

4.4. Method

Participants and Design

One hundred and four undergraduate and postgraduate students (52 females and 52 males; ages ranging from 18 to 34 with a mean age of 23.02) from the Swansea University, U.K., participated in this study for psychology subject pool credit or a payment of £2. Once again all participants were fluent English speakers and equal proportions of male and female participants were randomly assigned to each counterbalanced experimental condition. The experiment had a 2 (Target Honesty: Honest vs. Dishonest) x 3 (Practice Status: practised items from the practised category [Rp+], non-practised items from the practised category [Rp-], and non-practised items from the non-practised category [Nrp]) within subjects design.

Stimulus Materials

The stimuli used in this study were identical to those used in Experiment 2A; except that the facial pictures used were the two male (see Appendix III), instead of the two female target facial pictures. These were originally determined on the basis of honesty and attractiveness ratings given by participants in an earlier pilot study, where the male target rated as most honest and the male target rated as most dishonest in the pilot study were

chosen as the final stimulus materials, as judgement ratings of honesty was the dimension in question.

Procedure

The procedure used in this experiment was also identical to that used in Experiment 2A.

4.5. Results

4.5.1. Recall Performance:

Retrieval Practice Performance

The retrieval practice success rate for neutral traits during the retrieval practice phase was 85.96% ($M = 4.30, SE = .09$)

Initial Recall Performance:

An analysis of the data revealed the anticipated effect of item type on recall performance, where the proportion of neutral traits recalled correctly was greater when given retrieval practice ($M = .71, SE = .02$) than when not given retrieval practice ($M = .38, SE = .02$). Results from a paired samples t-test confirmed that the difference was significant [$t(103) = 11.946, p < .001, \eta^2 = .581$], thus demonstrating the recollective advantages of retrieval practice.

The mean correct cued-recall proportions for negative traits as a function of whether they had been associated with an honest or dishonest target and whether the target's neutral traits had or had not been given retrieval practice (i.e. their status as Rp- or Nrp items) on the initial recall test are shown in Table 7.

Table 7: Experiment 2B – Male Targets: Mean correct trait-recall proportions (and standard errors) in relation to item type and target honesty (honest or dishonest) on the initial recall test.

Item Type	Honest Target	Dishonest Target
Rp-	.33 (.03)	.34 (.03)
Nrp	.49 (.03)	.45 (.03)
Difference	-0.16	-0.11

Note: Rp- = unpractised valenced traits from the practised categories, Nrp = unpractised valenced traits from the unpractised categories, Difference = retrieval-induced forgetting effect.

The data summarised in this table were analysed using a 2 (Target Honesty: Honest vs. Dishonest) x 2 (Item type: Rp- vs. Nrp) within subjects design ANOVA.

A significant retrieval-induced forgetting effect was observed, with Rp- items (whether negative traits were associated with both an honest and dishonest male target) being recalled significantly less well ($M = .33$, $SE = .02$) than their Nrp counterparts ($M = .47$, $SE = .02$) [$F(1, 51) = 16.941$, $p < .001$, $\eta^2 = .103$]. In other words, the selective retrieval of neutral traits significantly impaired the participant's ability to recall competing negative traits on a later cued recall test.

On the other hand, the analyses of the data did not reveal any significant main effect of target honesty [$F(1, 51) = .189, ns, \eta^2 = .001$]. There was also no significant interaction between item type and target honesty [$F(1, 51) = .506, ns, \eta^2 = .003$].

Final Recall Performance:

An analyses of the data from the surprise final recall test revealed a persistent effect of item type on recall performance, where the proportion of neutral traits recalled correctly was larger when given retrieval practice ($M = .46, SE = .02$) than when not given retrieval practice ($M = .27, SD = .02$). Once again, results of paired samples t-tests confirmed that the difference was significant [$t(103) = 6.326, p < .001, \eta^2 = .280$], demonstrating the recollective advantages of retrieval practice over a delayed period as expected.

The mean correct category-cued recall proportions for negative traits as a function of whether they had been associated with an honest or dishonest target and whether the target's neutral traits had or had not been given retrieval practice (i.e. their status as Rp- or Nrp items) on the final recall test are shown in Table 8.

Table 8: Experiment 2B – Male Targets: Mean correct trait-recall proportions (and standard errors) in relation to item type and target honesty (honest or dishonest) on the final recall test.

Item Type	Honest Target	Dishonest Target
Rp-	.20 (.03)	.23 (.02)
Nrp	.38 (.03)	.33 (.03)
Difference	-0.18	-0.10

Note: Rp- = unpractised valenced traits from the practised categories, Nrp = unpractised valenced traits from the unpractised categories, Difference = retrieval-induced forgetting effect.

The data summarised in this table were analysed using a 2 (Target Honesty: Honest vs. Dishonest) x 2 (Item type: Rp- vs. Nrp) within subjects ANOVA to check for significance.

A significant retrieval-induced forgetting effect was observed, with Rp- items (whether negative traits were associated with either an honest or a dishonest male target) being recalled significantly less well ($M = .22$, $SE = .02$) than their Nrp counterparts ($M = .36$, $SE = .02$) [$F(1, 51) = 18.866$, $p < .001$, $\eta^2 = .124$]; thus, once again, demonstrating that the selective retrieval of neutral traits significantly impaired the participant's ability to recall competing negative traits on a later cued recall test.

However, as on the initial recall test, the analyses of data did not reveal any significant main effect of target honesty [$F(1, 51) = .140$, *ns*, $\eta^2 = .001$], nor was there any significant interaction between item type and target honesty [$F(1, 51) = 1.813$, *ns*, $\eta^2 = .011$].

Additional Analyses

As in Experiment 2A, in order to rule out non-inhibitory processes as the basis for the retrieval-induced effects found in the current experiment, an output interference score was calculated for each participant (Macrae & MacLeod, 1999). Results of paired samples *t*-tests conducted between the inhibition scores of the early Rp+ group and early Rp- group showed comparable pattern of results to those found in Experiment 2A. Findings indicate that in the initial recall test, the inhibition scores for dishonest targets were marginally lower for the early Rp+ group ($M = -.07$, $SE = .08$) as compared to the early Rp- group ($M = -.24$, $SE = .06$) [$t(25) = 1.868$, *ns*, $\eta^2 = .123$]. Similar differences were found between the early Rp+ and early Rp- groups for honest targets in the initial test ($M_s = -.08$ vs. $-.18$, $SEs = .06$ vs. $.06$) [$t(25) = 1.457$, *ns*, $\eta^2 = .054$], and for honest targets in the final test ($M_s = .03$ vs. $-.28$, $SEs = .06$ vs. $.04$) [$t(25) = 5.263$, $p < .001$, $\eta^2 = .526$]. Results also show that no difference was found between the mean inhibition scores for the early Rp+ and Rp- groups for dishonest targets in the final test ($M_s = -.14$ vs. $-.14$, $SEs = .05$ vs. $.06$) [$t(25) = .000$, *ns*, $\eta^2 = .000$]. Thus, it can be seen that the mean inhibition scores for the early Rp+ group were actually lower than those obtained for the early Rp- scores for dishonest and honest targets in the initial test and honest targets in the final test, which is opposite to the direction predicted. These results, once again, are not only consistent with those of Macrae and MacLeod (1999) and the results obtained in the previous experiments, but they also provide evidence against non-inhibitory processes, such as interference, as an explanation of the retrieval-induced forgetting effect for valenced traits that occurs in the above findings.

Once again, a scatter plot analyses of the raw data of the participants' output interference scores and inhibition scores and simple linear regression analyses were performed on scores for the dishonest and honest male targets in both the initial and final tests of recall to determine the effect of output interference on inhibition. Results demonstrated that

output interference did not significantly predict inhibition scores on the initial tests for honest, $\beta = .16$, $t(51) = 1.158$, *ns*, where $R^2 = .026$, $SE = .30$, $F(1, 51) = 1.341$, *ns*; as well as on the final test for dishonest targets $\beta = .05$, $t(51) = .374$, *ns*, where $R^2 = .003$, $SE = .28$, $F(1, 51) = .140$, *ns*. On the other hand, output interference significantly predicted inhibition scores for dishonest targets on the initial recall test, $\beta = .30$, $t(51) = 2.239$, $p < .05$. However, it can be seen that although the proportion of variance in inhibition scores explained by output interference reached significance, it was only 7.3% (adjusted R^2), where $R^2 = .091$, $SE = .35$, $F(1, 51) = 5.012$, $p < .05$. A similar pattern was also seen for scores on the final test for honest targets, $\beta = .45$, $t(51) = 3.511$, $p = .001$, where the proportion of variance in inhibition scores explained by output interference was 19.8% (adjusted R^2), $R^2 = .182$, $SE = .28$, $F(1, 51) = 12.330$, $p = .001$. Once again, unlike the results using the method proposed by Macrae & McLeod (1999), the results from the regression analyses provide some evidence for non-inhibitory processes, such as output interference, as an explanation of inhibition for dishonest targets on the initial recall test and for honest targets on the final recall test. However, the results for honest targets on the initial test and for dishonest targets on the final tests were in line with those obtained previously using the method proposed by Macrae & McLeod (1999).

4.5.2 Impression Ratings:

Honesty Ratings:

The mean honesty ratings obtained as a function of (a) whether the target was honest or dishonest, (b) whether the associated neutral traits had or had not been given retrieval practice, and (c) the point in the experiment at which they were made (Initial: before the study phase, or Final: immediately after the final category-cued recall test) are shown below in Table 9.

Table 9: Experiment 2B – Male Targets: Means (and standard errors) of honesty ratings in relation to item type and target honesty (honest or dishonest) obtained pre and post retrieval practice.

Targets	Time of Rating		
	Item Type	Initial	Final
Honest	Rp-	2.58 (.08)	2.94 (.13)
	Nrp	2.58 (.10)	3.08 (.14)
Dishonest	Rp-	3.38 (.11)	3.60 (.14)
	Nrp	3.33 (.10)	3.48 (.10)

Note: Rp- = unpractised valenced traits from the practised categories, Nrp = unpractised valenced traits from the unpractised categories.

The resulting ANOVA was a 2 (Target Honesty: Honest vs. Dishonest) x 2 (Item Type: Rp- vs. Nrp) x 2 (Time of Rating: Initial vs. Final) within subjects design.

Results revealed a significant main effect for target honesty [$F(1, 51) = 69.688, p < .001, \eta^2 = .160$], where honest male targets ($M = 2.79, SE = .06$) were significantly rated as more trustworthy as compared to dishonest male targets ($M = 3.45, SE = .07$). There was also a significant main effect for time of rating [$F(1, 51) = 16.653, p < .001, \eta^2 = .035$],

where there was a shift in ratings for both honest and dishonest male targets from being rated as average in terms of trustworthiness on the initial rating ($M = 2.97$, $SE = .05$) to being rated as less trustworthy on the final honesty ratings ($M = 3.27$, $SE = .07$).

A significant interaction effect was found between time of rating and target honesty [$F(1, 51) = 4.911$, $p < .05$, $\eta^2 = .006$] suggesting a relationship between ratings of honest and dishonest targets and whether the rating had been taken prior to the study phase or at the end of the study. Follow up paired samples t-tests revealed a significant difference between honesty ratings for honest targets taken at the initial ($M = 2.58$, $SE = .06$) and final times of rating ($M = 3.01$, $SE = .09$), [$t(51) = -4.173$, $p < .001$, $\eta^2 = .255$], as well as between honesty ratings for dishonest targets taken at the initial ($M = 3.36$, $SE = .07$) and final times of rating ($M = 3.54$, $SE = .09$), [$t(51) = -2.187$, $p < .05$, $\eta^2 = .086$], suggesting that for both honest and dishonest male targets, there was a significant shift in ratings towards the targets being considered as less trustworthy from the initial to the final times of rating.

On the other hand, the analyses of data also demonstrates that there was no significant main effect of item type [$F(1, 51) = .011$, ns , $\eta^2 = .000$]. There were also no significant interactions found between item type and time of rating [$F(1, 51) = .151$, ns , $\eta^2 = .000$], between item type and target honesty [$F(1, 51) = .495$, ns , $\eta^2 = .002$], and finally between item type, time of rating, and target honesty [$F(1, 51) = .605$, ns , $\eta^2 = .001$].

To summarise the key findings in Experiment 2B (honest and dishonest male targets), once again, there were strong practice effects accompanied by retrieval-induced forgetting effects in both the initial as well as the final tests of recall, where the selective retrieval of neutral traits significantly impaired the participant's ability to recall the target's competing negative traits on later category-cued recall tests. The recall data for both the initial and final recall tests were also analysed for output interference effects. Using the method proposed by Macrae and MacLeod (1999) it can be seen that, once again, the mean inhibition scores for the early Rp+ group were actually lower than those obtained for the early Rp- scores for the honest and dishonest targets in both the initial and final tests of recall, which provided evidence against output interference as an

explanation of the retrieval-induced forgetting effect for valenced traits that occurs in the above findings. Results from the regression analyses confirmed the previous pattern of findings for honest targets on the initial test and for dishonest targets on the final recall test, but did provide some evidence for output interference as an explanation of inhibition for dishonest targets on the initial test and honest targets on the final recall test. Once again, it must be noted that although the interaction reached significance, the proportion of the variance in inhibition scores that can be explained by output interference on these tests is not extremely large (dishonest targets on the initial test – 7.3%; honest targets on the final test – 19.8%). Findings from the honesty ratings revealed a significant main effect of target honesty, where honest male targets were rated as more trustworthy than dishonest male targets. There was also a significant main effect of time of rating, where ratings for both honest and dishonest targets significantly shifted towards them being rated as less trustworthy from initial to the final times of rating. Finally, a significant interaction effect between time of rating and target honesty confirmed that for both honest and dishonest male targets, there was a significant shift in ratings towards the targets being considered as less trustworthy from the initial to the final times of rating.

4.6. Discussion

In the current studies, the two experiments presented examined the role that the unintentional forgetting of an individual's unpracticed associated negative traits when its neutral traits are practiced plays in relation to trustworthy or untrustworthy male and female individuals. Across both experiments, a strong retrieval practice effect can be seen with the consistently high recall of practiced neutral traits on both initial and final recall tests for both male and female targets. It can also be seen that this practice effect led to a significant decrease in recall for the unpracticed associated negative traits for the concerned targets. Results of both experiments demonstrate a significant retrieval-induced forgetting effect for both honest and dishonest targets on both the initial and final recall tests.

These results are consistent with the results obtained by Storm and colleagues (2005), the findings from Experiment 1 and the inhibitory account of retrieval-induced forgetting (M.C. Anderson et al., 1994; M.C. Anderson & Spellman, 1995; M.D. MacLeod &

Saunders, 2005; Saunders & MacLeod, 2006; Veling & van Knippenberg, 2004), where retrieval-induced forgetting was found to occur when recall of Nrp items was high as compared to when they were low.

Although the negativity bias account of retrieval-induced forgetting cannot be directly evaluated as only negative traits were used in both experiments, the results of both studies are also consistent with the negativity bias account (Fiske, 1980; Rozin & Royzman, 2001), which suggests that negative information should be the most vulnerable to retrieval-induced forgetting as negative information is stronger in memory as compared to neutral or positive information. In Experiment 2A, the Nrp recall for dishonest female negative traits was consistently higher across both tests as compared to honest female negative traits, thus accounting for a stronger retrieval-induced forgetting effect for female dishonest targets. These results are thus consistent with Storm and colleagues (2005), where they found robust retrieval-induced forgetting effects for female negative traits as compared to the rest of the conditions. On the other hand, in Experiment 2B, stronger retrieval-induced forgetting effects occurred for male honest targets as compared to male dishonest targets. This can be explained in terms of the strength of Nrp negative items, with the Nrp recall of male honest traits being higher than the Nrp recall of male dishonest traits. Thus, it can be said that the female dishonest traits and the male honest traits are stronger items and are more likely to come to mind during retrieval practice as compared to female honest traits and male dishonest traits. This unwanted interference is therefore consequently combated through inhibition.

Results from the additional analysis conducted to test if non-inhibitory processes may underlie the retrieval-induced effects produced in both the current experiments also provide some support for the inhibitory account of retrieval-induced forgetting. Results from the analyses proposed by Macrae and MacLeod (1999) indicated that not only was there no difference between the inhibitory scores of participants who commenced their recall sequences with Rp+ and Rp- items, but also that the retrieval-induced forgetting effect occurred to a greater extent in the early Rp- group as compared to the early Rp+ group for both honest and dishonest male and female targets in the initial and final tests of recall. These findings, thus, demonstrate that inhibitory processes may indeed form the

basis of the retrieval-induced forgetting of valenced traits that occurred. Findings from the scatter plot, and subsequent simple linear regression analyses, on the other hand, demonstrated some support for output interference as an explanation of the retrieval-induced forgetting effect that occurred for honest female and male targets on the final test and for dishonest male targets on the initial test. It must be noted that although these differences reached significance, the proportion of variance that can be accounted for by output interference was not very large for female honest and male dishonest targets (i.e. 11.5% for female honest targets on the final test, 7.3% for male dishonest targets on the initial test vs. 19.8% for male honest targets on the final test).

Results of both experiments demonstrate that inhibition occurs for both negatively associated male and female targets and that it specifically occurs according to the perceived trustworthiness of a target and the gender of the target, where there is greater inhibition of associated unpracticed negative traits for a female dishonest target and a male honest target as compared to a female honest target and a male dishonest target. This does not support the adaptive account of retrieval-induced forgetting (Attrill & MacLeod, 2004), which predicts that retrieval-induced forgetting would fail to emerge in conditions whereby it would be not adaptive to forget traits about individuals. This account would thus expect negative traits about untrustworthy individuals not to be susceptible to retrieval-induced forgetting as they are indicators of possible future threatening or unpleasant behaviours and experiences. However, results show that gender of the target and the target's perceived trustworthiness also play a role in the extent to how much valenced information is recalled about the target.

The results of both experiments are also consistent with a context dependent account of retrieval-induced forgetting (Perfect et al., 2004), which can explain the current findings as occurring due to a match between the context at retrieval practice and the test phase; that is, it suggests that the cues used during the test are not functionally different from the cues used during retrieval practice resulting in suppression of information only within the same contexts as that present during retrieval practice. Given that the target's name and picture were used as cues during retrieval practice and test, the suppression of associated

but unpracticed negative traits could be accounted for by the context match between the two phases.

Impression ratings of honesty for male and female targets across both experiments showed that overall honest male and female targets were significantly rated as more trustworthy as compared to dishonest male and female targets over a period of time, which could serve as a manipulation check (see pilot results). Results of the impression ratings from both experiments also show that there is a significant shift in honesty ratings of both honest male and dishonest female targets being rated as being less trustworthy from initial to final times of rating by participants. These results are consistent with those obtained in Experiment 1 and confirm that there is no relationship between information in memory and impression judgements of honesty.

These results are once again in line with the inferential theory of metacognitive judgements (where judgements are said to be not made on information in memory but on what is accessible), as well as the anchoring-and-adjustment heuristic (where people scan, anchor and adjust their impression as new target information is presented until a final integrated judgement response can be made) that is thought to be employed in on-line judgements such as impression ratings of targets. Hastie and Park (1986) have outlined the difference between memory-based tasks that involve making judgements from information available in memory and on-line tasks that involve little or no relationship between memory and judgements. The results of the three experiments using retrieval-induced forgetting to manipulate the availability of information in memory conducted thus far represent support for the on-line nature of judgement tasks and processes employed here; and these results can be compared to those obtained by Iglesias-Parro and colleagues (2009), who examined retrieval-induced forgetting processes in memory-based choice tasks (e.g. job suitability of prospective candidates). Across two experiments, their results demonstrated that retrieval-induced forgetting effects were accompanied by parallel effects on choice, thus showing a direct relationship between the information available in memory and subsequent judgements based on that information (Iglesias-Parro et al., 2009). Thus, the difference in results between our experiments and those conducted by Iglesias-Parro and colleagues (2009) further illustrates the difference in the

Chapter 4

relationship between recall and judgements in impression formation in on-line vs. memory-based judgement tasks and processes.

CHAPTER 5

RETRIEVAL-INDUCED FORGETTING AND JUDGEMENTS ASSOCIATED WITH PEOPLE IN PROFESSIONS

5.1. Introduction

The previous two chapters focussed on whether or not retrieval-induced forgetting of valenced traits relating to a target individual influences honesty ratings for that target individual and this was done by associating neutral, positive and negative personality traits to various facial pictures of male and female targets. Findings of the previous experiments demonstrated that retrieval practice of a target's neutral traits results in the retrieval-induced forgetting of the target's associated negative or positive traits, regardless of whether the target is male or female (Experiments 1, 2A and 2B) or whether the target is perceived to be honest or dishonest (Experiments 2A and 2B). Moreover, consistent with previous findings in the literature, no direct relationship between impression judgements of honesty or trustworthiness and relevant information available in memory was found. On the other hand, the impression ratings of honesty tended to shift towards the target being considered as less trustworthy from initial to final times of rating, regardless of whether the target's associated neutral traits had received retrieval practice or not. The current chapter explores the effects on retrieval-induced forgetting of valenced traits in relation to individuals in different professions on impression ratings of honesty on those target professionals. By using positive traits to describe two target individuals, Macrae and MacLeod (1999) demonstrated that newly learned traits about a target individual are susceptible to forgetting. Thus, their early research in the area of retrieval-induced forgetting and impression formation established that retrieval-induced forgetting also occurred for socially meaningful materials.

Retrieval-induced forgetting has also been examined for stereotypic and individuating racial, professional, political and parental information. Across three experiments, Dunn and Spellman (2003), provided evidence that rehearsing information related to one aspect of identity not only facilitates memory for that information, but also inhibits memory for information related to another aspect of identity. In their first two studies, they found that either practising information related to one aspect of identity (Asian-American, Mother), resulted in poorer recall for other information also stereotypically associated with the target's identity (Artist, Feminist). These results were obtained regardless of the stem cue that was used during retrieval practice, either using a compound category cue (Experiment 1 – e.g. Asian-American Artist: Di____) or by using a limited sub-category cue (Experiment 2 – e.g. Asian-American: Di____). Experiment 3 focussed on the role of retrieval-induced forgetting and stereotypic or individuating information. Participants either studied all stereotypic traits describing each woman's group (June – Asian-American, Cheryl – Mother) or studied stereotypic and individuating traits associated with the two groups. Results showed that practising stereotypic traits resulted in impaired memory for individuating traits associated with the same target, and that practising individuating traits also resulted in poorer recall for the target's stereotypic-relevant traits. Results of the first and last studies also showed that the magnitude of retrieval-induced forgetting was related to the participant's belief in the relevant stereotype, where stronger belief in the stereotypic traits related to the category led to better recall of those traits on the final test. This relationship goes against the view of the role of item strength in inhibition (M.C. Anderson et al., 1994), as one would expect strong or high believers to show greater inhibition of stereotypic traits as compared to weak or low believers. On the other hand, this relationship makes sense if belief played the role of integration (M.C. Anderson & McCulloch, 1999), where strong belief in the relevant stereotype, actually integrated the practised and the unpractised traits, thus reducing inhibition.

Quinn, Hugenberg and Bodenhausen (2004) further confirmed that the magnitude of retrieval-induced forgetting is moderated by the evaluative consistency within stereotype representation. Participants read consistent and inconsistent (positive and negative) stereotypic traits associated with two target individuals (David and Susan) whose stereotype label was either known or unknown (Athlete or Feminist) and later received

retrieval practice for either half of the positive or half of the negative stereotypic traits relating to a particular target individual. Their findings suggested that both the evaluative consistency of the practised and unpractised traits and the availability of a group label influenced the effects of retrieval inhibition, where a typical retrieval-induced forgetting effect occurred for recall of unpractised stereotypic traits that were inconsistent with the practised traits, but the same did not occur for unpractised stereotypic traits that were consistent with the practised items, which were actually facilitated relative to the baseline condition. Thus, their results once again not only demonstrated the integrating effects of stereotypes, but also the adaptive nature of retrieval-induced forgetting.

Garcia-Bajos and Migueles (2009) looked at the effect of retrieval-induced forgetting on stereotype representation by manipulating the typicality of traits (high, low or control) associated with stereotypes of people in certain professions (Athlete, Scientist) as compared with when the traits were associated with the name of a person (Mikel, Jon). Their findings suggest that retrieval-induced forgetting failed to occur for high-typicality traits associated with the stereotype professionals, both immediately and after one week, which implies that these traits were integrated at the time of encoding. It could also be seen that both high-typicality and low-typicality traits in this condition were facilitated in a one-week recognition task. On the other hand, the high-typicality, low-typicality or control traits associated with a person's name produced a typical retrieval-induced forgetting effect both immediately and at a one-week interval, as they were treated as independent features of the person and no stereotype was activated.

The three studies described above on stereotypes and retrieval-induced forgetting used representative traits of the stereotypes, manipulating retrieval practice cues, type of trait information (stereotypic and individuating), evaluative consistency of traits, availability of a group label and trait typicality. However, none of them explore the relationship between retrieval-induced forgetting of valenced target information and judgement ratings associated with these targets associated with groups.

Predictions

The current experiment is an investigation into the relationship between retrieval-induced forgetting and judgement ratings of honesty in relation to people in certain professions that should be honest, but were considered either honest or dishonest. To put the research question of this study in simple terms: How beneficial (socially speaking) is it for a person to be in a profession that *should* be trustworthy but is perceived not to be trustworthy? Participants were presented with names of four targets and rated them on honesty after learning 10 traits about each target. Targets (professionals) were manipulated as to whether they should be honest and were actually viewed as honest (consistent targets) and whether they should be honest but were actually viewed as dishonest (inconsistent targets). Traits consisted of either neutral and positive or neutral and negative traits. Participants then completed retrieval practice on the neutral traits thereby making the valenced traits the Rp- items. Participants subsequently reported all of the traits about the target and completed a final honesty rating. The predictions made here were similar to those in Experiments 1 and 2. First, fewer negative traits (Rp- items) whose neutral counterparts were subject to retrieval practice were expected to be recalled as compared to those whose neutral counterparts had not been subject to retrieval practice (Nrp items). Second, no shift in the affective impression of a given studied individual (in terms of honesty ratings) was expected, i.e. retrieval-induced forgetting of negative traits should not make a target individual appear to be more trustworthy.

5.2. Method

Participants and Design

Eighty undergraduate and postgraduate students (40 females and 40 males; ages ranging from 18 to 37 with a mean age of 23.7) from St. Xavier's College and St. Dominic Savio Parish, Mumbai, India volunteered to participate in this study. The experiment had a 2 (Honesty of the Target: Consistent and Inconsistent) x 3 (Practice Status: practised items from the practised category [Rp+], non-practised items from the practised category [Rp-], and non-practised items from the non-practised category [Nrp]) x 2 (Valence: Positive and Negative) within subjects design.

Stimulus Materials

Pilot study: To determine the target stimuli to be used in the main study, stimuli that would be considered generally honest or dishonest, a pilot study was conducted. The stimuli used were names of twenty five different professionals (i.e. people in different professions). Using a web-based rating application, data was collected from twenty five Indian participants. Participants were shown the targets (i.e. names of professionals) in a random order and were asked to rate each one on a 5-point Likert scale for honesty i.e. whether they should be honest and whether they perceive them as being honest in reality. The 2 targets rated most honest (i.e. Air traffic controller and Paramedic) and most dishonest (i.e. Politician and Used car salesman) were selected as the target items to be used in the main study.

Main study: Thus, the pilot study conducted earlier determined the choice of the 4 targets (2 honest professionals and 2 dishonest professionals) to be used in the study on the basis of honesty ratings given by participants. Traits used to describe the targets were neutral and valenced traits that had been standardized (Storm et al., 2005). Once again, some of the traits used were removed and replaced by others that would better describe the dimension of honesty relating to professions. The study items (see Appendix V) consisted of twenty neutral items with a mean likeability rating of 330 (casual, consistent, orderly, serious, ordinary, normal, moderate, reserved, prudent, persistent, blunt, average, conventional, meek, passive, quiet, shy, lucky, talkative, persuasive), ten positive traits with a mean likeability rating of 506.5 (sincere, understanding, dependable, considerate, warm, responsible, clever, efficient, competent, modest), and ten negative traits with a mean likeability of 93.5 (prejudiced, disagreeable, rude, heartless, underhanded, insolent, offensive, hostile, impolite, ill-mannered). Each target had 10 traits assigned to them: either neutral-positive or neutral-negative. The Rp+ items were the neutral items for both the positive and negative targets, and thus, the valenced traits were the Rp- items. The Nrp items were the 10 valenced traits of the other 2 targets.

Procedure

Participants were told that they were going to learn traits describing 4 individuals in different professions and in the process they should form impressions about them.

Participants were informed that other participants had interacted with these target individuals in a prior study and had used the to-be-learned traits to describe these targets. They were also told that they might have to play a game with one of the targets at the end of the study and that the more they remembered about that target, the better they would do in the game.

In the study phase, participants read 10 word pairs (e.g., Air traffic controller: Quiet). Each word pair was displayed for 5 seconds. After all of the traits were presented to participants, they then had to rate the target on honesty using a 5-point Likert scale.

In the retrieval practice phase, participants received retrieval practice for neutral traits of 2 targets (e.g., Air traffic controller: Qu___), while for the other 2 targets participants received retrieval practice for an unrelated category (e.g. Fruit: Or___). This was followed by a 3 minute distracter task (i.e., word search puzzle) in the absence of the target item. No participant completed the distracter task in the allocated time.

In the recall phase, the target's name was placed in front of the participant and the participant had one minute to recall as many traits describing the target as possible. This process was repeated for each of the 4 targets. Subjects were then informed that they did not have to meet any of the individuals. They had to, however, rate each of the individuals again and then engage in a final surprise, final category-cued recall test. Participants were then debriefed, thanked for their effort and participation and then escorted outside the laboratory.

5.3. Results

5.3.1. Recall Performance:

Retrieval Practice Performance

The retrieval practice success rate of the target's neutral traits during the retrieval practice phase was around 74% ($M = 7.38$, $SE = .22$).

Initial Recall Performance:

An analysis of the data revealed the anticipated effect of item type on recall performance, where the proportion of neutral traits recalled correctly was greater when given retrieval practice ($M = .59, SE = .02$) than when not given retrieval practice ($M = .36, SE = .02$). A paired samples t-test revealed that this difference was significant [$t(159) = 8.736, p < .001, \eta^2 = .324$], thus demonstrating the benefits of retrieval practice.

The mean correct cued-recall proportions for positive and negative traits as a function of whether they had been associated with a consistent or inconsistent target and whether the target's neutral traits had or had not been given retrieval practice (i.e. their status as Rp- or Nrp items) on the initial recall test are shown in Table 10.

Table 10: Mean correct trait-recall proportions (and standard errors) in relation to trait valence, item type, and target consistency on the initial recall test.

Consistency	Trait Valence		
	Item Type	Positive	Negative
Consistent	Rp-	.31 (.03)	.28 (.03)
	Nrp	.28 (.03)	.33 (.03)
	Difference	0.03	-0.05
Inconsistent	Rp-	.31 (.03)	.22 (.02)
	Nrp	.33 (.04)	.30 (.04)
	Difference	-0.02	-0.08

Note: *Rp-* = unpractised valenced traits from the practised categories, *Nrp* = unpractised valenced traits from the unpractised categories, *Difference* = retrieval-induced forgetting effect.

The data summarised in this table were analysed using a 2 (Trait Valence: Positive vs. Negative) x 2 (Target Consistency: Consistent vs. Inconsistent) x 2 (Item Type: Rp- vs. Nrp) within subjects ANOVA.

Analyses of the data revealed no significant main effect of item type [$F(1, 39) = 2.099$, ns , $\eta^2 = .006$] suggesting that there was no significant difference between Rp- and Nrp items.

The data revealed a significant interaction between consistency and trait valence [$F(1, 39) = 4.060$, $p = .05$, $\eta^2 = .010$], suggesting a difference between positive and negative consistent and inconsistent targets. Follow up paired samples t-tests demonstrated that the effect of trait valence was marginally significant for inconsistent targets [$t(39) = 1.897$, $p = .07$, $\eta^2 = .085$], but not significant for consistent targets [$t(39) = 1.897$, $p = .07$, $\eta^2 = .085$]. Thus, for inconsistent targets, there is evidence that positive traits ($M = .32$, $SE = .02$) were better remembered as compared to negative traits ($M = .26$, $SE = .02$); whereas for consistent targets, the difference was not significant (positive $M = .29$, $SE = .03$; negative $M = .30$, $SE = .02$)

On the other hand the data revealed no significant main effects of consistency [$F(1, 39) = .303$, ns , $\eta^2 = .001$] or of trait valence [$F(1, 39) = 1.680$, ns , $\eta^2 = .005$]. There were also no significant interaction effects between item type and consistency [$F(1, 39) = 2.983$, ns , $\eta^2 = .004$], between item type and trait valence [$F(1, 39) = 2.332$, ns , $\eta^2 = .009$] or between item type, consistency and trait valence [$F(1, 39) = .040$, ns , $\eta^2 = .001$].

Final Recall Performance:

An analysis of the data revealed the anticipated effect of item type on recall performance, where the proportion of neutral traits recalled correctly was greater when given retrieval practice ($M = .32$, $SE = .02$) than when not given retrieval practice ($M = .16$, $SE = .01$). Results from a paired samples t-test confirmed that this difference was significant [$t(159) = 7.186$, $p < .001$, $\eta^2 = .245$], demonstrating the persistent advantageous effects of retrieval practice.

The mean correct cued-recall proportions for positive and negative traits as a function of whether they had been associated with a consistent or inconsistent target and whether the target's neutral traits had or had not been given retrieval practice (i.e. their status as Rp- or Nrp items) on the final recall test are shown in Table 11.

Table 11: Mean correct trait-recall proportions (and standard errors) in relation to trait valence, item type, and target consistency on the final recall test.

Consistency	Item Type	Trait Valence	
		Positive	Negative
Consistent	Rp-	.10 (.02)	.10 (.02)
	Nrp	.11 (.02)	.10 (.02)
	Difference	-0.01	0.0
Inconsistent	Rp-	.24 (.03)	.15 (.02)
	Nrp	.14 (.03)	.17 (.03)
	Difference	0.10	-0.02

Note: *Rp-* = unpractised valenced traits from the practised categories, *Nrp* = unpractised valenced traits from the unpractised categories, *Difference* = retrieval-induced forgetting effect.

The data summarised in this table were once again analysed using a 2 (Trait Valence: Positive vs. Negative) x 2 (Target Consistency: Consistent vs. Inconsistent) x 2 (Item Type: *Rp-* vs. *Nrp*) within subjects ANOVA.

As on the initial recall test, analyses of the data revealed no significant main effect of item type [$F(1, 39) = .869$, *ns*, $\eta^2 = .003$]. On the other hand, a significant main effect of consistency was demonstrated [$F(1, 39) = 10.981$, $p < .01$, $\eta^2 = .056$], suggesting that recall was greater for inconsistent targets ($M = .17$, $SE = .02$) as compared to consistent targets ($M = .10$, $SE = .02$).

A marginally significant interaction effect was also seen between the three variables - item type, target consistency and trait valence [$F(1, 39) = 3.572$, $p = .07$, $\eta^2 = .012$]. Further analyses in the form of nested two-way ANOVAs were conducted to better explore the pattern of interaction between these three variables.

A 2 (Item Type: Rp- vs. Nrp) x 2 (Target Consistency: Consistent vs. Inconsistent) interaction was analysed at both levels of trait valence (i.e. Positive and Negative). For positive traits, results of a two-way within subjects ANOVA revealed no significant main effect of item type [$F(1, 39) = 2.942$, *ns*, $\eta^2 = .019$]. However, there was a significant main effect of target consistency [$F(1, 39) = 7.820$, $p < .01$, $\eta^2 = .072$], suggesting that recall for positive traits was significantly higher for inconsistent targets ($M = .19$, $SE = .02$) as compared to consistent targets ($M = .11$, $SE = .02$). There was also a significant interaction effect between item type and target consistency [$F(1, 39) = 4.301$, $p < .05$, $\eta^2 = .029$]. Follow up paired samples t-tests were carried out to see where the differences lay. Results demonstrated that the effect of target consistency was significant for Rp-items [$t(39) = 3.313$, $p < .01$, $\eta^2 = .220$], but not for Nrp items [$t(39) = .813$, *ns*, $\eta^2 = .017$]. Thus, there is evidence that Rp- positive traits were better remembered for inconsistent targets ($M = .24$, $SE = .03$) as compared to consistent targets ($M = .10$, $SE = .02$); whereas there was no significant difference between recall of Nrp positive items for these two targets (inconsistent $M = .14$, $SE = .03$; consistent $M = .11$, $SE = .03$). For negative traits, results of a two-way within-subjects ANOVA revealed no significant main effect of item type [$F(1, 39) = .220$, *ns*, $\eta^2 = .002$]. However, there was a significant main effect of target consistency [$F(1, 39) = 5.155$, $p < .05$, $\eta^2 = .052$], suggesting that recall for negative traits was significantly higher for inconsistent targets ($M = .16$, $SE = .02$) as compared to consistent targets ($M = .10$, $SE = .02$). There was also no significant

interaction effect between item type and target consistency [$F(1, 39) = .551, ns, \eta^2 = .003$].

On the other hand, the data did not demonstrate a significant main effect of trait valence [$F(1, 39) = 1.507, ns, \eta^2 = .004$], suggesting that there was no significant difference between the recall of positive and negative traits. There were also no significant interaction effects found between item type and trait valence [$F(1, 39) = 2.303, ns, \eta^2 = .008$], between item type and target consistency [$F(1, 39) = 2.033, ns, \eta^2 = .004$], or between target consistency and trait valence [$F(1, 39) = .447, ns, \eta^2 = .002$].

Additional Analyses

As in the previous experiments, an output interference score was calculated for each participant in order to find out if output interference played a role in determining the amount and pattern of participants' recall performance in the experiment's free recall task (Macrae & MacLeod, 1999). Results of paired samples t-tests conducted between the inhibition scores of the early Rp+ group and early Rp- group indicate that in the initial recall test, the inhibition scores for inconsistent targets were lower for the early Rp+ group ($M = -.03, SE = .04$) as compared to the early Rp- group ($M = -.08, SE = .05$) [$t(39) = .960, ns, \eta^2 = .023$] and that there was no difference between the inhibition scores of the early Rp+ group ($M = -.01, SE = .03$) as compared to the early Rp- group ($M = -.01, SE = .03$) for consistent targets in the initial recall test [$t(39) = .000, ns, \eta^2 = .000$]. In the same way, results also indicate that in the final recall test, the early Rp- group demonstrated larger inhibition effects as compared to the early Rp+ group for consistent targets ($M_s = -.04$ vs. $.03, SE_s = .03$ vs. $.03$) [$t(39) = 1.482, ns, \eta^2 = .053$]. The findings also demonstrate that although no inhibition effects were found between the early Rp+ and early Rp- groups in the final recall test for inconsistent targets ($M_s = .07$ vs. $-.00, SE_s = .04$ vs. $.03$) [$t(39) = 1.516, ns, \eta^2 = .056$], the pattern of results was in the same direction as the other conditions. Thus, it can be seen that the mean inhibition scores for the early Rp- group were either equal to or lower than those obtained for the early Rp+ scores for inconsistent and consistent targets in the initial and final tests, which is opposite to the direction predicted by the interference theory of forgetting (Roediger & Schmidt, 1980;

Tulving & Arbuckle, 1963). These results are once again consistent with those of Macrae and MacLeod (1999) as well as the results obtained in the previous experiments.

As in previous experiments, the data was analysed in a different way to the above method. Following a scatter plot analyses of the raw data of the participants' output interference scores and inhibition scores, simple linear regression analyses were performed for inconsistent and consistent targets in both the initial and final tests of recall in order to determine the effect of output interference on inhibition. Results demonstrated that output interference did not significantly predict inhibition scores on the initial tests for both inconsistent, $\beta = .16$, $t(79) = 1.392$, *ns*, where $R^2 = .024$, $SE = 1.71$, $F(1, 79) = 1.937$, *ns*, and consistent targets $\beta = .02$, $t(79) = .207$, *ns*, where $R^2 = .001$, $SE = .18$, $F(1, 79) = .043$, *ns*; as well as on the final test for inconsistent targets $\beta = -.17$, $t(79) = -1.498$, *ns*, where $R^2 = .028$, $SE = 1.23$, $F(1, 79) = 2.243$, *ns*. On the other hand, output interference significantly predicted inhibition scores on the final test for consistent targets, $\beta = .33$, $t(79) = 3.079$, $p = .003$. However, it can be seen that although the proportion of variance in inhibition scores explained by output interference reached significance, it was only 9.7% (adjusted R^2), where $R^2 = .108$, $SE = .17$, $F(1, 79) = 9.479$, $p = .003$. Unlike the results using the method proposed by Macrae & McLeod (1999), the results from the regression analyses provide some evidence for non-inhibitory processes, such as output interference, as an explanation of inhibition for consistent targets on the final recall test. However, the rest of the results for inconsistent and consistent targets on the initial test and for inconsistent targets on the final tests were in line with those obtained previously using the method proposed by Macrae & McLeod (1999).

5.3.2. Impression Ratings:

Honesty Ratings:

The mean honesty ratings obtained as a function of (a) whether the target was consistent or inconsistent, (b) had been presented as a positive or negative target, (c) whether the associated neutral traits had or had not been given retrieval practice, and (d) the point in the experiment at which they were made (initial and final) are shown below in Table 12.

Table 12: Means (and standard errors) of honesty ratings in relation to target consistency, trait valence and item type obtained pre and post retrieval practice.

Consistency	Valence	Time of Rating	
		Initial	Final
Item Type			
Consistent	Positive		
	Rp-	3.38 (.20)	1.85 (.12)
	Nrp	2.20 (.13)	2.23 (.12)
	Negative		
	Rp-	2.08 (.12)	2.00 (.12)
	Nrp	2.35 (.16)	2.23 (0.15)
Inconsistent	Positive		
	Rp-	3.18 (.15)	2.90 (.17)
	Nrp	2.30 (.18)	3.48 (.21)
	Negative		
	Rp-	4.00 (.12)	3.98 (.12)
	Nrp	3.73 (.18)	3.75 (.16)

Note: Rp- = unpractised valenced traits from the practised categories, Nrp = unpractised valenced traits from the unpractised categories.

The resulting ANOVA was a 2 (Trait Valence: Positive vs. Negative) x 2 (Target Consistency: Consistent vs. Inconsistent) x 2 (Item Type: Rp- vs. Nrp) x 2 (Time of Rating: Initial vs. Final) within subjects design ANOVA.

Analyses of the data revealed no significant main effect of item type [$F(1, 39) = 2.853$, ns , $\eta^2 = .003$]. On the other hand, there was a significant main effect of target consistency [$F(1, 39) = 139.470$, $p < .001$, $\eta^2 = .226$], suggesting that consistent targets ($M = 2.29$, $SE = .07$) were considered as significantly more trustworthy as compared to inconsistent targets ($M = 3.41$, $SE = .06$). Results also revealed a significant main effect trait valence [$F(1, 39) = 12.681$, $p < .001$, $\eta^2 = .019$], suggesting that targets associated with positive traits ($M = 2.69$, $SE = .07$) were significantly considered as more trustworthy as compared to targets associated with negative traits ($M = 3.01$, $SE = .06$). A significant main effect of time of rating can also be seen [$F(1, 39) = 5.189$, $p < .05$, $\eta^2 = .002$], suggesting that there was a significant difference between the initial ratings of consistent and inconsistent targets ($M = 2.90$, $SE = .05$) and the final ratings of both these targets ($M = 2.80$, $SE = .05$), although the size of the effect is very small.

Analyses of the data revealed a significant three-way interaction effect between item type, target consistency and trait valence [$F(1, 39) = 6.452$, $p < .05$, $\eta^2 = .006$], suggesting a relationship between whether the target did or did not receive retrieval practice for its associated neutral traits, whether the target was consistent or inconsistent and whether the target had positive or negative traits also associated with it. Further analyses in the form of nested two-way ANOVAs were conducted to better explore the pattern of interaction between these three variables.

A 2 (Item Type: Rp- vs. Nrp) x 2 (Target Consistency: Consistent vs. Inconsistent) interaction was analysed at both levels of trait valence (i.e. Positive and Negative). For positive traits, results of a two-way within subjects ANOVA revealed a significant main effect of item type [$F(1, 39) = 5.526$, $p < .05$, $\eta^2 = .036$], where participants rated positively associated targets whose neutral traits had been practised ($M = 2.83$, $SE = .10$) as less trustworthy in comparison to positively associated targets whose neutral traits had not been practised ($M = 2.55$, $SE = .08$). There was also a significant main effect of target consistency [$F(1, 39) = 25.822$, $p < .001$, $\eta^2 = .142$], where participants rated consistent targets ($M = 2.41$, $SE = .07$) as more trustworthy in comparison to inconsistent targets ($M = 2.96$, $SE = .10$). However, there was no significant interaction effect between item type and target consistency [$F(1, 39) = .371$, ns , $\eta^2 = .007$]. For negative traits, results of a

two-way within subjects ANOVA revealed no significant main effect of item type [$F(1, 39) = .000$, *ns*, $\eta^2 = .000$]. On the other hand, there was a significant main effect of target consistency [$F(1, 39) = 137.556$, $p < .001$, $\eta^2 = .588$], where participants rated consistent targets ($M = 2.16$, $SE = .11$) as more trustworthy in comparison to inconsistent targets ($M = 3.86$, $SE = .08$). The data also revealed a significant interaction effect between item type and target consistency [$F(1, 39) = 4.561$, $p < .05$, $\eta^2 = .013$]. Follow up paired samples *t*-tests were carried out to see where the differences lay. Results demonstrated that the effect of target consistency was significant for Rp- targets [$t(39) = -2.322$, $p < .05$, $\eta^2 = .122$] as well as for Nrp targets [$t(39) = -4.030$, $p < .001$, $\eta^2 = .294$]. Thus, for negatively associated Rp- targets, there is evidence that consistent targets ($M = 2.61$, $SE = .13$) were rated as more trustworthy than inconsistent targets ($M = 3.04$, $SE = .14$); whereas for negatively associated Nrp targets, there is evidence that consistent targets ($M = 2.21$, $SE = .12$) were also rated as more trustworthy than inconsistent targets ($M = 2.89$, $SE = .11$).

Analyses of the data also revealed a significant three-way interaction effect between item type, trait valence and time of rating [$F(1, 39) = 21.869$, $p < .001$, $\eta^2 = .025$], suggesting a relationship between whether the target did or did not receive retrieval practice for its associated neutral traits, whether the target had positive or negative traits also associated with it and whether the honesty ratings were taken initially or at the end of the study. Further analyses in the form of nested two-way ANOVAs were conducted to better explore the pattern of interaction between these three variables.

A 2 (Item Type: Rp- vs. Nrp) x 2 (Time of Rating: Initial vs. Final) interaction was analysed at both levels of trait valence (i.e. Positive and Negative). For positive traits, results of a two-way within-subjects ANOVA revealed a significant main effect of item type [$F(1, 39) = 5.526$, $p < .05$, $\eta^2 = .035$], where participants rated positively associated targets whose neutral traits had been practised ($M = 2.83$, $SE = .10$) as less trustworthy in comparison to positively associated targets whose neutral traits had not been practised ($M = 2.55$, $SE = .08$). There was also significant main effect of time of rating [$F(1, 39) = 5.639$, $p < .05$, $\eta^2 = .010$], where participants rated positively associated targets at the initial time of rating ($M = 2.76$, $SE = .08$) as more trustworthy as compared to the final time of rating ($M = 2.61$, $SE = .07$). There was also significant interaction effect between

item type and time of rating [$F(1, 39) = 27.315, p < .001, \eta^2 = .261$]. Follow up paired samples t-tests were carried out to see where the differences lay. Results demonstrated that the effect of time of rating was significant for Rp- targets [$t(39) = 6.590, p < .001, \eta^2 = .527$] as well as for Nrp targets [$t(39) = -3.435, p = .001, \eta^2 = .232$]. Thus, for positively associated Rp- targets, there is evidence that they were rated as becoming more trustworthy from the initial time of rating ($M = 3.28, SE = .14$) to the final time of rating ($M = 2.38, SE = .09$); whereas for positively associated Nrp targets, there is evidence that they were rated as becoming less trustworthy from the initial time of rating ($M = 2.25, SE = .12$) to the final time of rating ($M = 2.85, SE = .11$). For negative traits, results of a two-way within-subjects ANOVA revealed no significant main effects of item type [$F(1, 39) = .000, ns, \eta^2 = .000$] or time of rating [$F(1, 39) = .372, p < .001, \eta^2 = .003$]. There was also no significant interaction effect between item type and time of rating [$F(1, 39) = .000, ns, \eta^2 = .000$].

A significant three-way interaction effect between target consistency, trait valence and time of rating [$F(1, 39) = 14.182, p < .001, \eta^2 = .014$] was also found, suggesting a relationship between whether the target was consistent or inconsistent, whether the target had positive or negative traits also associated with it and whether the honesty ratings were taken initially or at the end of the study. Further analyses in the form of nested two-way ANOVAs were conducted to better explore the pattern of interaction between these three variables.

A 2 (Trait Valence: Positive vs. Negative) x 2 (Time of Rating: Initial vs. Final) interaction was analysed at both levels of target consistency (i.e. Consistent and Inconsistent). For consistent targets, results of a two-way within subjects ANOVA revealed a significant main effect of trait valence [$F(1, 39) = 4.286, p < .05, \eta^2 = .049$], where participants rated positively associated consistent targets ($M = 2.41, SE = .07$) as less trustworthy in comparison to negatively associated consistent targets ($M = 2.16, SE = .11$). There was also a significant main effect of time of rating [$F(1, 39) = 38.732, p < .001, \eta^2 = .142$], where participants rated consistent targets at the initial time of rating ($M = 2.50, SE = .07$) as less trustworthy as compared to the final time of rating ($M = 2.08, SE = .08$). There was also significant interaction effect between trait valence and time of

rating [$F(1, 39) = 23.456, p < .001, \eta^2 = .083$]. Follow up paired samples t-tests were carried out to see where the differences lay. Results demonstrated that the effect of time of rating was significant for positively associated consistent targets [$t(39) = 6.708, p < .001, \eta^2 = .536$], but not for negatively associated consistent targets [$t(39) = 1.309, ns, \eta^2 = .042$]. Thus, for positively associated consistent targets, there is evidence that they were rated as becoming more trustworthy from the initial time of rating ($M = 2.79, SE = .10$) to the final time of rating ($M = 2.04, SE = .08$); whereas for negatively associated consistent targets, there was no difference between the two times of ratings (initial $M = 2.21, SE = .12$; final $M = 2.11, SE = .11$). For inconsistent targets, results of a two-way within subjects ANOVA revealed a significant main effect of trait valence [$F(1, 39) = 48.647, p < .001, \eta^2 = .361$], where participants rated positively associated inconsistent targets ($M = 2.96, SE = .10$) as more trustworthy in comparison to negatively associated inconsistent targets ($M = 3.86, SE = .08$). There was also significant main effect of time of rating [$F(1, 39) = 6.146, p < .05, \eta^2 = .023$], where participants rated inconsistent targets at the initial time of rating ($M = 3.30, SE = .07$) as more trustworthy as compared to the final time of rating ($M = 3.53, SE = .09$). There was also significant interaction effect between trait valence and time of rating [$F(1, 39) = 5.409, p < .05, \eta^2 = .023$]. Follow up paired samples t-tests were carried out to see where the differences lay. Results demonstrated that the effect of time of rating was significant for positively associated inconsistent targets [$t(39) = -2.730, p < .01, \eta^2 = .160$], but not for negatively associated inconsistent targets [$t(39) = .000, ns, \eta^2 = .000$]. Thus, for positively associated inconsistent targets, there is evidence that they were rated as becoming less trustworthy from the initial time of rating ($M = 2.74, SE = .12$) to the final time of rating ($M = 3.19, SE = .14$); whereas for negatively associated inconsistent targets, there was no difference between the two times of ratings (initial $M = 3.86, SE = .10$; final $M = 3.86, SE = .09$).

A significant interaction effect was also found between target consistency and valence [$F(1, 39) = 45.368, p < .001, \eta^2 = .059$], suggesting a relationship between ratings of consistent and inconsistent targets and whether they were associated with positive or negative traits. Follow up paired samples t-tests were performed to analyse where the difference lay. Results revealed a significant difference in honesty ratings between consistent targets associated with positive traits ($M = 2.41, SE = .07$) and consistent

targets associated with negative traits ($M = 2.16$, $SE = .11$), [$t(39) = 2.070$, $p < .05$, $\eta^2 = .099$], suggesting that consistent targets were viewed as being less trustworthy when associated with positive traits as compared to when they were associated with negative traits. On the other hand, there was also a significant difference between inconsistent targets associated with positive traits ($M = 2.96$, $SE = .10$) and inconsistent targets associated with negative traits ($M = 3.86$, $SE = .08$), [$t(39) = -6.975$, $p < .001$, $\eta^2 = .555$], suggesting that inconsistent targets were viewed as being more trustworthy when associated with positive traits as compared to when they were associated with negative traits.

A significant interaction effect was also found between item type and time of rating [$F(1, 39) = 24.460$, $p < .001$, $\eta^2 = .025$], suggesting a relationship between whether the target's associated neutral traits received practice or not and whether the ratings were taken initially or at the end of the study. Follow up paired samples t-tests were performed to analyse where the difference lay. Results revealed a significant difference in honesty ratings Rp- targets between initial honesty ratings ($M = 3.16$, $SE = .07$) and final honesty ratings ($M = 2.68$, $SE = .07$), [$t(39) = 5.978$, $p < .001$, $\eta^2 = .478$], suggesting that targets whose associated neutral traits received practice were viewed as becoming more trustworthy from initial to final times of rating, regardless of whether they were also associated with positive or negative traits. On the other hand, a significant difference can also be seen in honesty ratings for Nrp targets between initial honesty ratings ($M = 2.64$, $SE = .08$) and final honesty ratings ($M = 2.92$, $SE = .08$), [$t(39) = -2.893$, $p < .01$, $\eta^2 = .177$], suggesting that targets whose associated neutral traits did not receive practice were viewed as becoming less trustworthy from initial to final times of rating, regardless of whether they were also associated with positive or negative traits.

A significant interaction effect was found between target consistency and time of rating [$F(1, 39) = 23.352$, $p < .001$, $\eta^2 = .019$], suggesting a relationship between ratings of consistent and inconsistent targets and whether they were taken initially or at the end of the study. Follow up tests using paired samples t-tests were performed to analyse where the difference lay. Results revealed a significant difference in honesty ratings for consistent targets between initial honesty ratings ($M = 2.50$, $SE = .07$) and final honesty

ratings ($M = 2.08$, $SE = .08$), [$t(39) = 6.224$, $p < .001$, $\eta^2 = .498$], suggesting that there was a shift in ratings for consistent targets towards them being considered as more trustworthy from initial to final times of rating. On the other hand, a significant difference can also be seen in honesty ratings for inconsistent targets between initial honesty ratings ($M = 3.30$, $SE = .07$) and final honesty ratings ($M = 3.52$, $SE = .08$), [$t(39) = -2.4796$, $p < .05$, $\eta^2 = .136$], suggesting that there was a shift in ratings for inconsistent targets towards them being considered as less trustworthy from initial to final times of rating.

The analyses of data also revealed no significant interactions between item type and target consistency [$F(1, 39) = .357$, ns , $\eta^2 = .001$], between item type and trait valence [$F(1, 39) = 2.379$, ns , $\eta^2 = .003$], between trait valence and time of rating [$F(1, 39) = 1.564$, ns , $\eta^2 = .001$], between item type, target consistency and time of rating [$F(1, 39) = .000$, ns , $\eta^2 = .000$], and finally between item type, target consistency, trait valence and time of rating [$F(1, 39) = .229$, ns , $\eta^2 = .000$].

To summarise the key findings of this experiment, there were strong practice effects found in both the initial and final tests of recall. However, these were not accompanied by the anticipated retrieval-induced forgetting effect of the targets' valenced traits. There was a significant interaction between consistency and trait valence in the initial recall test, where positive traits associated with inconsistent targets were better remembered as compared to negative traits. The data in the final recall test demonstrated a significant main effect of consistency, where recall was greater for inconsistent targets as compared to consistent targets. A marginally significant interaction effect between item type, target consistency and trait valence demonstrated that recall of Rp- positive traits were significantly higher for inconsistent targets as compared to consistent targets. Although there were no retrieval-induced forgetting effects in both the initial and final tests of recall, the data were analysed to determine the role that output interference played in both of the free recall tests. Using the method proposed by Macrae and MacLeod (1999), it can be seen that the mean inhibition scores for the early Rp- group were either equal to or lower than those obtained for the early Rp+ scores for inconsistent and consistent targets in the initial and final tests. The results of recall scores for consistent and inconsistent targets on the initial test and for inconsistent targets on the final test are confirmed by

separate analyses using scatter plots and regression. On the other hand, the results from the regression analyses provide some evidence for output interference as an explanation of inhibition for consistent targets on the final recall test. It must be noted here that the proportion of variance in inhibition scores explained by output interference was only 9.7%, even though it reached significance. Results from the honesty ratings demonstrated significant main effects of target consistency, trait valence and time of rating, although the effect sizes of the latter two factors are quite small. A three-way interaction effect between item type, target consistency and trait valence was seen, where negatively associated Rp- and Nrp consistent targets were rated as more trustworthy than negatively associated Rp- and Nrp inconsistent targets. The significant three-way interaction effect between item type, trait valence and time of rating demonstrated that positively associated Rp- targets were rated as becoming more trustworthy from the initial to the final time of rating; whereas the opposite trend occurred for positively associated Nrp targets. A significant three-way interaction effect between target consistency, trait valence and time of rating was also found, where positively associated consistent targets were rated as becoming more trustworthy from the initial to the final time of rating; whereas positively associated inconsistent targets were rated as becoming less trustworthy from the initial to the final time of rating. A significant interaction effect between target consistency and valence revealed that positively associated consistent targets were viewed as being less trustworthy as compared to negatively associated consistent targets, whereas positively associated inconsistent targets were viewed as being more trustworthy as compared to negatively associated inconsistent targets. A significant interaction effect between item type and time of rating demonstrated that the Rp- targets were viewed as becoming more trustworthy from initial to final honest rating times; whereas Nrp targets were viewed as becoming less trustworthy from initial to final honest rating times. Finally, a significant interaction effect between target consistency and time of rating revealed that consistent targets were considered more trustworthy from initial to final times of rating; whereas, inconsistent targets were considered as less trustworthy from initial to final times of rating.

5.4. Discussion

The current findings provide mixed support for the findings of Quinn and colleagues (2004). According to Quinn and colleagues, the presence of a stereotype group label and the evaluative consistency of the traits influenced retrieval inhibition, where a typical retrieval-induced forgetting effect did not occur for unpracticed stereotypic traits that were consistent with the practiced items, which were actually facilitated relative to the baseline condition, suggesting that these factors may have promoted the integration of stereotypic traits that provided protection against retrieval-induced forgetting effects. Consistent with Quinn and colleagues' findings is the failure to find significant retrieval-induced forgetting effects for honest (i.e. consistent) targets associated with positive traits in the initial and final recall tests as well as for dishonest (i.e. inconsistent) targets associated with negative traits in the initial and final recall tests. In addition, a slight facilitation effect can be seen for positively associated honest targets in the initial recall test, where participants recalled more positive traits as compared with the baseline condition.

Inconsistent with their results, however, is the failure to find significant retrieval-induced forgetting effects for positively associated dishonest targets and negatively associated honest targets in both the initial and final recall tests. Quinn and colleagues argue that retrieval-induced forgetting only occurs for recall of unpracticed stereotypic traits that are evaluatively inconsistent with the practiced traits and the label, as there is lesser opportunity for integration of items to take place.

It could be argued that the traits used to describe these honest and dishonest professionals were not highly typical of their categories and thus, there was a failure to find significant retrieval-induced forgetting effects due to the weak relation between the category labels and their traits. However, these results would still be inconsistent with the current literature, as Garcia-Bajos and Migueles (2009) demonstrated that only highly typical traits related to stereotypes as compared to traits with low-typicality were protected against retrieval-induced forgetting effects. Thus, according to them, retrieval-induced forgetting effects should occur for any condition in which the traits are not highly typical of their stereotypic category label.

Findings from the current experiment also provide mixed support for the adaptive and inhibitory accounts of retrieval inhibition. The adaptive account of retrieval-induced forgetting predicts that forgetting occurs only when it is adaptive to do so and is not based on competition (Attrill & MacLeod, 2004). The failure to find retrieval-induced forgetting for negative information in the current experiment, therefore, is consistent with the adaptive account of retrieval-induced forgetting (Attrill & MacLeod, 2004), which suggests that it may not be adaptive to forget negative information concerning individuals, especially dishonest ones. On the other hand, this adaptive account of retrieval-induced forgetting is not supported as there was also a failure to find retrieval-induced forgetting for positive traits about honest and dishonest targets on both the initial and final times of testing. Negative information about a dishonest target may be regarded as informative about a target's future negative behaviour and, therefore, may not be susceptible to retrieval-induced forgetting (Skowronski & Carlston, 1987, 1989). Positive traits, on the other hand, especially concerning an honest target, should, thus, be susceptible to retrieval-induced forgetting as this information is not informative about future negative behaviour.

Results from the additional analyses using the method proposed by Macrae and MacLeod (1999) conducted to test if non-inhibitory processes may underlie the retrieval-induced effects produced in the current experiment provide support for the inhibitory account of retrieval-induced forgetting, where the retrieval-induced forgetting effect occurred to a greater extent in the early Rp- group as compared to the early Rp+ group. These findings demonstrate that inhibitory processes may form the basis of the retrieval-induced forgetting of valenced traits that occurred. On the other hand, the inhibitory account of retrieval-induced forgetting is not fully supported as the results from the additional analyses using scatter plots and simple linear regression analyses demonstrated that output interference significantly predicted inhibition for consistent targets on the final test, thereby providing some support for non-inhibitory processes, such as output interference, as underlying any inhibition effects that occurred in that group. However, it must be noted that the proportion of variance that could be accounted for by output interference for consistent targets on the final test was only 9.7% and that results of the

scatter plots and simple linear regression analyses were consistent with those obtained using the method proposed by Macrae and MacLeod (1999) for inconsistent targets on the initial and final recall tests and for consistent targets on the initial test of recall.

With regards to honesty judgement ratings, consistent targets were rated as significantly more trustworthy than inconsistent targets, which served as a manipulation check (see pilot study) and positively associated targets were rated as significantly more trustworthy than negatively associated targets. It can also be seen that although retrieval practice of a target's neutral traits did not produce any retrieval-induced forgetting effects of the target's associated valenced traits, it did influence the target's subsequent honesty judgement ratings; where positively and negatively associated targets whose neutral traits had received retrieval practice were rated as becoming more trustworthy from initial to final times of rating, and positively and negatively associated targets whose neutral traits did not receive retrieval practice were rated as becoming less trustworthy from initial to final times of rating. Results also demonstrated an overall shift in ratings, where positively and negatively associated consistent and inconsistent targets were significantly rated as becoming more trustworthy from initial to final times of rating.

Thus, the impression findings in the current experiment are consistent with those obtained in the previous experiments in the current thesis, where no direct relationship can be seen between information available in memory and the subsequent impression judgement formed. In terms of the literature on feeling-of-knowing metacognitive judgements, these results, once again do not provide support for the direct access model of metacognitive judgements, which state that impressions are based on direct access to information about the target in memory. However, they may be consistent with the inferential account of metacognitive judgements that are based on likelihood of accessibility and not on availability of information in memory (Koriat, 1993, 1997).

In terms of the literature on judgement and decision-making, the current findings provide further support for the on-line processing of target information when the task entails an impression formation goal (Hastie & Park, 1986). Lopes (1982; based on the anchoring-and-adjustment heuristic given by Tversky and Kahneman, 1974) suggests that a person

scans, evaluates, anchors and adjusts his/her impressions of the target on-line as information is being received, and this results in a final judgements that is closer to the mean value of all the important target information available at the time of encoding. Memory-based processing, on the other hand, involves a direct relationship between judgements and relevant information available in memory and this kind of information processing occurs when, at the time of encoding, a person is instructed to pay attention to other aspects of the stimuli (e.g. memorising, grammatical analysis, comprehension, etc) and is unaware that he/she will be required to make a later impression judgement.

The impression results of the current study, as well as those obtained in previous experiments, are consistent with the literature on on-line judgements as they have demonstrated that there is no link between information available in memory and honesty judgements formed regarding male and female honest and dishonest target individuals and consistent and inconsistent target professionals.

CHAPTER 6

NON-INHIBITORY PROCESSES IN RETRIEVAL-INDUCED FORGETTING

6.1. Introduction

The previous experiments have demonstrated the role of retrieval-induced forgetting in impression formation. The question that remains to be answered is what kind of processes form the basis of this specified pattern of impairment in recall caused due to retrieval practice? The current experiment examines whether the underlying mechanism of retrieval-induced forgetting in the context of person memory and impression formation is inhibitory or non-inhibitory in nature. This is achieved by adopting M.C. Anderson and Spellman's (1995) independent probe method in conjunction with materials similar to those used in Experiment 1.

Inhibitory and non-inhibitory theories (e.g. interference theories) are different in terms of their nature and their relation to retrieval cues in memory. Inhibition is viewed as an adaptive and active process that is invoked when required. The theory postulates that the memory trace itself is inhibited and so in the case of retrieval-induced forgetting, inhibition causes the memorial representations of the competing Rp- items to be suppressed. The theory also implies that the impairment of the competing Rp- items is independent of the cues used at encoding and retrieval and will persist despite the use of novel cues at the final test phase. Thus, according to the theories of inhibition, retrieval-induced forgetting can be viewed as an example of cue-independent forgetting (M.C. Anderson & Spellman, 1995; M.C. Anderson & Green, 2001; M.C. Anderson et al., 2000; Levy & Anderson, 2002).

Interference, on the other hand, is viewed as a passive process that occurs as an uncontrollable consequence of retrieval. Interference accounts suggest that the

strengthening of the associative link between a category cue and an item may either, block the competitor, rob the spread of activation to the competitor or weaken the associative bond between the cue and the competitor, thereby resulting in decreased recall of these competing items. The main difference to be noted here, as compared to the inhibitory theories of forgetting, is the dependence on use of the original retrieval cue at the final recall test to result in impairment of competing items. Thus, the theory predicts that if novel retrieval cues are employed during the final recall phase, different to those used during the practice phase, then the problem of interference will be solved and retrieval-induced forgetting will not occur. This kind of forgetting is largely referred to as being cue-dependent (M.C. Anderson & Spellman, 1995; Tulving, 1974). This difference mainly distinguishes between interference and inhibitory accounts of forgetting.

M.C. Anderson and Spellman's (1995) independent probe method assesses the underlying processes of retrieval-induced forgetting, by testing memory for inhibited items through the use of retrieval cues that have not been used in the experiment until the final recall test. It is based on the logic that if novel cues are used during the final recall test as compared to those used during the retrieval practice phase, then the activation of experimental items can be tested directly as they are independent from the changes in the associative strength between cue and target. There is evidence that supports the inhibitory account of forgetting, with the use of independent cues, in both the retrieval-practice paradigm (M.C. Anderson & Bell, 2001; M.C. Anderson et al., 2000; M.C. Anderson & Spellman, 1995; Johnson & Anderson, 2004) and the think/no-think paradigm (M.C. Anderson & Green, 2001; M.C. Anderson et al., 2004). On the other hand, there is also evidence demonstrating the failure of the production of retrieval-induced forgetting effects with the use of independent cues (Williams & Zacks, 2001; Butler, Williams, Zacks & Maki, 2001).

In the current experiment, the independent probe method was employed to discover the underlying mechanisms of retrieval-induced forgetting in impression formation. The materials and procedure used were similar to those used in Experiment 1. The current experiment differs from the previous one in its use of novel cues (non retrieval practice category cues) in the form of word fragments during the final recall phase. Previous

research has also demonstrated the use of word fragment completion tasks as a test of implicit memory in the retrieval practice paradigm (Butler, Williams, Zacks & Maki, 2001; Hicks & Starns, 2004)

Predictions

A number of predictions can be made based on previous research that used the independent probe method to investigate the processes underlying retrieval-induced forgetting (M.C. Anderson & Bell, 2001; M.C. Anderson et al., 2000; M.C. Anderson & Spellman, 1995; Johnson & Anderson, 2004). If inhibition is the basis for retrieval-induced forgetting to occur for valenced information associated with target individuals, then the retrieval-induced forgetting effect should still be found to occur even when novel cues are employed during the final recall test. In other words, if the memorial representations of the Rp- items are truly inhibited, then recall for these items should suffer despite the change in retrieval cues that were used to strengthen Rp+ items from the retrieval practice phase to the final testing phase. On the other hand, if non-inhibitory processes underlie forgetting, then retrieval-induced forgetting should fail to occur. More specifically, the recall performance of Rp- items should be similar to that in the Nrp category. Honesty judgement ratings of the given target individuals were also included at the beginning and the end of the study to confirm that there would be no changes in the affective impression formed by participants from initial to final times of rating. Based on the findings in the literature and on the previous impression findings in the current thesis, there was no expectation of any shift in the affective impression formed of a given studied individual (in terms of honesty) in relation to the extent that both positive and negative information about that individual was impaired or facilitated as a consequence of retrieval practice.

6.2. Method

Participants and Design

Forty undergraduate and postgraduate students (20 females and 20 males; ages ranging from 18 to 34 with a mean age of 21.0) from Swansea University, U.K., volunteered to participate in this study or participated in this study for psychology subject pool credits. As in all the previous studies conducted, all participants were fluent English speakers and

equal proportions of male and female participants were randomly assigned to each counterbalanced experimental condition. The experiment had a 2 (Trait Valence: Positive and Negative) x 3 (Practice Status: practised items from the practised category [Rp+], non-practised items from the practised category [Rp-], and non-practised items from the non-practised category [Nrp]) x 2 (Target Gender: Male or Female) mixed design with repeated measures on the latter two factors.

Stimulus Materials

The stimuli used in the main study were same facial pictures of 2 male and 2 female targets used in Experiments 2A and 2B (see Appendix III) and they were associated with the same neutral, positive and negative traits used in Experiment 1 (see Appendix II). A recall task based on M.C. Anderson and Spellman's (1995) independent probe technique was employed as a manipulation task (see also Butler et al., 2001). The independent probe technique uses new and different cues that have not previously been used to prompt recall in the experiment. These cues were in the form of word fragments, where participants had to fill in the appropriate letters to form the correct words. In order to determine the stimuli materials (i.e. word fragments of the traits to be studied) for the recall test to be used, a pilot study on 76 participants was conducted. The forty studied traits to be associated with the targets were transformed into word fragments, so that participants had a below 50% chance of completing the trait word without having previously studied it. Forty additional unrelated word fragments taken from an earlier pilot of 50 participants were also used. The pilot studies therefore determined the final list of word fragments used in the recall phase of the experiment, which consisted of the both the forty studied trait word fragments and the additional forty unrelated word fragments interleaved together in a random order (see Appendix VI).

Procedure

The procedure used was similar to the procedure used in Experiment 1, where participants were told that they were going to learn traits describing 4 individuals and in the process they should form impressions about them. They were told that other participants had interacted with these individuals in a prior study and had used the to-be-learned traits to describe these individuals. Participants were also told that they might have to play a game

with one of the individuals at the end of the study and that the more they remembered about that individual, the better they would do in the game.

In the study phase, participants read 10 word pairs that appeared underneath a target's picture (e.g., Ryan: Average). The neutral and valenced traits associated with a given target were presented in a random and interleaved order. Each word pair was displayed for 5 seconds. After all of the traits were presented to participants, they had to rate the target on honesty and attractiveness using a 5-point Likert scale, whereby 1 indicated that the target was very honest and 5 indicated that the target was very dishonest. As honesty was the measure of interest, it was placed first to exclude any possible ordering effects and the other rating judgement of attractiveness was incorporated to try and limit the participant's ability to remember his or her honesty ratings when a post-study rating task was to be administered. In the retrieval practice phase, participants received retrieval practice for neutral traits of 2 targets (e.g. Ryan: Av___), while for the other 2 targets, participants received retrieval practice for an unrelated category (e.g. Fruit: Or___), thus creating Rp- and Nrp conditions, respectively, for the unpractised valenced traits. When the target's neutral traits were practised, the associated positive and negative traits were considered to be Rp- items, while when an unrelated category was practised, the valenced traits were considered as Nrp items. This phase was followed by a 3 minute distracter task (i.e., word search puzzle) in the absence of the target's picture. No participant completed the distracter task in the allocated time.

This process was repeated for each of the 4 targets. Participants were then required to engage in a surprise final recall test using the independent cues in order to see whether any retrieval-induced forgetting effects would occur after a delay. The names and pictures of the targets were not presented during the recall phase. Following this, participants were informed that they did not have to meet any of the individuals, but that they had to rate each of the individuals again. Participants were then debriefed, thanked for their effort and participation, and escorted outside the laboratory.

6.3. Results

6.3.1. Recall Performance:

Retrieval Practice Performance

The retrieval practice success rate for neutral traits during the retrieval practice phase was 81% ($M = 8.10$, $SE = .24$).

Recall Performance:

An analysis of the data of the final independent-cued recall test did not reveal the anticipated effect of item type on recall performance, where the proportion of neutral traits recalled correctly when given retrieval practice ($M = .50$, $SE = .03$) did not differ from when not given retrieval practice ($M = .49$, $SE = .02$). Results of the paired samples t-test confirmed that this difference was not significant [$t(79) = .461$, ns , $\eta^2 = .003$], thus demonstrating an absence of the retrieval practice effect or lack of a generation effect on an implicit memory task.

The mean correct independent-cued recall proportions for positive and negative traits as a function of whether they had been associated with a male or female target and whether the target's neutral traits had or had not been given retrieval practice (i.e. their status as Rp- or Nrp items) on the final recall test are shown in Table 13.

Table 13: Mean correct trait-recall proportions (and standard errors) in relation to trait valence, item type, and gender of the target in the final implicit recall test.

Target	Trait Valence		
	Item Type	Positive	Negative
Male	Rp-	.40 (.05)	.57 (.07)
	Nrp	.18 (.04)	.39 (.05)
	Difference	0.22	0.18
Female	Rp-	.45 (.05)	.45 (.06)
	Nrp	.17 (.04)	.39 (.04)
	Difference	0.28	0.06

Note: Rp- = unpractised valenced traits from the practised categories, Nrp = unpractised valenced traits from the unpractised categories, Difference = retrieval-induced forgetting effect.

The data summarised in this table were analysed using a 2 (Trait Valence: Positive vs. Negative) x 2 (Target Gender: Male vs. Female) x 2 (Item type: Rp- vs. Nrp) mixed design ANOVA, with trait valence the only between subjects variable.

Findings demonstrated that there was a significant main effect of item type, but that a retrieval-induced forgetting effect failed to occur, with Rp- items ($M = .47$, $SE = .03$) (whether positive or negative traits and whether associated with a male or female target) being recalled significantly better than their Nrp counterparts ($M = .28$, $SE = .02$) [$F(1, 38) = 43.280$, $p < .001$, $\eta^2 = .189$], demonstrating that the selective retrieval of neutral traits actually facilitated participants' ability to recall competing positive or negative traits on a later implicit recall test. There was also a significant main effect of trait valence found [$F(1, 38) = 12.302$, $p = .001$, $\eta^2 = .034$], where negative traits ($M = .45$, $SE = .03$) were recalled significantly better than positive traits ($M = .30$, $SE = .03$).

There was also a significant interaction found between item type and trait valence [$F(1, 38) = 5.343$, $p < .05$, $\eta^2 = .023$], suggesting a difference between whether or not targets had received practice for their associated neutral traits and whether they also had positive or negative traits associated with them. Results from follow up independent samples t-tests demonstrated a significant effect of trait valence on Nrp items [$t(38) = -4.079$, $p < .001$, $\eta^2 = .305$], but not on Rp- items [$t(38) = -1.713$, ns , $\eta^2 = .072$]. Thus, for Nrp items, participants recalled significantly more negative traits ($M = .39$, $SE = .04$) as compared to positive traits ($M = .39$, $SE = .03$); whereas there was no significant difference in recall between the valenced traits for Rp- items (negative $M = .51$, $SE = .04$, positive $M = .43$, $SE = .03$).

On the other hand, the analyses of the data did not reveal a significant main effects of target gender [$F(1, 38) = .320$, ns , $\eta^2 = .002$]. There were also no significant interactions between item type and target gender [$F(1, 38) = .140$, ns , $\eta^2 = .001$] nor between target gender and trait valence [$F(1, 38) = 1.280$, ns , $\eta^2 = .009$] nor between item type, target gender and trait valence [$F(1, 38) = 1.256$, ns , $\eta^2 = .011$].

6.3.2 Impression Ratings:

Honesty Ratings:

The mean honesty ratings obtained as a function of (a) whether the target was male or female, (b) had been presented as a positive or negative target, (c) whether the associated neutral traits had or had not been given retrieval practice, and (d) the point in the

experiment at which they were made (Initial: immediately after the study phase, or Final: immediately after the final independent-cued implicit recall test) are shown below in Table 14.

Table 14: Means (and standard errors) of honesty ratings in relation to gender of target, trait valence and item type obtained pre and post retrieval practice.

Trait Valence	Targets	Time of Rating		
		Initial	Final	
	Item Type			
Positive	Male	Rp-	2.05 (.14)	2.50 (.20)
		Nrp	2.40 (.29)	2.85 (.31)
	Female	Rp-	2.50 (.24)	2.90 (.23)
		Nrp	1.50 (.18)	2.10 (.24)
Negative	Male	Rp-	3.55 (.25)	2.85 (.26)
		Nrp	3.85 (.17)	3.65 (.23)
	Female	Rp-	3.70 (.18)	3.30 (.24)
		Nrp	3.40 (.20)	3.15 (.26)

Note: Rp- = unpractised valenced traits from the practised categories, Nrp = unpractised valenced traits from the unpractised categories.

The resulting ANOVA was a 2 (Trait Valence: Positive vs. Negative) x 2 (Target Gender: Male vs. Female) x 2 (Item Type: Rp- vs. Nrp) x 2 (Time of Rating: Initial vs. Final) mixed-design ANOVA, with trait valence being the only between subjects variable.

The data demonstrated that there were no significant main effects found for either item type [$F(1, 38) = .285, ns, \eta^2 = .001$], target gender [$F(1, 38) = .998, ns, \eta^2 = .006$] or time of rating [$F(1, 38) = .230, ns, \eta^2 = .001$]. On the other hand, there was a significant main effect of trait valence [$F(1, 38) = 46.146, p < .001, \eta^2 = .033$], where negatively associated targets ($M = 3.43, SE = .11$) were rated as significantly less trustworthy as compared to positively associated targets ($M = 2.35, SE = .11$).

A significant interaction effect of item type and trait valence [$F(1, 38) = 4.305, p < .05, \eta^2 = .013$] was also found, suggesting a relationship between whether the target's associated neutral traits had or had not received retrieval practice and whether the target was associated with positive or negative traits. Further analyses of the data using independent samples t-tests revealed that there was a significant effect of trait valence on both Rp- [$t(38) = -4.758, p < .001, \eta^2 = .373$] and Nrp targets [$t(38) = -6.496, p < .001, \eta^2 = .526$]. Thus, there is evidence that both, positively associated Rp- ($M = 2.49, SE = .12$) and Nrp ($M = 2.21, SE = .15$) targets were rated as more trustworthy as compared to negatively associated Rp- ($M = 3.35, SE = .13$) and Nrp ($M = 3.51, SE = .13$) targets.

Results also revealed a significant interaction effect of trait valence and time of rating [$F(1, 38) = 22.308, p < .001, \eta^2 = .051$], suggesting a relationship between whether the rating had been taken prior to the retrieval practice phase or post retrieval practice and whether the target was associated with positive or negative traits. Further analyses of the data using paired samples t-tests revealed a significant effect of rating times on both positive [$t(19) = -3.329, p < .01, \eta^2 = .368$], as well as negative targets [$t(19) = 3.401, p < .01, \eta^2 = .378$]. Thus, there is evidence that for positively associated targets were rated as becoming less trustworthy from the initial ($M = 2.11, SE = .13$) to the final ($M = 2.58, SE = .14$) times of rating; whereas negatively associated targets were rated as becoming more trustworthy from the initial ($M = 3.63, SE = .10$) to the final ($M = 3.24, SE = .14$) times of rating.

A significant interaction effect was also found between item type and target gender [$F(1, 38) = 12.826, p < .01, \eta^2 = .071$] suggesting a relationship between ratings of male and female targets and whether the target's associated neutral traits had or had not been given retrieval practice. Follow up tests using paired samples t-tests demonstrated that there was a significant effect of item type on both male [$t(19) = -2.215, p < .05, \eta^2 = .205$], as well as female targets [$t(19) = -3.750, p = .001, \eta^2 = .425$]. Thus, there is evidence that Rp-male targets ($M = 2.74, SE = .15$) were rated as more trustworthy than Nrp male targets ($M = 3.19, SE = .18$); whereas Rp- female targets ($M = 3.10, SE = .14$) were rated as less trustworthy than Nrp female targets ($M = 2.54, SE = .18$).

However, there were no significant interactions found between item type and time of rating, [$F(1, 38) = .903, ns, \eta^2 = .003$], between target gender and trait valence [$F(1, 38) = .153, ns, \eta^2 = .001$], between target gender and time of rating [$F(1, 38) = .281, ns, \eta^2 = .001$], between item type, target gender and trait valence [$F(1, 38) = .706, ns, \eta^2 = .004$], between item type, time of rating and trait valence [$F(1, 38) = .543, ns, \eta^2 = .001$], between target gender, time of rating and trait valence [$F(1, 38) = .052, ns, \eta^2 = .000$], between item type, time of rating and target gender [$F(1, 38) = .043, ns, \eta^2 = .000$], and finally between item type, time of rating, target gender and trait valence [$F(1, 38) = .575, ns, \eta^2 = .001$].

To briefly summarise the key findings of this experiment, results from the independent-cued implicit recall test did not reveal any practice effects or retrieval-induced forgetting effects. There was a significant main effect of item type demonstrating that the selective retrieval of neutral traits actually facilitated the participant's ability to recall competing positive or negative traits on a later implicit recall test. A significant main effect of trait valence was also found, where negative traits were recalled significantly better than positive traits, and a significant interaction between item type and trait valence revealed that this difference between positive and negative trait recall was mainly present for Nrp traits as compared to Rp- traits. With regards to the honesty ratings, there was a significant main effect of trait valence, where negatively associated targets were rated as significantly less trustworthy as compared to positively associated targets. A significant interaction effect of item type and trait valence was also found, where positively

associated Rp- and Nrp targets were rated as more trustworthy as compared to negatively associated Rp- and Nrp targets. Results also revealed a significant interaction effect of trait valence and time of rating, where positively associated targets were rated as becoming less trustworthy from the initial to the final times of rating; whereas the opposite trend occurred for negatively associated targets. A significant interaction effect was also found between item type and target gender, where Rp- male targets were rated as more trustworthy than Nrp male targets; whereas Rp- female targets were rated as less trustworthy than Nrp female targets.

6.4. Discussion

Previous research has provided evidence in support of inhibition as an underlying process in retrieval-induced forgetting (M.C. Anderson & Spellman, 1995; M.C. Anderson & Green, 2001; M.C. Anderson et al., 2000; Levy & Anderson, 2002). In addition, the results of Experiment 1, which used the category-cued recall method at the retrieval practice and final recall phases, are also consistent with these findings. However, findings of the current experiment, which employed the independent probe method, can be seen to provide evidence against the inhibitory account of forgetting. Results indicate that retrieval practice of neutral items associated with the targets was not only unsuccessful in the facilitation of those items, but also failed to produce a retrieval-induced forgetting effect on the later recall test. On the other hand, results demonstrated no benefits of retrieval practice in the current study. As such practice effects have been demonstrated time and again in previous studies (Allen et al., 1969; R.A. Bjork, 1975; Carrier & Pashler, 1992; Morris & Fritz, 2000, 2002; Iglesias-Parro et al., 2009), it must be noted that the design or administration of the current experiment may have been flawed in some way.

The current findings, however, provide support for the alternative non-inhibitory interference accounts, which emphasise the cue-dependent nature of forgetting (Tulving, 1974). The results are also consistent with the findings of Butler and colleagues (2001). Butler and colleagues also used a word fragment completion task in the retrieval-practice paradigm and failed to obtain retrieval-induced forgetting. The absence of the retrieval-induced forgetting effect was also found using category-plus-word-fragment-cued recall

and category-plus-stem-cued recall. The results of the current experiment differ from those of Butler and colleagues in one way. Where they found comparable recall of the Rp- and Nrp items, the current experiment actually found a significant facilitation effect for the Rp- items as compared to the Nrp items. Thus, selective retrieval practice of neutral items associated with a target surprisingly resulted in the increased recall of the target's associated valenced information.

Non-inhibitory processes of forgetting have been explained by three main accounts of interference theories that occur at the level of the association link between the retrieval cue and the item (M.C. Anderson et al. 1994; M.C. Anderson & Spellman, 1995). Firstly, the occlusion model suggests that the strengthening of a cue and an item actually blocks the retrieval of a competing item associated with the same cue. Secondly, the resource diffusion model suggests that since the spread of activation is a finite resource, the strengthening of a link between cue and item results in decreased activation for the competing item associated with the same cue. Thirdly, the associative decrement model suggests that the increased strength between cue and item results in the weakening of other competing cue-item associations. Another factor put forth to explain the absence of retrieval-induced forgetting using the retrieval practice paradigm is integration (M.C. Anderson & McCulloch, 1999). They suggest that when category items are associated to one another, it provides them with protection against retrieval-induced forgetting.

Another possible non-inhibitory theory that can account for the current findings is the context dependent account (Perfect et al., 2004), which suggests that the suppression of Rp- items occurs as a result of a match between the contexts at retrieval practice and the final test phase. Given that the contexts did not match in the current experiment as the target's name and picture that were used during retrieval practice were substituted with word fragments in the absence of the target's name and picture during final recall, it suggests that context is an important factor in modulating the retrieval-induced forgetting effect in impression formation; that is, when the contexts do not match no retrieval-induced forgetting is found.

Impression ratings of honesty demonstrated shifts in opposite directions, where targets that were associated with positive traits were rated as being considered less trustworthy from the initial to the final time of rating and targets that were associated with negative traits were rated as being considered more trustworthy from initial to the final time of rating, irrespective of whether they received retrieval practice for their associated neutral traits. Impression results also show that retrieval practice of a target's neutral traits affected honesty ratings depending on the sex of the target, where the male target in the retrieval practice condition was viewed as being more trustworthy as compared to the control condition, whereas, the female target in the retrieval practice condition was viewed as being less trustworthy as compared to the control condition. These results, although in a different direction as compared to when retrieval-induced forgetting of the target's valenced information occurs, are yet once again consistent with the inferential theory of metacognitive judgements (Koriat, 1993) and 'on-line' information processing of impression judgements (Hastie & Park, 1986), which suggest that affective ratings are not based on availability of relevant information in memory.

THE BEHAVIOURAL CONSEQUENCES OF RETRIEVAL-INDUCED FORGETTING

7.1. Introduction

The research reported in the previous empirical chapters has focused on two main objectives. Firstly, an investigation was made into whether or not retrieval-induced forgetting does take place for valenced traits relating to a target individual, which was done by using target names and faces (Experiments 1 and 2) and names of honest and dishonest target professionals (Experiment 3) and the underlying processes of retrieval-induced forgetting were also examined (Experiment 4). Secondly, an examination of the relationship between this impaired recall and participant's ratings of honesty for these target individuals was carried out. Thus, the research conducted so far has mainly employed the basic retrieval practice paradigm to test the occurrence of the retrieval-induced forgetting effect and has introduced rating scales to examine changes (if any) in judgements of honesty made by participants. However, it fails to demonstrate how this retrieval practice, and consequent impairment, affects not only our impressions formed, but also our behaviour exhibited towards these target individuals. As we live in a social world and interact with other individuals on a daily basis, it would be interesting and useful to find out if the impairment of information relating to an individual's personality could actually lead to changes in behaviour towards that particular individual.

The current chapter provides an initial investigation into the behavioural consequences of retrieval-induced forgetting in relation to impression formation. The results of the previous experiments have provided evidence for the absence of a direct relationship between memory and judgements formed during impression formation by using retrieval-induced forgetting. These findings support previous conclusions that the impression we

form about others does not seem to be based on the availability of relevant information in memory (Storm et al., 2005).

As noted in the previous chapter, retrieval-induced forgetting has also been examined in the area of stereotypes, where Dunn and Spellman (2003) demonstrated that both individuating and stereotypic information were found to be susceptible to retrieval-induced forgetting, suggesting that this type of unintentional forgetting can be used to alter the availability of stereotypic information.

Research conducted in the area of stereotypes and thought suppression have investigated the relationship between memory for stereotypic trait information and social behaviour using a behavioural measure to test the effects of unwanted thought suppression (Macrae, Bodenhausen, Milne & Jetten, 1994). Following a period of thought suppression about skin heads, participants were told that they were going to meet the target and were asked to wait outside the laboratory for him, where there was a row of empty seats and on the first seat was the “target’s belongings”. Participants were asked to take a seat and wait for the target to return. The choice of seat was the behavioural measure introduced to check for effects of thought suppression. Their results demonstrated that there was a behavioural cost to suppressing a stereotype and participants who suppressed the stereotype chose a seat further away from the target than participants who did not suppress the stereotype, thus supporting the existing evidence in the area of thought suppression, where suppression of an unwanted thought causes the thought to rebound uncontrollably.

The current experiments use the same measure employed by Macrae and colleagues (1994) in order to examine the behavioural consequences of retrieval-induced forgetting for valenced trait information associated with a target individual. In the following two studies, participants read neutral and positive traits (Experiment 5A), and neutral and negative traits (Experiment 5B), describing a target individual and then engaged in selective retrieval of the neutral traits only as a means to induce retrieval-induced forgetting for the valenced traits. Participants were next taken outside the laboratory, where there were eight empty seats with the targets belongings placed on the first seat and were asked to sit and wait for the target to return. Participants were then informed that

they could meet the target later and were taken back into the laboratory where they then free recalled all of the traits concerning the target.

Predictions

As the findings of Macrae and colleagues (1994) were consistent with the typical effects of thought suppression, the behavioural measure employed by them (i.e. the seating task) was used to examine if the behavioural effects of retrieval-induced forgetting were consistent with the theory, where forgetting of valenced traits would lead to a change in the participant's choice of seat relative to the target individual. There were two main predictions for the current experiments. The first prediction was that if positive trait information related to a target individual was subject to retrieval-induced forgetting, then participants would view the target as becoming less trustworthy and consequently choose a seat further away from the target. Conversely, if negative trait information was subject to retrieval-induced forgetting, then participants would view the target as becoming more trustworthy and as a result choose to sit closer to the target. The second prediction was similar to those made in previous experiments, where retrieval-induced forgetting of valenced information was not expected to explicitly shift the affective rating of the target accordingly, from the initial to the final times of rating.

EXPERIMENT 5A – THE BEHAVIOURAL CONSEQUENCE OF RETRIEVAL-INDUCED FORGETTING EFFECT OF POSITIVE TRAITS

7.2. Method

Participants and design:

Sixty six undergraduate and postgraduate students (32 male, 34 female; ages ranging from 18 to 35, with a mean age of 21.88) from Swansea University, U.K.; volunteered to participate in the experiment in exchange for course credit or £2. The experiment had a between subjects variable whereby participants either completed relevant retrieval practice (Rp), or non-relevant retrieval practice (Nrp), thus making the design of the experiment a 2 (Condition: Relevant retrieval practice and Non-relevant retrieval

practice) x 3 (Practice Status: practised items from the practised category [Rp+], non-practised items from the practised category [Rp-], and non-practised items from the non-practised category [Nrp]) between subjects one. The dependent variables were the proportion of retrieved and unretrieved items reported, and the choice of seat. There were 33 participants in each condition.

Stimulus Materials

The stimuli used in this study were twenty cards with word pairs consisting of the target's name and a personality trait associated with him (e.g., Mark - Casual). The twenty personality traits relating to "Mark" consisted of ten positive (kind, helpful, clever, loyal, friendly, sincere, understanding, warm, efficient, and modest) and ten neutral traits (casual, ordinary, prudent, normal, shy, moderate, blunt, passive, average, and quiet) drawn from N.H. Anderson's (1968) likeability scale (see Appendix VII). The average likeability of the positive traits was 512.8 and the average for the neutral traits was 313.4. Once again, the neutral and valenced traits that were used to describe the targets had been standardised (Storm et al., 2005). A row of 8 empty chairs were placed outside the laboratory with a jacket and a bag placed on the first chair to indicate the presence of the target person (see Appendix VIII). As mentioned before, it was predicted that the participant's choice of seating would be affected by the earlier testing session, varying according to whether they received relevant retrieval practice of neutral traits as compared to non-relevant retrieval practice of fruits.

Procedure

Participants arrived at the laboratory and were greeted by a female experimenter. They were instructed that they would learn traits about an individual named "Mark" and that they should try and form an impression about him based on those traits. They were also informed that the to-be-learned traits were given by people who had interacted with the target in a previous study and that they would have to meet the target at some point during the study for a brief introduction. The testing session began once the participants had fully understood what was required of them for the study. In the study phase, all participants were shown 20 names of fruits presented in the form of category-exemplar pairs on cards (e.g., Fruit – Apple) and 20 personality traits relating to "Mark", that

consisted of ten positive and ten neutral traits (see Appendix VII). Each trait was also presented on a card with the name Mark followed by the trait (e.g., Mark – Casual). Participants then had to rate the target on honesty and likeability using a 5-point Likert scale, whereby 1 indicated that the target was very honest or very likeable and 5 indicated that the target was very dishonest or very unlikeable. As honesty was the measure of interest, it was placed first to exclude any possible ordering effects and the other rating judgement of likeability was incorporated to try and limit the participant's ability to remember his or her honesty ratings when the post study rating task was to be administered. Following this, participants were assigned to either the relevant retrieval practice condition (Rp) or non-relevant retrieval practice condition (Nrp). In the relevant retrieval practice condition, participants completed retrieval practice of the ten neutral traits. Participants were presented with the name Mark and a two letter stem prompt (e.g. Mark – Ca _____) and participants had to write down the correct trait. Each of the ten neutral traits was practised in this way three times each. This retrieval practice produced items differing in retrieval status. The neutral traits formed the practised sub-set (i.e. Rp+ items) while the positive traits formed the unpractised sub-set (i.e. Rp- items). In the non-relevant retrieval practice condition participants practised items of fruit (e.g. Fruit – Ap _____), and thus the final recall of the target's positive traits provided a between subjects baseline (i.e. Nrp items). Following the retrieval practice phase participants completed a word search puzzle for 3 minutes. On completion of this task, participants were informed that they were going to meet the target and were escorted outside the laboratory. Round the corner from the laboratory was a row of 8 seats with a denim jacket and bag placed on the first seat to indicate the presence of the target. The experimenter pointed out that the jacket and bag belonged to the target, explained to the participant that the target must have gone to the bathroom, and requested them to take a seat and wait for the target to return. The experimenter then returned to the laboratory and waited for 30 seconds before returning to note the seat number. Participants were then informed that they could meet the target later and they were taken back into the laboratory for the final recall phase, whereby participants were presented with the category cue (i.e. target's name – "Mark") and were asked to free recall all of the traits concerning the target and then rate the target once again on the dimensions of honesty and likeability using the

same 5-point Likert scales. Participants were then thanked, debriefed and escorted outside the laboratory.

7.3. Results

7.3.1. Recall Performance

Retrieval practice success rate:

The retrieval practice success rate for neutral traits during the retrieval practice phase was 86.06% ($M = 25.82$, $SE = .64$).

Recall performance:

An analysis of the data revealed the anticipated effect of item type on recall performance, where the proportion of neutral traits recalled correctly when given relevant retrieval practice ($M = .65$, $SE = .03$) was greater as compared to when given non-relevant retrieval practice ($M = .20$, $SE = .03$) [$t(64) = 11.325$, $p < .001$, $\eta^2 = .667$]; thus, as usual, demonstrating the benefits of retrieval practice on later recall.

The mean correct cued-recall proportions (and standard errors) for positive traits as a function of whether the target's neutral traits had or had not been given retrieval practice (i.e. their status as Rp- or Nrp items) on the final recall test are shown in Table 15.

Table 15: Mean correct trait-recall proportions (and standard errors) reported on the final recall test – Experiment 5A

	Mean Recall of Positive Traits
Rp-	0.14 (.02)
Nrp	0.35 (.02)
<i>Difference</i>	<i>-0.21</i>

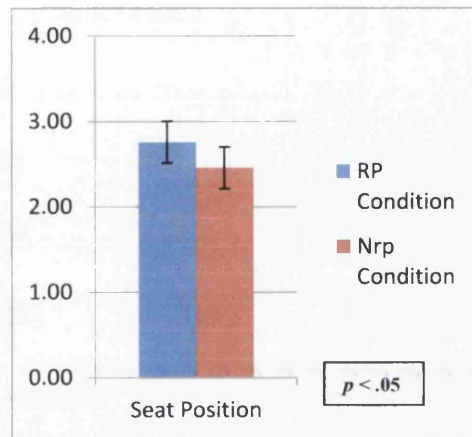
Note: Rp- = unpractised valenced traits from the practised category, Nrp = unpractised valenced traits from the unpractised category, Difference = retrieval-induced forgetting effect.

The data from the above table reveals an expected decrease in the recall of positive traits in the relevant retrieval practice condition as compared to the non-relevant retrieval practice condition. To test if this difference was significant, an independent samples t-test was performed. Findings demonstrate that positive Rp- items ($M = .14$, $SE = .02$) were indeed reported at a lower rate as compared to positive Nrp items ($M = .35$, $SE = .02$) and that this difference reached significance [$t(64) = -6.434$, $p < .001$, $\eta^2 = .393$]. Thus, retrieval-induced forgetting was detected for positive traits.

Seating position:

Findings demonstrated that participants in the relevant retrieval practice group were found to choose a seat further away from the target's seat ($M = 2.76$, $SE = .09$) than participants in the non-relevant retrieval practice group ($M = 2.45$, $SE = .10$) and this difference also reached significance [$t(64) = 2.306$, $p < .05$, $\eta^2 = .077$], (see Figure 21 below).

Figure 21: Mean position of seat chosen by participants in the relevant retrieval practice condition (Rp) as compared to the non-relevant retrieval practice condition (Nrp) – Experiment 5A



Note: Participants in the Rp condition choose a seat significantly further away from the target's belongings as compared to participants in the Nrp condition.

7.3.2. Impression Ratings

Honesty Ratings:

The mean honesty ratings obtained as a function of (a) whether the associated neutral traits had or had not been given retrieval practice, and (b) the point in the experiment at which they were made (Initial: before the retrieval practice phase, or Final: immediately after the final category-cued recall test) are shown below in Table 16.

Table 16: Means (and standard errors) of honesty ratings in relation to condition obtained pre and post retrieval practice – Experiment 5A

Condition	Time of Rating	
	Initial	Final
Rp	1.85 (.14)	1.88 (.14)
Nrp	1.79 (.14)	2.00 (.14)

Note: Rp- = unpractised valenced traits from the practised category, Nrp = unpractised valenced traits from the unpractised category.

A 2 (Condition: Relevant retrieval Practice and Non-relevant retrieval practice) x 2 (Time of Rating: Initial vs. Final) mixed ANOVA, with time of rating as the within subjects factor, was conducted to check for any significant differences. Results revealed no significant main effect of condition [$F(1, 64) = .025$, *ns*, $\eta^2 = .000$]. There was, however, a significant effect of honesty rating times [$F(1, 64) = 4.971$, $p < .05$, $\eta^2 = .069$], where the positively associated target was rated as becoming significantly less trustworthy from initial ($M = 1.82$, $SE = .10$) to final ($M = 1.94$, $SE = .10$) times of rating, regardless of whether his associated neutral traits had been practised or not. On the other hand, there was no significant interaction between condition and time of rating [$F(1, 64) = 2.796$, *ns*, $\eta^2 = .039$].

Likeability Ratings:

The mean likeability ratings obtained as a function of (a) whether the associated neutral traits had or had not been given retrieval practice, and (b) the point in the experiment at

which they were made (Initial: before the retrieval practice phase, or Final: immediately after the final category-cued recall test) are shown below in Table 17.

Table 17: Means (and standard errors) of likeability ratings in relation to condition obtained pre and post retrieval practice – Experiment 5A

Condition	Time of Rating	
	Initial	Final
Rp	2.18 (.13)	2.30 (.14)
Nrp	1.79 (.15)	1.85 (.15)

Note: Rp = unpractised valenced traits from the practised category, Nrp = unpractised valenced traits from the unpractised category.

Once again, a 2 (Condition: Relevant retrieval Practice and Non-relevant retrieval practice) x 2 (Time of Rating: Initial vs. Final) mixed ANOVA, with time of rating as the within subjects factor, was conducted to check for any significant differences. Results revealed a significant effect of condition [$F(1, 64) = 4.941, p < .05, \eta^2 = .009$], where participants in the relevant retrieval practice condition ($M = 2.24, SE = .14$) rated the target as significantly less likeable as compared to the non-relevant retrieval practice condition ($M = 1.82, SE = .14$). There was, however, no significant main effect of time of likeability ratings [$F(1, 64) = 2.007, ns, \eta^2 = .030$]. There was also no significant interaction between condition and time of rating [$F(1, 64) = .223, ns, \eta^2 = .003$].

Thus, from the above findings of the current experiment, when the behavioural measure was administered immediately after the retrieval practice phase, it can be seen that

relevant retrieval practice was found to lead to a reliable behavioural effect, whereby the retrieval-induced forgetting of positive traits led to participants choosing to sit further away from the target as compared to participants who did not demonstrate retrieval-induced forgetting. Results of the honesty ratings demonstrated that there was no significant difference in honesty ratings between the relevant retrieval practice condition and the non-relevant retrieval practice condition, nor was there a significant interaction between the two conditions and the initial and final times of rating. On the other hand, a significant main effect of time of rating was found, where participants rated the positively associated target as becoming less trustworthy from initial to final times of rating. Results of the likeability ratings demonstrate a significant main effect of condition, where participants in the relevant retrieval practice condition rated the positively associated target as significantly less likeable as compared to the non-relevant retrieval practice condition. However, there were no significant shifts in likeability ratings from initial to final times of rating, nor was there is a significant interaction between conditions and times of rating. Experiment 5B will extend the paradigm from Experiment 5A to examine whether the same behavioural consequence is also found for negative personality traits.

EXPERIMENT 5B – THE BEHAVIOURAL CONSEQUENCE OF RETRIEVAL-INDUCED FORGETTING EFFECT OF NEGATIVE TRAITS

7.4. Method

Participants and design:

Sixty six undergraduate and postgraduate students (32 male, 34 female; ages ranging from 18 to 34 with a mean age of 21.08) from Swansea University, U.K.; volunteered to participate in the experiment in exchange for course credit or £2. The experiment had a between subjects variable whereby participants either completed relevant retrieval practice (Rp), or non-relevant retrieval practice (Nrp), thus making the design of the experiment a 2 (Condition: Relevant retrieval practice and Non-relevant retrieval practice) x 3 (Practice Status: practised items from the practised category [Rp+], non-practised items from the practised category [Rp-], and non-practised items from the non-

practised category [Nrp]) between subjects design. The dependent variables were the proportion of retrieved and unretrieved items reported, and the choice of seat. There were 33 participants in each condition.

Materials and Procedure

The same materials and procedure as Experiment 5A were used with one exception; the ten positive traits were removed and replaced with ten negative traits (cruel, offensive, mean, impolite, insincere, prejudiced, selfish, rude, heartless and liar). The mean likeability of these negative traits was 70.2 (see Appendix VII).

7.5. Results

7.5.1. Recall Performance

Retrieval practice success rate:

The retrieval practice success rate for neutral traits during the retrieval practice phase was 73.90% ($M = 23.52$, $SE = .76$).

Recall performance:

An analysis of the data revealed the anticipated effect of item type on recall performance, where the proportion of neutral traits recalled correctly when given retrieval practice ($M = .61$, $SE = .03$) was greater as compared to when not given retrieval practice ($M = .35$, $SE = .02$) [$t(64) = 6.796$, $p < .001$, $\eta^2 = .419$], thus once again demonstrating the benefits of retrieval practice on a later recall test.

The mean correct cued-recall proportions (and standard errors) for negative traits as a function of whether the target's neutral traits had or had not been given retrieval practice (i.e. their status as Rp- or Nrp items) on the final recall test are shown in Table 18.

Table 18: Mean correct trait-recall proportions (and standard errors) reported on the final recall test – Experiment 5B

	Mean Recall of Negative Traits
Rp-	0.21 (.03)
Nrp	0.45 (.02)
Difference	-0.24

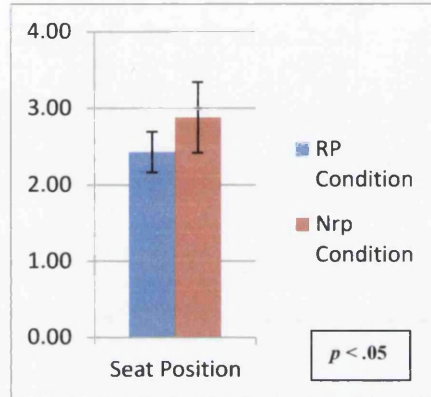
Note: Rp- = unpractised valenced traits from the practised category, Nrp = unpractised valenced traits from the unpractised category, Difference = retrieval-induced forgetting effect.

The data from the above table reveals lower recall of negative traits in the retrieval practice condition as compared to the non-relevant retrieval practice condition. To test if this difference was significant, an independent samples t-test was performed. Findings demonstrate that negative Rp- items ($M = .21$, $SE = .03$) were indeed reported at a lower rate as compared to negative Nrp items ($M = .45$, $SE = .02$) and that this difference reached significance [$t(64) = -6.641$, $p < .001$, $\eta^2 = .408$]. Thus, retrieval-induced forgetting was also detected for negative traits.

Seating position:

Findings demonstrated that participants in the relevant retrieval practice group were found to choose a seat closer to the target's seat ($M = 2.42$, $SE = .11$) than participants in the non-relevant retrieval practice group ($M = 2.88$, $SE = .16$) and this difference also reached significance [$t(64) = -2.348$, $p < .05$, $\eta^2 = .079$], (see Figure 22 below).

Figure 22: Mean position of seat chosen by participants in the relevant retrieval practice condition (Rp) as compared to the non-relevant retrieval practice condition (Nrp) – Experiment 5B



Note: Participants in the Rp condition chose a seat significantly closer to the target's belongings as compared to participants in the Nrp condition.

7.5.2. Impression Ratings

Honesty Ratings:

The mean honesty ratings obtained as a function of (a) whether the associated neutral traits had or had not been given retrieval practice, and (b) the point in the experiment at which they were made (Initial: before the retrieval practice phase, or Final: immediately after the final category-cued recall test) are shown below in Table 19.

Table 19: Means (and standard errors) of honesty ratings in relation to condition (Rp or Nrp) obtained pre and post retrieval practice – Experiment 5B

Condition	Time of Rating	
	Initial	Final
Rp	3.76 (.20)	3.64 (.20)
Nrp	3.67 (.18)	3.73 (.16)

Note: Rp = unpractised valenced traits from the practised category, Nrp = unpractised valenced traits from the unpractised category.

A 2 (Condition: Relevant retrieval Practice and Non-relevant retrieval practice) x 2 (Time of Rating: Initial vs. Final) mixed ANOVA, with time of rating as the within subjects factor, was conducted to check for any significant differences. Results revealed no significant main effects of condition [$F(1, 64) = .000$, *ns*, $\eta^2 = .000$] or of times of honesty ratings [$F(1, 64) = .223$, *ns*, $\eta^2 = .003$]. There was also no significant interaction between condition and time of rating [$F(1, 64) = 2.007$, *ns*, $\eta^2 = .030$].

Likeability Ratings:

The mean likeability ratings obtained as a function of (a) whether the associated neutral traits had or had not been given retrieval practice, and (b) the point in the experiment at which they were made (Initial: before the retrieval practice phase, or Final: immediately after the final category-cued recall test) are shown below in Table 20.

Table 20: Means (and standard errors) of likeability ratings in relation to condition obtained pre and post retrieval practice – Experiment 5B

Condition	Time of Rating	
	Initial	Final
Rp	4.15 (.19)	4.09 (.19)
Nrp	4.27 (.16)	4.24 (.14)

Note: Rp = unpractised valenced traits from the practised category, Nrp = unpractised valenced traits from the unpractised category.

A 2 (Condition: Relevant retrieval Practice and Non-relevant retrieval practice) x 2 (Time of Rating: Initial vs. Final) mixed ANOVA, with time of rating as the within subjects factor, was conducted to check for any significant differences. Results revealed no significant main effects of condition [$F(1, 64) = .332, ns, \eta^2 = .000$] or of times of likeability ratings [$F(1, 64) = .068, ns, \eta^2 = .012$]. There was also no significant interaction between condition and time of rating [$F(1, 64) = .008, ns, \eta^2 = .001$].

Thus, as in the previous experiment, when the behavioural measure was administered immediately after the retrieval practice phase, it can be seen that retrieval practice was found to lead to a reliable behavioural effect, whereby the retrieval-induced forgetting of negative traits led to participants choosing to sit closer to the target as compared to participants who did not demonstrate retrieval-induced forgetting. The data also revealed that the retrieval-induced forgetting of negative traits had no effect on impression ratings of honesty and likeability, as there were no significant main effects of condition or time of rating, nor was there a significant interaction between the factors.

7.6. Discussion of Experiments 5A and 5B

The results of the current two experiments provide support for Storm and colleagues (2005) findings concerning retrieval-induced forgetting of valenced traits and metacognitive judgements. Consistent with Storm and colleagues findings is that significant retrieval-induced forgetting was found for both positive and negative traits in the later cued-recall test. The current findings take these results one step further and provide evidence for a reliable behavioural effect, where forgetting of valenced traits associated with a target individual can directly influence behaviour displayed towards that individual. Specifically, it can be seen that by practising neutral traits, the target's associated positive traits become less available in memory and thus, results in participants choosing a seat further away from the target as compared to participants who did not receive retrieval practice for the target's associated neutral traits (Experiment 5A). In the same way, it can be seen that by practising neutral traits, the target's associated negative traits become less available in memory and thus, results in participants choosing a seat closer to the target as compared to participants who did not receive retrieval practice for the target's associated neutral traits (Experiment 5B).

The current findings are consistent with both the inhibitory (M.C. Anderson et al., 1994) and the context dependent accounts of retrieval-induced forgetting (Perfect et al., 2004). The inhibitory account suggests that the mental representations of the valenced traits are actively suppressed through inhibitory processes and this can be seen even on an intermediate implicit test of memory (i.e. the seating task). The context dependent account suggests that forgetting occurs as a result of the functional overlap in contexts during retrieval practice and test phases. As the cue used during retrieval practice was the target's name, it can be said that both, choosing a seat 'to wait for' the target in the implicit behavioural test and explicitly recalling traits about the target using the same cue (i.e. the target's name) in the final test, contribute to a high degree of similarity in contexts between phases. Participants may have employed the retrieval practice context during the test phases to guide their memory. Another explanation may be put forth in context of the findings by Storm and colleagues (2008), where re-learning or re-exposure led to enhanced retrievability of Rp- items. As the behavioural test was taken immediately after the retrieval practice phase and before the explicit final recall phase, participants

have not been re-exposed to the valenced traits and thus, accelerated re-learning did not occur. In this situation, retrieval-induced forgetting effects are able to manifest themselves on the seating task.

The impression results provide support for Storm and colleagues (2005) findings. Consistent with their findings is the lack of evidence indicating that retrieval-induced forgetting affects judgements of rating, where retrieval-induced forgetting of positive as well as negative traits does not lead to a change in ratings of target's honesty from initial to final times of rating. The only difference between the current findings of honesty ratings and those found by Storm and colleagues was the significant shift in the overall ratings for the positively associated target, where participants in both conditions rated the target as becoming less trustworthy from initial to final times of rating. The current results obtained for the likeability ratings demonstrated that participants in the retrieval practice condition rated the positively associated target as less likeable than participants in the control condition. However, there was no significant shift in likeability ratings, for either of the conditions, from initial to final times of rating. Thus, it can be said that the overall honesty and likeability ratings for both the positively and negatively associated target support the inferential model of metacognitive judgements and 'on-line' processing of information in an impression task, which suggests that impression judgements are not based on our memory content.

7.7. Rationale for Experiments 5C and 5D

The previous two experiments have demonstrated how unintentional inhibition, through the use of the retrieval practice paradigm, can lead to a reliable behavioural shift, where forgetting of positive traits associated with a target individual led participants to maintain more distance from the target as compared to participants for whom retrieval-induced forgetting of positive traits did not occur; as well as where forgetting of negative traits associated with a target individual led participants to maintain a closer proximity to the target individual as compared to participants for whom retrieval-induced forgetting of negative traits did not occur.

On the other hand, as mentioned earlier, research in the area of suppression, also using the same behavioural measure, has found the opposite effect (Macrae et al., 1994). Their work is based on the famous white bear task and is an example of how this kind of thought suppression can be extended to real life materials. In the white bear task, participants are instructed to suppress all thoughts of a white bear for five minutes before being instructed to think of whatever they want, including the white bear. Findings indicated that instructions to suppress thoughts failed and participants tended to think of the white bear even when instructed not to. In addition, in the think freely phase participants thought of the white bear more as compared to when they thought of the white bear first – an effect known as the post-suppression rebound effect (Wegner, Schneider, Carter & White, 1987).

Macrae and colleagues (1994) examined whether stereotypes were susceptible to rebound effects, whereby participants become more biased following suppression. They found that deliberately attempting to suppress stereotypical thoughts of skin heads led to participants composing a more stereotypic story about a skin head, than if they had not tried to suppress the stereotype. They also extended these results to the behavioural domain by using the seating task and their results demonstrated that a behavioural rebound effect did occur, where participants who suppressed the stereotype chose a seat further away from the target than participants who did not suppress the stereotype.

More recent research has also been concerned with whether conscious suppression can lead to impaired performance. Using the think/no-think task (M.C. Anderson & Green, 2001), participants were trained to intentionally suppress some memories while retrieving other memories. Their findings indicated that memory for items suppressed up to sixteen times was found to be recalled more poorly than baseline items that have never been suppressed. This memory suppression effect has also been extended from neutral material (M.C. Anderson & Green, 2001) to include negative material (Depue, Banich & Curran, 2006) as well as finding deficits in suppression of negative material in depression (Joorman, Hertel, Brozovich & Gotlib, 2005). This finding that intentional suppression leads to memory failure was surprising given past research using the white bear task,

which suggested that intentional suppression leads to the suppressed item becoming more, not less, accessible (Wegner et al., 1987).

The above findings, using the think/no-think task, are similar to evidence related to retrieval-induced forgetting, which shows that suppression can have a lasting impact on the accessibility of a memory. In the area of impression formation, Macrae and MacLeod (1999; see also M.D. MacLeod & Macrae, 2001) found that selective retrieval practice led to retrieval-induced forgetting of character traits about a fictitious individual. Extending this work further, Storm and colleagues (2005) examined retrieval-induced forgetting for positive and negative traits about fictitious individuals. They found that selective retrieval of neutral characteristics led to retrieval-induced forgetting for both positive and negative traits regarding another individual.

Thus, the work using the think/no-think and retrieval-induced forgetting paradigms appear to be in opposition to research using the white bear task suggesting an inconsistent picture of whether suppression leads to memory impairment or not. There is, however, an important difference between the paradigms which may provide an explanation for the inconsistent findings. In the white bear task, participants are given only one item to suppress which may make the item distinctive in memory. Conversely, in the think/no-think and retrieval practice paradigms, participants are given multiple items to suppress. Thus, it may be the case that suppression is likely to lead to memory impairment when there are multiple items requiring suppression which may lead the memories to become less distinctive.

Aside from these differences between the paradigms a type of rebound effect following retrieval-induced forgetting has recently been uncovered. Storm and colleagues (2008) examined whether forgotten items became more memorable when undergoing re-learning following retrieval-induced forgetting. Not only did re-learning of items subjected to retrieval-induced forgetting restore recall to that found during re-learning of items never subjected to retrieval-induced forgetting, but it also reversed the effect; that is, items previously subjected to retrieval-induced forgetting were reported at a higher rate following re-learning than that found with items never subjected to retrieval-induced

forgetting. This effect may be comparable to the rebound effect found in thought suppression studies. Specifically, the retrievability of information that has undergone retrieval-induced forgetting may become more retrievable than information never subjected to retrieval-induced forgetting.

Predictions

To examine whether retrieval-induced forgetting can also lead to behavioural rebound the seating task was combined with and administered immediately after the completion of the retrieval practice paradigm used by Storm and colleagues (2005). Participants read neutral and positive traits (Experiment 5C), and neutral and negative traits (Experiment 5D), describing a target individual and then engaged in selective retrieval of the neutral traits only as a means to induce retrieval-induced forgetting for the valenced traits. Then, following a short distracter phase, participants were asked to recall all of the traits concerning the target before being asked to wait outside the laboratory to meet the target. Outside the laboratory were eight seats and participants were requested to sit and wait for the target to return (see Appendix VIII). Thus, if positive traits are subject to retrieval-induced forgetting, then participants may choose to sit closer to the target than participants who do not demonstrate retrieval-induced forgetting. Conversely, if negative traits are subject to retrieval-induced forgetting, then participants may choose to sit further away from the target. In addition to this behavioural measure, impression ratings of the target were also taken to examine the relationship between retrieval-induced forgetting and judgement ratings of the target's honesty, where based on findings in the literature and previous findings in the current thesis, retrieval-induced forgetting of valenced information was not expected to shift the affective rating of the target accordingly from the initial to the final times of rating.

EXPERIMENT 5C – BEHAVIOURAL REBOUND OF POSITIVE TRAITS

7.8. Method

Participants and design:

Seventy undergraduate and postgraduate students (34 male, 36 female; ages ranging from 18 to 34 with a mean age of 22.19) from Swansea University, U.K.; volunteered to participate in the experiment in exchange for course credit or £2. The experiment had a between subjects variable whereby participants either completed relevant retrieval practice (Rp), or non-relevant retrieval practice (Nrp), thus making the design of the experiment a 2 (Condition: Relevant retrieval practice and Non-relevant retrieval practice) x 3 (Practice Status: practised items from the practised category [Rp+], non-practised items from the practised category [Rp-], and non-practised items from the non-practised category [Nrp]) between subjects one. The dependent variables were the proportion of retrieved and unretrieved items reported, and the choice of seat. There were 35 participants in each condition.

Stimulus Materials and Procedure

The materials and procedure used in this study were the same as the ones used in Experiment 5A with a few exceptions in the procedure. Firstly, in the study phase, participants were presented with only the twenty personality traits associated with the target (ten neutral and ten positive), and were not presented the additional category of fruits. Secondly, the behavioural measure was taken immediately after the final recall phase, instead of immediately after the retrieval practice phase, in order to test if the inhibited recall of positive traits was responsible for the participant's choice of seat. Finally, with regards to the impression ratings, the dimension of likeability was removed and participants were asked to rate the target on only the dimension of honesty, as this was the one in question.

7.9. Results

7.9.1. Recall Performance

Retrieval practice success rate:

The retrieval practice success rate for neutral traits during the retrieval practice phase was 70.86% ($M = 7.09$, $SE = .21$).

Recall performance:

An analysis of the data revealed the anticipated effect of item type on recall performance, where the proportion of neutral traits recalled correctly when given relevant retrieval practice ($M = .59, SE = .03$) was greater as compared to when given non-relevant retrieval practice ($M = .36, SE = .03$) [$t(68) = 5.482, p < .001, \eta^2 = .307$], thus demonstrating the benefits of retrieval practice on later recall. The mean correct cued-recall proportions (and standard errors) for positive traits as a function of whether the target's neutral traits had or had not been given retrieval practice (i.e. their status as Rp- or Nrp items) on the final recall test are shown in Table 21.

Table 21: Mean correct trait-recall proportions (and standard errors) reported on the final recall test – Experiment 5C

	Mean Recall of Positive Traits
Rp-	0.31 (.03)
Nrp	0.41 (.03)
Difference	-0.10

Note: Rp- = unpractised valenced traits from the practised categories, Nrp = unpractised valenced traits from the unpractised categories, Difference = retrieval-induced forgetting effect.

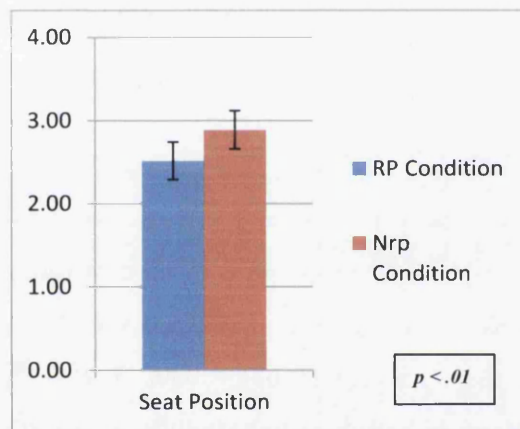
The data from the above table reveals lower recall of positive traits in the relevant retrieval practice condition as compared to the non-relevant retrieval practice condition. To test if this difference was significant, an independent samples t-test was performed. Findings demonstrate that positive Rp- items ($M = .31, SE = .03$) were indeed reported at a lower rate as compared to positive Nrp items ($M = .41, SE = .03$) and that this difference

reached significance [$t(68) = -2.559, p < .05, \eta^2 = .088$]. Thus, retrieval-induced forgetting was detected for positive traits.

Seating position:

Findings demonstrated that participants in the relevant retrieval practice group were found to sit closer to the target's seat ($M = 2.51, SE = .09$) than participants in the non-relevant retrieval practice group ($M = 2.89, SE = .08$) and this difference also reached significance [$t(68) = -3.175, p < .01, \eta^2 = .129$], (see Figure 23 below).

Figure 23: Mean position of seat chosen by participants in the relevant retrieval practice condition (Rp) as compared to the non-relevant retrieval practice condition (Nrp) – Experiment 5C



Note: Participants in the Rp condition chose a seat significantly closer to the target's belongings as compared to participants in the Nrp condition.

7.9.2. Impression Ratings

Honesty Ratings:

The mean honesty ratings obtained as a function of (a) whether the associated neutral traits had or had not been given retrieval practice, and (b) the point in the experiment at which they were made (Initial: before the retrieval practice phase, or Final: immediately after the final category-cued recall test) are shown below in Table 22.

Table 22: Means (and standard errors) of honesty ratings in relation to condition obtained pre and post retrieval practice.

Condition	Time of Rating	
	Initial	Final
Rp	1.91 (.14)	1.83 (.11)
Nrp	1.86 (.12)	1.83 (.12)

Note: *Rp* = unpractised valenced traits from the practised category, *Nrp* = unpractised valenced traits from the unpractised category.

A 2 (Condition: Relevant retrieval Practice and Non-relevant retrieval practice) x 2 (Time of Rating: Initial vs. Final) mixed ANOVA, with time of rating as the within subjects factor, was conducted to check for any significant differences. Results revealed no significant main effects of condition [$F(1, 68) = .030, ns, \eta^2 = .000$] or of time of honesty ratings [$F(1, 68) = .788, ns, \eta^2 = .011$]. There was also no significant interaction between condition and time of rating [$F(1, 68) = 2.007, ns, \eta^2 = .003$].

Thus, from the above findings of the current experiment, it can be seen that retrieval-induced forgetting was found to lead to a behavioural rebound effect, whereby the retrieval-induced forgetting of positive traits led to participants choosing to sit closer to the target than participants who did not demonstrate retrieval-induced forgetting. This occurred despite significant retrieval-induced forgetting occurring for positive traits. Thus, although participants were unable to explicitly report the positive traits they appear to have still had indirect access to them. Findings from the impression ratings, however, demonstrate that retrieval-induced forgetting of positive traits had no effect on

participants' ratings of the target's honesty. Experiment 5D will extend the paradigm from Experiment 5C to examine whether behavioural rebound is found for negative personality traits.

EXPERIMENT 5D – BEHAVIOURAL REBOUND OF NEGATIVE TRAITS

7.10. Method

Participants and design:

Seventy undergraduate and postgraduate students (34 male, 36 female; ages ranging from 18 to 29 with a mean age of 21.17) from Swansea University, U.K.; volunteered to participate in the experiment in exchange for course credit or £2. The experiment had a between subjects variable, whereby participants either completed relevant retrieval practice (Rp), or non-relevant retrieval practice (Nrp), thus making the design of the experiment a 2 (Condition: Relevant retrieval practice and Non-relevant retrieval practice) x 3 (Practice Status: practised items from the practised category [Rp+], non-practised items from the practised category [Rp-], and non-practised items from the non-practised category [Nrp]) between subjects one. The dependent variables were the proportion of retrieved and unretrieved items reported, and the choice of seat. There were 35 participants in each condition.

Materials and Procedure

The same materials and procedure as Experiment 5C were used with one exception. The ten positive traits were removed and replaced with ten negative traits (cruel, offensive, mean, impolite, insincere, prejudiced, selfish, rude, heartless and liar). The mean likeability of these negative traits was 70.2 (see Appendix VII).

7.11. Results

7.11.1. Recall Performance

Retrieval practice success rate:

The retrieval practice success rate for neutral traits during the retrieval practice phase was 66.86% ($M = 6.69$, $SE = 1.39$).

Recall performance:

An analysis of the data revealed the anticipated effect of item type on recall performance, where the proportion of neutral traits recalled correctly when given relevant retrieval practice ($M = .50$, $SE = .03$) was greater as compared to when given non-relevant retrieval practice ($M = .36$, $SE = .03$) [$t(68) = 3.456$, $p = .001$, $\eta^2 = .149$], thus once again demonstrating the benefits of retrieval practice on a later recall test.

The mean correct cued-recall proportions (and standard errors) for negative traits as a function of whether the target's neutral traits had or had not been given retrieval practice (i.e. their status as Rp- or Nrp items) on the final recall test are shown in Table 23 below.

Table 23: Mean correct trait-recall proportions (and standard errors) reported on the final recall test – Experiment 5D

	Mean Recall of Positive Traits
Rp-	0.32 (.02)
Nrp	0.47 (.04)
<i>Difference</i>	<i>-0.15</i>

Note: Rp- = unpractised valenced traits from the practised category, Nrp = unpractised valenced traits from the unpractised category, Difference = retrieval-induced forgetting effect.

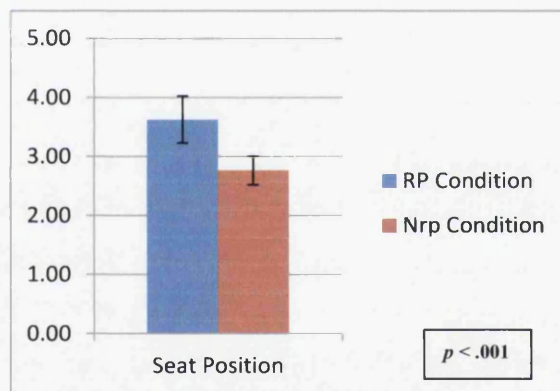
The data from the above table reveals lower recall of negative traits in the relevant retrieval practice condition as compared to the non-relevant retrieval practice condition. To test if this difference was significant, an independent samples t-test was performed. Findings demonstrate that negative Rp- items ($M = .32$, $SE = .02$) were indeed reported at

a lower rate as compared to negative Nrp items ($M = .47$, $SE = .043$) and that this difference reached significance [$t(68) = -3.586$, $p = .001$, $\eta^2 = .159$]. Thus, retrieval-induced forgetting was also detected for negative traits.

Seating position:

Findings demonstrated that participants in the relevant retrieval practice group were found to sit further away from the target's seat ($M = 3.63$, $SE = .11$) than participants in the non-relevant retrieval practice group ($M = 2.77$, $SE = .09$) and this difference also reached significance [$t(68) = 5.993$, $p < .001$, $\eta^2 = .346$], (see Figure 24).

Figure 24: Mean position of seat chosen by participants in the relevant retrieval practice condition (Rp) as compared to the non-relevant retrieval practice condition (Nrp) – Experiment 5D



Note: Participants in the Rp condition chose a seat significantly further away from the target's belongings as compared to participants in the Nrp condition.

7.11.2. Impression Ratings

Honesty Ratings:

The mean honesty ratings obtained as a function of (a) whether the associated neutral traits had or had not been given retrieval practice, and (b) the point in the experiment at which they were made (Initial: before the retrieval practice phase, or Final: immediately after the final category-cued recall test) are shown below in Table 24.

Table 24: Means (and standard errors) of honesty ratings in relation to condition obtained pre and post retrieval practice – Experiment 5D

Condition	Time of Rating	
	Initial	Final
Rp	3.80 (.15)	3.77 (.14)
Nrp	3.74 (.18)	3.94 (.15)

Note: Rp- = unpractised valenced traits from the practised category, Nrp = unpractised valenced traits from the unpractised category.

A 2 (Condition: Relevant retrieval Practice and Non-relevant retrieval practice) x 2 (Time of Rating: Initial vs. Final) mixed ANOVA, with time of rating as the within subjects factor, was conducted to check for any significant differences. Results revealed no significant main effects of condition [$F(1, 68) = .078, ns, \eta^2 = .000$] or of time of honesty ratings [$F(1, 68) = 1.144, ns, \eta^2 = .016$]. There was also no significant interaction between condition and time of rating [$F(1, 68) = 2.034, ns, \eta^2 = .029$].

Thus, as in the previous experiment, it can be seen that retrieval-induced forgetting was found to lead to a behavioural rebound effect, whereby the retrieval-induced forgetting of negative traits led to participants choosing to sit further away from the target than participants who did not demonstrate retrieval-induced forgetting. Thus, as with positive traits, although participants were unable to explicitly report the negative traits they appear to have still had indirect access to the negative traits. Also consistent with the findings from the previous experiment was the failure of retrieval-induced forgetting of valenced traits to influence the affective impression of the target, as there were no significant

effects of condition or time of rating found, nor was there any significant interaction between these two factors.

7.12. Discussion of Experiments 5C and 5D

Previous research has suggested that the intentional suppression of stereotypes can result in that stereotype rebounding both cognitively and behaviourally (Macrae et al., 1994). The two current experiments provide an initial investigation into whether retrieval-induced forgetting can also have a behavioural rebound effect. Although by the very nature of retrieval-induced forgetting the forgotten memories are less retrievable participants' performance on the seating task suggests that this information is still accessible if only on an implicit and indirect level.

Previous research has suggested that information that is not accessible on an explicit memory task can be accessible using implicit memory tasks. For example, E.L. Bjork and Bjork (1996), using the directed forgetting procedure, found that words that could not be produced on an explicit memory task could be produced on an implicit memory task. Likewise, Camp and colleagues (2005) found that retrieval-induced forgetting only occurs on implicit memory tasks when participants realise the connection between the test and study phase thereby making the implicit task an explicit task. On the other hand, Veling and van Knippenberg (2004) demonstrated retrieval-induced forgetting effects using recognition latencies. The current findings appear consistent with Camp and colleagues, where lack of awareness of the link between the explicit and implicit tasks may have resulted in the absence of the retrieval-induced forgetting effect on the implicit measure of memory.

Not only is the valenced information about the target still available indirectly on the seating task but the valenced information appears to become more positive or negative following retrieval-induced forgetting. Specifically, positive traits subject to retrieval-induced forgetting appear to have become more positive with participants choosing to sit closer to the target while negative information subject to retrieval-induced forgetting appears to have become more negative with participants choosing to sit further away from the target. These findings may be likened to the work by Storm and colleagues (2008),

where items that are subject to retrieval-induced forgetting are re-learned to a greater degree than items not subject to retrieval-induced forgetting. This finding suggests that items may have become more retrievable following retrieval-induced forgetting thereby indicating a rebound effect. There is one difference, however, between the rebound effect found by Storm and colleagues and that reported in the current experiments. The rebound effect found by Storm and colleagues related to a greater re-learning as measured by an explicit memory test. In the current experiments no attempt was made to reverse the retrieval-induced forgetting effect, such as through re-learning, and, rather, the effect of retrieval-induced forgetting on rebound was measured through an indirect measure of memory. These findings, therefore, suggest that rebound effects can occur for valenced information through reversing retrieval-induced forgetting or via other indirect measures. One way to test this prediction would be to examine memory for positive and negative traits using implicit memory tests. If retrieval-induced forgetting can cause rebound to occur indirectly then positive and negative Rp- traits should be remembered more than unpractised control items.

The findings of the current experiments are also consistent with the finding that suppressing a stereotype can lead to this negative information rebounding. Macrae and colleagues (1994) found that suppressing negative information such as a stereotype can cause that information to become even more negative resulting in participants choosing to sit further away from the target. The current findings suggest that retrieval-induced forgetting may also lead to rebounding, and extends this rebounding effect to include positive information as well as negative information. That thought suppression and retrieval-induced forgetting can initiate rebound effects is of interest as both thought suppression and retrieval-induced forgetting have typically been seen as being in opposition to one another. For example, the thought suppression paradigm of stereotypes demonstrates that intentional suppression is ineffective (Macrae et al., 1994) while conversely retrieval-induced forgetting has been found lead to successful suppression of stereotypes (Dunn & Spellman, 2003). The current findings suggest that these two paradigms may have something in common; the ability to produce rebound effects.

Although both thought suppression and retrieval-induced forgetting can produce rebound effects with valenced material it is likely that the mechanism underlying each effect is different. The environmental cueing hypothesis (Wegner, 1989) has been put forward as an explanation for thought suppression's ineffectiveness, which suggests that an attempt to suppress an unwanted thought initiates two processes: a controlled distracter search and an unconscious target search. When we attempt to avoid thinking about an unwanted thought the controlled distracter search examines our environment and memory for thoughts to distract ourselves from the unwanted thought. At the same time as we are thinking of distracting thoughts the unconscious target search is searching through our conscious awareness for evidence of the unwanted thought. As the unconscious target search is automatic it always finds evidence of the unwanted thought and we become aware of it. The controlled distracter search is then re-started and we attempt to distract ourselves with another distracting thought but again the unconscious target search finds evidence of the unwanted thought. Eventually, we become surrounded by distracting thoughts that have all become associated with the unwanted thought leading to the unwanted thought to rebound uncontrollably.

Conversely, an inhibitory account of memory has been put forward to explain retrieval-induced forgetting effects. This account suggests that the successful retrieval of target memories is aided by the inhibition of related but unwanted competing items (M.C. Anderson & Spellman, 1995). When we are presented with a cue it activates not just the target memory but other related but ultimately unwanted memories as well. In order to resolve the retrieval competition emanating from the unwanted but related items inhibitory processes are brought to bear on the unwanted items resulting in these items becoming harder to remember for a period of time after the target item has been retrieved. Thus, the inhibitory account suggests that it is the mental representations of Rp- items that are actively suppressed below baseline levels. The current findings suggest, however, that although the mental representations of Rp- items cannot be accessed directly on explicit memory tests, they can be accessed indirectly. Thus, during the seating task, participants are still able to access the implicit representation of the valenced traits allowing them to make their selection on the seating task leading to the rebound effect.

Retrieval-induced forgetting effects have also been explained by non-inhibitory processes such as the interference theory, which assumes that the stored memory is still intact, but competition created by newly acquired material results in the failure of retrieval. Thus, it can also be argued that the current findings might be explained in this manner, where practice of some items (e.g., neutral traits) strengthens the association of those item with the cue (i.e., Mark), thereby making the same cue less effective for other items (e.g., valenced traits) and creating an effect that could be viewed as inhibition. The associative blocking account (Perfect et al., 2004) can also explain these findings, as it suggests that it is the episodic representation of the valenced traits that are blocked and not their conceptual representation. Thus, the conceptual representation of the valenced traits remains accessible and actively guides choice on the seating task. In addition to the above explanations, non-inhibitory theorists could also perhaps correctly argue that output interference played an important role in these studies, as no attempt was made to control for these effects. On the final free recall task, participants may have recalled the stronger practised neutral traits before recalling the unpractised valenced traits. Thus, recency effects due to the later recollection of the target's weaker valenced traits on the final recall test may have affected the participant's choice in the seating task. To test if this is actually the case, additional experimentation needs to be done using item-specific cues during the final recall test or by cuing Rp- items ahead of Rp+ items in the recall test.

A number of other factors could have also contributed to the occurrence of the current findings. On one hand, it could be argued that the rebound effect found may be attributed in some way to the explicit final recall task, which was taken just before the behavioural measure, where the participants' recall somehow altered their judgements regarding the target person on an implicit level. Rebound effects may be found because participants re-exposed themselves to the valenced traits on the recall test prior to the seating task. This finding may be considered as similar to that obtained by Storm and colleagues (2008), who found that re-exposure (through re-learning), led to enhanced recall of Rp- items. In the current experiments, participants may have been re-exposed to the Rp- items that they recalled on the test lead to the increased retrievability of these items. When participants come to make a choice on the seating task, their choice is guided by these highly retrievable items. It could also be said that the mere task of practice, of either neutral

traits or unrelated items of fruit, could have somehow affected participants' choice of seat on the behavioural task or even just the simple passage of time between the study phase and the behavioural task. Once again, in order to test if one of these factors played a role, additional experimentation needs to be conducted introducing a condition that does not complete any final recall task or receive practice of any kind as a baseline category to compare effects. Another avenue for future experimentation lies in the examination of whether these behavioural effects are specific to the object of inhibition by manipulating whether the seat is 'occupied' by an object or another individual.

Finally, the impression ratings of the target as a measure of judgements demonstrated no difference between the first and last measures of honesty. These results are consistent with those found by Storm and colleagues (2005) and with previous findings in this thesis. Thus, despite valenced traits being subject to retrieval-induced forgetting, the reduced retrievability of the valenced traits did not influence honesty ratings. Specifically, the retrieval-induced forgetting of negative traits did not make the target seem more trustworthy and likewise the retrieval-induced forgetting of the positive traits did not make the target appear less trustworthy. Thus, once again, results confirm that we do not make these judgements based on what is available in memory concerning a target and are consistent with the inferential theory of metacognitive judgements (Koriat, 1993) and the anchoring-and-adjustment model in the formation of on-line judgements (Lopes, 1982; Hastie & Park, 1986).

GENERAL DISCUSSION

8.1. Introduction

As social beings, we interact with other people on a daily basis and in the process, almost intuitively, form impressions about them. These impressions, in turn, provide the raw material that help us to understand another person's thoughts, motivations and actions, predict their behaviour and most importantly, influence *our* behaviour towards these individuals in future interactions. It would seem reasonable to attribute the bases of these impressions to memories of previous encounters and experiences. For example, a negative impression formed about a particular individual should be based on the ability to recall past unpleasant memories concerning that individual, and in the same way, a positive impression should be based on the availability of pleasant memories concerning a particular individual.

Basing judgements on content in memory has a rich history in the feeling of knowing literature. Two popular but contrasting theories have been put forth as explanations for the process of forming evaluative judgements – the trace access and the inferential theories of metacognitive judgements. The trace access account of metacognitive judgements suggests that feeling of knowing and tip of the tongue states act as a “storage state indicator” (Hart, 1967, p. 689) which monitors the information available in memory. In other words, metacognitive judgements are based on memories which are explicitly accessible. On the other hand, inference-based accounts suggest that metacognitive judgements are based on inferential processes, whereby cue-related information is used to form a judgement about the likely presence of a target in memory. Inferential accounts, therefore, postulate that we do not directly tap into memory when forming a judgement (e.g., Metcalfe, 1994). In the past, these proposed underlying mechanisms of metacognitive judgements have been widely researched in the area of feeling of knowing

but the question of whether the contents of memory are actively tapped during impression formation remained largely overlooked. What research that has been conducted suggests that metacognitive judgements are not based on the availability of information in memory. For example, Klein, Loftus and Kihlstrom (1996) reported the case study of a young woman who suffered traumatic brain injury and was unable to provide memories of her first year at college; however, she was able to provide intact self trait descriptions. These findings in the metacognitive literature are consistent with findings in the literature on judgement and decision-making, where research into the relationship between memory and social judgements has distinguished between on-line and memory-based judgements. On-line judgements are said to be formed by the continuous integrating and updating of judgements based on the presentation of new information from the external environment; whereas memory-based judgements primarily entail the retrieval of relevant information in memory upon which judgements are later formed (Hastie & Park, 1986). Research has demonstrated that impression judgements, judgements of morality and probability judgements are typically on-line judgements and these judgements are typically evaluated and revised on-line by comparing values of an anchor to new information values as they are encountered (Hastie & Park, 1986; Lopes, 1982; based on the anchoring-and-adjustment model given by Tversky & Kahneman, 1974). Thus, these on-line judgements have been found to have little or no relationship with information in memory as compared to memory-based judgements. The present thesis focussed on judgements of honesty or trustworthiness concerning a target individual and sought to confirm the underlying mechanism influencing these judgement ratings by manipulating the amount of the target's valenced information available in memory through retrieval-induced forgetting.

More recently, research has examined the role of retrieval-induced forgetting in impression formation (M.D. MacLeod & Macrae, 2001; Macrae & MacLeod, 1999; Storm et al., 2005). Retrieval-induced forgetting refers to the unintentional consequence of repeated retrieval of information, whereby irrelevant information that is related to the target information is inhibited in order to reduce competition for retrieval access (M.C. Anderson et al., 1994; M.C. Anderson & Spellman, 1995). In social terms, retrieval-induced forgetting is believed to be an adaptive and flexible process that allows us to function effectively in a constantly changing social world by updating memory through

the goal-directed reduction of unwanted or irrelevant information (R.A. Bjork, 1998; M.D. MacLeod & Macrae, 2001; Macrae & MacLeod, 1999; M.D. MacLeod et al., 2003).

Retrieval-induced forgetting has been found to occur in impression formation whereby newly learned traits about a target individual are susceptible to forgetting (M.D. MacLeod & Macrae, 2001; Macrae & MacLeod, 1999). Retrieval-induced forgetting has also been examined for stereotypic and individuating information. Dunn and Spellman (2003) found that practising stereotypic information suppressed individuating information and that practising individuating information suppressed stereotypic information about a target individual. Thus, retrieval-induced forgetting also occurs for more socially meaningful materials. Macrae and Roseveare (2002) found retrieval-induced forgetting only for information processing relating to others and not for the self, as self-referent processing is believed to be a distinctive process that protects against inhibition. Their findings were extended by Attrill and MacLeod (2004) who examined impression formation for the 'self' and for an 'other' experimental partner. Consistent with previous findings, no forgetting was found in relation to both positive and negative traits for oneself. On the other hand, retrieval-induced forgetting was found only for positive and not negative traits relating to an experimental partner, possibly because negative information is diagnostic about an individual and it may not be adaptive to forget negative information about another individual (Attrill & MacLeod, 2004). More recently, in the examination of whether retrieval-induced forgetting can alter metacognitive judgements of likeability, Storm and colleagues (2005) found significant retrieval-induced forgetting for both positive and negative traits suggesting that the prior retrieval of neutral traits decreased the accessibility of the non-retrieved positive and negative traits. However, no effect of retrieval-induced forgetting was found on the likeability ratings; i.e. targets remained as likeable or dislikeable across the two ratings measures.

The present thesis extends from past research conducted in the field to further examine the relationship between retrieval-induced forgetting of a target's valenced traits and judgements of impressions, specifically impressions of honesty, concerning that target individual. If judgement ratings of honesty are based on information available in memory (i.e. the trace-access account and the availability model in memory-based judgements),

then retrieval-induced forgetting of a target's valenced traits should alter the judgement ratings for the target accordingly; i.e., retrieval-induced forgetting of a target's negative traits should make the target appear more honest and conversely, retrieval-induced forgetting of a target's positive traits should make the target appear less honest. On the other hand, based on Storm and colleagues' findings and previous findings in the literature on memory and impression judgements, no relationship between target information available in memory and later target judgement ratings was predicted in the current thesis.

Experiment 1 demonstrated some support for the previous findings obtained by Storm and colleagues (2005), where significant retrieval-induced forgetting effects occurred on both the initial and final recall tests for positive and negative traits associated with male and female targets. On the other hand, inconsistent with findings by Storm and colleagues, who found a stronger retrieval-induced forgetting effect for negative traits, was the overall increased magnitude of retrieval-induced forgetting effect for positive traits as compared to negative traits in the current findings. With regards to the impression ratings of honesty, results of this experiment were consistent with those found in the literature in that there was no relationship found between retrieval-induced forgetting and judgement ratings of honesty, although retrieval-induced forgetting occurred for both positive and negative traits.

Experiments 2A and 2B sought to examine the adaptive nature of retrieval-induced forgetting, specifically whether negative information is susceptible to retrieval-induced forgetting and also sought to confirm that judgement ratings of honesty concerning honest and dishonest target individuals are not influenced by relevant information available in memory. Results of both Experiments 2A (female targets) and 2B (male targets) demonstrated significant retrieval-induced forgetting effects for both honest and dishonest targets on the initial as well as the final recall tests, with higher recall of associated trait information for dishonest female targets as compared to honesty female targets. Findings from the honesty ratings of these experiments once again confirm the lack of a relationship between memory content and social judgements, where retrieval-induced forgetting of valenced information had no effect on judgement ratings of honesty.

However, there was a significant overall shift in honesty ratings for both male and female honest and dishonest targets, where all targets were rated as becoming less trustworthy from initial to final times of rating irrespective of whether their associated neutral traits had received retrieval practice.

Experiment 3 sought to examine the relationship between retrieval-induced forgetting and judgement ratings of honesty in relation to people in certain professions that should be honest, but were socially perceived as being either honest or dishonest. Findings demonstrated no significant retrieval-induced forgetting effects for positively and negatively associated consistent and inconsistent targets on both initial and final recall tests. The impression results suggested that there was a significant overall shift in honesty ratings towards targets being rated as more trustworthy from initial to final times of rating. Further analyses revealed that the targets whose associated neutral traits had received retrieval practice were rated as becoming more trustworthy from initial to final times of rating; whereas the targets whose associated neutral traits had not received retrieval practice were rated as becoming less trustworthy from initial to final times of rating.

In Experiment 4, an independent probe method was used to measure the presence of inhibitory processes. No significant retrieval-induced forgetting effects were found, indicating the presence of non-inhibitory processes. Impression ratings demonstrated that once again there was no relationship found between memory content and social impression judgements. However, positively associated male and female targets were rated as becoming less trustworthy from initial to final times of rating; whereas the opposite occurred for negatively associated male and female targets (i.e. they were rated as becoming more trustworthy from initial to final times of rating).

Experiments 5A and 5B demonstrated the retrieval-induced forgetting effect for both positive and negative traits associated with a target not only on a recall task, but also on an implicit behavioural measure (i.e. a seating choice task) that was administered immediately after the retrieval practice phase, where retrieval-induced forgetting of positive traits led participants to choose a seat further away from the target's belongings

and retrieval-induced forgetting of negative traits led participants to choose a seat closer to the target's belongings. On the other hand, there was no relationship found between retrieval-induced forgetting of either positive or negative traits and honesty or likeability ratings. However, impression results demonstrate that the positively associated target was rated as becoming less trustworthy from initial to final times of rating, irrespective of whether his neutral traits had been practised or not; and that when the positively associated target's neutral traits had received practice, the target was rated as less likeable as compared to when his neutral traits did not receive retrieval practice. Experiments 5C and 5D were identical to the previous two experiments in terms of the materials and procedure employed, with the exception that they manipulated the position of the recall task by administering it immediately before the behavioural measure was taken and only obtained an honesty measure. Findings replicated the retrieval-induced forgetting effect on the recall tests in both experiments. Results also demonstrated no significant change in honesty ratings of the positively or negatively associated target from initial to final times of rating. On the other hand, results demonstrated a surprising behavioural rebound effect, where retrieval-induced forgetting of positive traits led participants to choose a seat closer to the target's belongings and retrieval-induced forgetting of negative traits led participants to choose a seat further away from the target's belongings.

8.2. Retrieval as a memory modifier

Retrieval as a process plays a very important role in modifying the human memory system by determining what information is available to us in our conscious awareness. It has long been established that successful retrieval of information from long term memory facilitates the probability that the information will be recalled subsequently on a later attempt at retrieval, thus proving itself to be an effective technique for learning (Allen et al., 1969; R.A. Bjork, 1975; Carrier & Pashler, 1992; Morris & Fritz, 2000, 2002; Iglesias-Parro et al., 2009). Furthermore, it has also been demonstrated that the more difficult the initial retrieval attempt is, the greater the probability of subsequent successful recall attempts (Landauer & Bjork, 1978). A second advantage of the retrieval process that has been repeatedly demonstrated over the past two decades is the simultaneous reduction of availability of related but unwanted information in memory (M.C. Anderson et al., 1994; M.C. Anderson & Spellman, 1995). In other words, retrieval of information

from memory not only facilitates recall of that information but also actively inhibits interfering goal-irrelevant information from retrieval and thus plays a critical role in automatically updating and maintaining an efficient and flexible memory system (Saunders, 2003). To many of us, forgetting of information is viewed as an annoying and negative experience; however, in reality, this forgetting at many times, helps us to go about our daily lives with minimum disruption to our ongoing cognitive abilities and in the process, it enables us to adapt cognitively to, and function in, a constantly changing social world (Attrill & MacLeod, 2004, Attrill, 2005; E.L. Bjork & Bjork, 1996; Iglesias-Parro et al., 2009; M.D. MacLeod & Macrae, 2001; M.D. MacLeod et al., 2003; Macrae & MacLeod, 1999).

While retrieval-induced forgetting is also viewed as an adaptive process, it may be viewed as such only in terms of the attainment of our immediate goals and not our future ones (Saunders, 2003). In other words, although retrieval-induced forgetting aids in the successful retrieval of target information by suppressing unwanted competitors, it may also prevent us from attaining the goal of retrieving these previously unwanted competitors at a later time. In terms of the retrieval practice paradigm, retrieval-induced forgetting suppresses Rp- items in order to promote the goal of successful retrieval of Rp+ items during the retrieval practice phase, but it does not satisfy the future goal of retrieving all items during the final recall phase (Saunders, 2003). This negative consequence of retrieval-induced forgetting has been extended to various social situations such as interpersonal perceptions (Attrill & MacLeod, 2004; M.D. MacLeod & Macrae, 2001; Macrae & MacLeod, 1999; Macrae & Roseveare, 2002; Storm et al., 2005), maintenance of stereotypical information (Dunn & Spellman, 2003; Garcia-Bajos & Migueles, 2009; Quinn et al., 2004), modification of autobiographical memories through the process of social sharing (Coman et al., 2009) and the reporting of an eye witnessed event (M.D. MacLeod, 2002; M.D. MacLeod & Saunders, 2006, 2008; Migueles & Garcia-Bajos, 2007; Saunders et al., 2009; Saunders & MacLeod, 2002; Shaw et al., 1995). The present thesis adds to this literature by demonstrating that the retrieval-induced forgetting not only occurs for trait information on a final recall test, but can also be manifested behaviourally depending on factors such as the passage of time since retrieval practice and the position of the recall test, where retrieval-induced forgetting

effects have been demonstrated behaviourally immediately after retrieval practice and before the administration of the recall test.

8.3. Output Interference at Final Recall

The phenomenon of output interference could be viewed as an operating factor in the production of retrieval-induced forgetting effects, as it can influence what information is retrieved and what information remains unavailable for recollection (Saunders, 2003). However, this occurrence is not related to the selective retrieval practice phase and takes place only during the final recall stage. Since output interference refers to the phenomenon where recollection of the first items on a recall test interferes with the subsequent recall of related items (Roediger & Schmidt, 1980; Tulving & Arbuckle, 1963), prior retrieval practice of the neutral traits associated with a target could have led the participants to recall these traits first on the subsequent free recall test, which could then have resulted in the forgetting of the target's associated valenced traits due to interference. Thus, in order to determine if the retrieval-induced forgetting effects demonstrated in the present studies could be attributed to output interference effects, additional analyses of the data obtained in the free-recall phases were conducted using the method proposed by Macrae and MacLeod (1999) as well as scatter plots and simple linear regression analyses.

Using the method proposed by Macrae and MacLeod (1999), if output interference, indeed, played a role in the retrieval-induced forgetting effects found, then only participants who recalled the target's neutral traits first should demonstrate this effect and not participants who initially recalled the target's associated valenced traits. The present findings demonstrate that in both the initial and the final recall tests, the early recall Rp+ group (i.e. participants who initially retrieved the target's neutral traits) actually produced equal or smaller inhibitory effects as compared to the early Rp- groups (i.e. participants who initially retrieved the target's valenced traits) for both positive and negative traits associated with a male or female target (Experiment 1), honest or dishonest target (Experiments 2A and 2B) and consistent and inconsistent target professionals (Experiment 3). These results are consistent with the findings obtained by Macrae and MacLeod (1999) and thus, provide evidence against non-inhibitory processes, such as

output interference, as an explanation of the retrieval-induced forgetting effect for valenced traits that occurs in the above findings. Bäuml (1998) also demonstrated that prior retrieval of moderately strong exemplars in an output interference paradigm suppressed recall for strong but not weak exemplars, which suggests that inhibitory processes may not only be elicited during the retrieval practice phase, but may also be in operation during the final recall phase (Saunders, 2003).

On the other hand, it could be argued that the method proposed by Macrae and MacLeod (1999) to test for output interference effects may be inappropriate, as it uses a median split to divide inhibition scores into two groups (i.e. early Rp+ and early Rp- groups). Thus, in order to avoid the loss of any data in the analyses of output interference effects, scatter plot analyses and subsequent simple linear regression analyses were employed to examine the effects of output interference on inhibition scores in the free-recall tests obtained in the current thesis. Findings demonstrate some support for output interference as significantly predicting inhibition scores for positively and negatively associated targets on the initial recall test (Experiment 1), for negatively associated honest female targets on the final recall test (Experiment 2A), for negatively associated dishonest male targets on the initial test and negatively associated honest male targets on the final test (Experiment 2B), as well as for consistent targets on the final test (Experiment 3). Thus, there is some evidence for non-inhibitory processes, such as output interference, as underlying retrieval-induced forgetting effects in the above experiments. The remainder of the results were in line with findings using the method proposed by Macrae and MacLeod (1999). As previously noted in the empirical chapters, it is important to point out that even though this evidence reached significance for some of the findings reported above, the actual proportion of variance in inhibition scores that can be accounted for by output interference in most conditions was quite small (i.e. Experiment 1 – positive target: 12% and negative targets: 13%; Experiment 2A – honest targets: 11.5%; Experiment 2B – dishonest targets: 7.3%; Experiment 3 – consistent targets: 9.7%). Experiment 2B (male honest and dishonest targets), on the other hand, demonstrated that output interference significantly predicted 19.8% of inhibition scores on the final recall test, which is quite large as compared to other effects.

Thus, taking the above findings into consideration, it can be said that there is mixed evidence for output interference as an explanation for the retrieval-induced forgetting effects found in the current thesis, where results using the method proposed by Macrae and MacLeod (1999) demonstrate considerable support for inhibition as underlying the retrieval-induced forgetting effects seen and other results using simple linear regression analyses provide mixed support for the same. From this difference, it may be implied that the method proposed by Macrae and MacLeod may not be an appropriate test for determining the effects of output interference in free-recall tests.

8.4. Forgetting of valenced material

In the area of person memory and in terms of valenced information regarding target individuals, retrieval-induced forgetting was first found to occur for positive information associated with two fictitious target individuals (Macrae & MacLeod, 1999; M.D. MacLeod & Macrae, 2001). Storm and colleagues (2005) later extended this finding to include negative trait information and behaviours concerning target individuals, and suggested that it is these traits that are particularly vulnerable to retrieval-induced forgetting. As their findings demonstrated that the Nrp recall of negative traits concerning female targets was the highest it suggested that negative Rp- traits were the strongest traits and susceptible to retrieval-induced forgetting thereby supporting the negativity bias and inhibitory accounts of retrieval-induced forgetting. The current findings from chapters 3 (Experiment 1), 4 (Experiments 2A and 2B) and 7 (Experiments 5A, 5B, 5C and 5D) are all consistent with the findings of Storm and colleagues for retrieval-induced forgetting of valenced information, as they demonstrate the presence of significant retrieval-induced forgetting of the target's associated unpractised positive and negative information when the target's neutral traits were given retrieval practice. The present findings contribute to the literature in the field by demonstrating that forgetting of valenced information not only occurs irrespective of whether the target is perceived as honest or dishonest (Experiments 2A and 2B), but that this forgetting can be manifested behaviourally as well, where retrieval-induced forgetting of positive traits led participants to choose a seat further away from the target's belonging (Experiment 5A) and the retrieval-induced forgetting of negative traits led participants to choose a seat closer to the target's belongings (Experiment 5B).

On the other hand, the findings from Experiment 2A and 2B are not compatible with the findings of Attrill and MacLeod (2004), who proposed that retrieval-induced forgetting is an adaptive mechanism that remains absent for self-referent traits due to integration effects and for other-referent traits when participants expect future interaction with these other target individuals, as this information may be diagnostic concerning those individuals (Attrill & MacLeod, 2004). Attrill and MacLeod demonstrated that participants who were led to believe that they would be required to interact with their study partners again in the future failed to display retrieval-induced forgetting for positive other-referent traits, thus providing further evidence for the adaptive nature of retrieval-induced forgetting. Similar to the condition where participants were given explicit instructions to expect future interaction in Attrill and MacLeod's study, in Experiments 1, 2A and 2B, all participants were explicitly informed that they may have to interact with some of the target individuals after the study; yet results from these experiments provide evidence of retrieval-induced forgetting for not only positive information, but also negative information regarding other honest and dishonest target individuals. Thus, it can be seen that retrieval-induced forgetting can occur for both positive and negative information regarding other target individuals, irrespective of whether it may be adaptive or not to do so.

8.5. Competing theories

In the present thesis, five main experiments are presented which examine the roles that target gender, valence of traits and perceived trustworthiness play in modulating the retrieval-induced forgetting effect. Across several experiments presented in this thesis, variable evidence for the retrieval-induced forgetting of valenced traits was found. In Experiment 1, retrieval-induced forgetting was found for both positively and negatively associated male and female targets in the initial and final recall tests. In Experiments 2A and 2B, retrieval-induced forgetting was found for honest and dishonest female and male targets that were associated with negative traits in both the initial and final recall tests. In Experiment 3, no retrieval-induced forgetting effects were found for consistent or inconsistent targets associated with either positive or negative traits in both the initial and final recall tests. Experiment 4, which used an independent probe method, also found an absence of the retrieval-induced forgetting effect for both positively and negatively

associated male and female targets. Experiments 5A and 5C once again demonstrated retrieval-induced forgetting for positive traits and Experiments 5B and 5D demonstrated retrieval-induced forgetting for negative traits as well.

Adaptive account

Mixed evidence was found for the adaptive account of retrieval-induced forgetting (Attrill & MacLeod, 2004). Although the underlying mechanism of this account is unclear, this account predicts that retrieval-induced forgetting would fail to emerge in conditions whereby it would be unadaptive to forget traits about other individuals, specifically, negative traits about targets, and particularly negative traits about dishonest or untrustworthy individuals. Positive traits, on the other hand according to this account, are predicted to be susceptible to retrieval-induced forgetting as positive traits are not diagnostic of possible future negative or threatening experiences. Consistent with the adaptive account is the failure to find a retrieval-induced forgetting effect for negatively associated consistent and inconsistent target professionals in the initial and final recall tests (Experiment 3) and for negatively associated male and female targets using an independent probe method (Experiment 4). The facilitation of recall for negative traits concerning male targets in Experiment 4 provides further support for the adaptive account of retrieval-induced forgetting. Also consistent with the adaptive account is the presence of the retrieval-induced forgetting effect for positive traits associated with both male and female targets in the initial and final recall tests (Experiment 1), for a hypothetical positively associated male target (Experiments 5A and 5C), as well as for positive traits associated with honest and dishonest female (Experiment 2A) and male (Experiment 2B) targets.

Some findings, however, are inconsistent with the adaptive account. In Experiment 1, significant retrieval-induced forgetting effects were found for negative traits associated with both male and female targets in the initial and final recall test, despite negative traits being an indicator of possible future negative experiences. In Experiment 4, no retrieval-induced forgetting was seen for positive traits associated with both male and female targets. In fact, facilitation in the recall for positive trait information was found relative to the baseline measure. It could be argued that trustworthiness of the target influences the

occurrence of the retrieval-induced forgetting effect and that it may be adaptive not to forget any trait information regarding dishonest or untrustworthy individuals, irrespective of whether it is positive or negative trait information. However, compelling evidence against this proposition can be seen in Experiments 2A and 2B, where there were significant retrieval-induced forgetting effects found for negative traits associated with both female and male dishonest target individuals. Furthermore, there was no retrieval-induced forgetting found for positively associated honest and dishonest target professionals (Experiment 3). Significant retrieval-induced forgetting effects are also replicated in Experiments 5B and 5D for a negatively associated hypothetical target. While it could be argued that all negative traits should be immune to retrieval-induced forgetting, irrespective of trustworthiness, the adaptive account cannot explain the failure to find retrieval-induced forgetting for positive traits concerning trustworthy professionals, as these traits should have been vulnerable.

Negativity bias

The negativity bias refers to the tendency for people, when forming impressions, to attribute greater weight to negative behaviours and character traits than to positive behaviours and character traits, as this kind of information is particularly diagnostic of an individual's moral traits and behaviours (Skowronski & Carlston, 1987, 1989). Thus, research in the area of impression formation has demonstrated the presence of a negativity bias in the perception of impression formation (Fiske, 1980; Rozin & Royzman, 2001; Storm et al., 2005). In terms of retrieval-induced forgetting, the pattern suppression account (M.C. Anderson et al., 1994; M.C. Anderson & Spellman, 1995) proposes that negative traits may be most susceptible to this forgetting effect, as negative traits, being diagnostic information about another individual, may be suggested as stronger than positive ones and hence, be subject to greater inhibition. The present findings demonstrate mixed evidence for the negativity bias account in the retrieval practice paradigm. Consistent with this account was the finding that the largest retrieval-induced forgetting effect occurred for negative traits about male target individuals in the final recall test (Experiment 1). In addition, there were significant retrieval-induced effects found for negatively associated male and female targets in the initial recall test (Experiment 1). Also consistent with the negativity bias account is the strong presence of

retrieval-induced forgetting for negative traits concerning both honest and dishonest male and female targets (Experiments 2A and 2B). Furthermore, as this account predicted, the strongest retrieval-induced forgetting effects were found for female dishonest targets on both the initial and final recall tests, suggesting that these traits benefited from a negativity bias which made them stronger and thus, more vulnerable to inhibition (Experiment 2A). In Experiments 5B and 5D, findings also demonstrated significant retrieval-induced forgetting effects for the negatively associated hypothetical male target.

Inconsistent with the negativity bias account was the finding that the smallest amount of retrieval-induced forgetting occurred for negative traits concerning female targets in the final recall test (Experiment 1) and this finding was also inconsistent with the findings from Storm and colleagues (2005) who found evidence of the highest retrieval-induced forgetting effect for negative female behaviours. Of most surprise was the failure to find retrieval-induced forgetting for negative traits concerning dishonest target professionals in both the initial and final recall test (Experiment 3), which presumably should produce the most negative traits; that is, negative traits about dishonest targets could be interpreted as more negative than the same negative traits about honest targets. No retrieval-induced forgetting effects were also found for negatively associated honest targets in both the initial and final recall tests (Experiment 3). In Experiment 4, which employed an independent probe method, an absence of the retrieval-induced forgetting effect was found for both male and female targets that were associated with negative traits. These results indicating an absence of the effect for the supposedly stronger negative traits may suggest that negativity does not necessarily convey strength.

Inhibitory theories

The inhibitory account of retrieval-induced forgetting suggests that only strong competitors should be vulnerable to retrieval-induced forgetting as it is strong competitors which compete for retrieval and disrupt the retrieval process (M.C. Anderson et al., 1994). The findings of the first two experiments are consistent with the inhibitory account, where retrieval-induced forgetting effects for positive and negative traits associated with male and female targets in the initial and final recall tests (Experiment 1), and for female and male honest and dishonest targets in both the initial and final recall

tests (Experiments 2A and 2B) suggest that the valenced traits were competitive during retrieval practice. Valenced traits may have created competition for retrieval with the practised associated neutral traits resulting in their suppression. However, results of the Experiment 1 show the lowest recall for Nrp negative traits associated with female targets ($M = .29$), which suggests that these female negative traits may not have been strong enough to compete for retrieval and in turn not strong enough to initiate strong retrieval-induced forgetting effects as compared to the other Nrp items. Results from the additional analyses using the method proposed by Macrae and MacLeod (1999) conducted in Experiments 1, 2A, 2B and 3, in order to test if non-inhibitory processes may underlie the produced retrieval-induced effects demonstrated that the retrieval-induced forgetting effect occurred to a greater extent in the early Rp- group as compared to the early Rp+ group. These findings were confirmed by results obtained using scatter plots and simple linear regression analyses for positively and negatively associated male and female targets in the final recall test (Experiment 1), for honest and dishonest female targets on the initial recall test and dishonest female targets on the final recall test (Experiment 2A), for honest male targets on the initial tests and dishonest male targets on the final test (Experiment 2B), as well as for consistent and inconsistent targets on the initial recall test and inconsistent targets on the final recall test (Experiment 3). These findings, thus once again, demonstrate that inhibitory processes may form the basis of the retrieval-induced forgetting of valenced traits that occurred. The findings of Experiments 5A, 5B, 5C and 5D provide additional support for the inhibitory account of retrieval-induced forgetting as they once again demonstrate the typical forgetting effect for both positive and negative traits.

The findings described above can also be explained by Saunders and MacLeod's (2006) associative model of retrieval inhibition, which postulates that inhibition occurs at the level of the category instead of the level of the item. Their associative control of spreading activation model proposes that an inhibitory mechanism reduces interference from non-target memories by limiting the spread of activation to and from those items. In the context of the current experiments, repeated practice for the practiced category of neutral traits increases the association strength of those items both to the category cue and to one another, while simultaneously decreasing the strength of associations between the

unpracticed category of valenced items and the shared cue, as well as between the valenced items themselves (Attrill, 2005). Unwanted valenced items were, thus, controlled by limiting their activation so they create less interference, and in turn, do not reach the threshold for retrieval (see also Oram & MacLeod, 2001).

Some findings from the current thesis provide evidence against both the inhibitory and control of spreading activation accounts of retrieval-induced forgetting. No significant retrieval-induced forgetting effects were found for either positively or negatively associated consistent and inconsistent target professionals (Experiment 3) using the retrieval practice paradigm. In addition, results from the additional analyses using scatter plots and simple linear regression analyses demonstrated that output interference significantly predicted inhibition for positively (12%) and negatively (13%) associated targets on the initial recall test (Experiment 1), for honest female targets (11.5%) on the final recall test (Experiment 2A), for dishonest male targets (7.3%) on the initial recall test and for honest male targets (19.8%) on the final recall test (Experiment 2B), and for consistent targets (9.7%) on the final test (Experiment 3), thereby providing some support for non-inhibitory processes, such as output interference, as underlying any inhibition effects that occurred in those groups. The findings of Experiment 4 are also inconsistent with an inhibitory account of retrieval-induced forgetting in impression formation. When independent cues were used during final recall no retrieval-induced forgetting was found for valenced traits for both male and female targets. This suggests that the valenced traits were not being actively suppressed but rather were subject to non-inhibitory processes. These findings also cannot be explained by the control of spreading activation model as this model predicts that the practiced neutral traits should not suffer in recall performance when novel independent cues are used due to the fact that participants also employ episodically defined cues at test, which will result in better recall for the practiced neutral items relative to unpracticed valenced items. The connection strengths of Nrp items to their category cue should remain similar to that established during the initial study phase, as the absence of retrieval practice for items in that category implies no partial activation of these items.

Non-inhibitory theories

Unlike inhibition, which is presumed to be an active process that involves executive control over the activation of memory traces, non-inhibitory models such as interference, postulate a passive process where changes in relative associative strengths between memory traces are sufficient to decrease the likelihood that a certain memory trace is retrieved. As Experiments 1 – 3 and 5 in the present thesis were not designed to test the nature of the underlying processes of retrieval-induced forgetting, the significant forgetting effects in Experiments 1, 2, and 4 can also be explained by non-inhibitory theories, where forgetting can be a result of blocking (i.e. strengthening of a memory trace blocks retrieval of a competing trace), resource diffusion (i.e. strengthening the cue-target activation simultaneously decreases the amount of activation of the cue-competitor due to limited amount of activation) or associative decrement (i.e. strengthening of the cue-target association weakens the cue-competitor association due to reduction in the cue's capacity to activate the competitor). Another theory that can account for the current findings is the context dependent account (Perfect et al., 2004) which suggests that during Experiments 1, 2A, 2B, 3 and 4, the context at retrieval practice was reinstated during final recall. As the target's name and picture were used during retrieval practice and final test it suggests an overlap in the contexts. This reinstatement of the retrieval practice context during the final test would then guide memory. As the retrieval practice context guided participants away from retrieving the Rp- items this would lead to poorer recall of these items at final test. The strategy disruption account (Dodd et al., 2006) also provides an alternative explanation for the retrieval-induced forgetting effect observed in the current experiments. This account states that selective retrieval of the practiced neutral traits during the retrieval practice phase disrupted the original serial organisation of neutral-valenced traits for each target resulting in the impairment of the unpracticed valenced traits. As no selective practice of items is present for Nrp categories, no strategy disruption takes place and participants are easily able to recall most items from that category. According to this account, the lack of retrieval-induced forgetting observed in Experiment 3 can be attributed to the restoration of the individual's strategy during time, rather than to inhibitory processes.

Evidence to support non-inhibitory processes can be seen in findings from the additional analyses using scatter plots and simple linear regression analyses in Experiments 1 – 3. Results demonstrated that output interference significantly predicted inhibition for positively and negatively associated targets on the initial recall test (Experiment 1), for honest female targets on the final recall test (Experiment 2A), for dishonest male targets on the initial recall test and for honest male targets on the final recall test (Experiment 2B), and for consistent targets on the final test (Experiment 3), thereby providing some support for non-inhibitory processes, such as output interference, as underlying any inhibition effects that occurred in those groups.

Compelling evidence for the non-inhibitory explanations of retrieval-induced forgetting was found in Experiment 4 that employed word fragments as independent final recall probes to test the underlying processes of the retrieval-induced forgetting effect. A crucial difference between the inhibitory and the non-inhibitory views concerns cue-dependent and cue-independent forgetting. Inhibition theorists suggest that the memorial traces themselves of the unwanted competing items are inhibited and therefore, these items should not be recalled despite the use of an alternative cue at test. Interference theorists, on the other hand, suggest that forgetting is cue-dependent, where strengthening of the association between the cue and the unwanted competitor results in reduced accessibility of the item only with that cue and that forgetting should be overcome with the use of another cue at test. Findings from Experiment 4 indicate not only an absence of the retrieval-induced forgetting effect with the use of novel cues at test, but also demonstrate significant facilitation effects for negative and positive traits concerning male targets and for negative traits concerning female targets.

These findings are also consistent with the context dependent account (Perfect et al., 2004), which suggests that the suppression of Rp- items occurs as a result of a match between the contexts at retrieval practice and the final test phase. Given that the contexts did not match in the current experiment as the target's name and picture that were used during retrieval practice were substituted with word fragments in the absence of the target's name and picture during final recall, it suggests that context is an important factor

in modulating the retrieval-induced forgetting effect in impression formation; that is, when the contexts do not match no retrieval-induced forgetting is found.

8.6. Behavioural or implicit tests of retrieval-induced forgetting

Experiments 5A, 5B, 5C and 5D provide an initial investigation into whether retrieval-induced forgetting can also have a behavioural effect. In Experiments 5A and 5B when the recall task appeared after the seating task the retrieval-induced forgetting of valenced traits led to retrieval-induced forgetting effects on the seating task with participants who suppress positive traits choosing to sit further away from the target and participants who suppress negative traits choosing to sit closer to the target. This suggests that although by the very nature of retrieval-induced forgetting the forgotten memories are less retrievable, participants' performance on the seating task suggests that this information is still accessible if only on an implicit and indirect level. On the other hand, previous research has suggested that the intentional suppression of stereotypes can result in that stereotype rebounding both cognitively and behaviourally (Macrae et al., 1994). In Experiments 5C and 5D when the recall task appeared before the seating task retrieval-induced forgetting of valenced traits led to a behavioural rebound effect with participants who suppressed positive traits choosing to sit closer to the target and participants who suppressed negative traits choosing to sit further away from the target. Not only is the valenced information about the target still available indirectly on the seating task but in Experiments 5C and 5D the valenced information appears to become more positive or negative following retrieval-induced forgetting.

Experiments 5A - 5D do not test between inhibitory and non-inhibitory accounts of retrieval-induced forgetting. The inhibitory and associate blocking accounts, however, may be most likely to explain the current findings. The inhibitory account suggests that the mental representations of the valenced traits are actively suppressed through inhibitory processes and this can be seen even on an intermediate implicit test of memory (i.e. the seating task, Experiments 5A and 5B). The findings of Experiments 5C and 5D suggest that during the seating task, participants are still able to access the implicit representation of the valenced traits allowing them to make their selection on the seating task leading to the rebound effect. The associate blocking account (Perfect et al., 2004)

can also explain the current findings. In Experiments 5A and 5B, it can be said that both, choosing a seat 'to wait for' the target in the implicit behavioural test and explicitly recalling traits about the target using the same cue (i.e. the target's name) in the final test contribute to a high degree of similarity in contexts between phases and thus, the use of the retrieval practice context by participants during the test phases could have resulted in a consistent behavioural forgetting effect. This account can also explain the results of Experiments 5C and 5D, as this account suggests that it is the episodic representation of the valenced traits which are blocked rather than a conceptual representation. Thus, while the valenced traits in these experiments may remain inaccessible, their conceptual representation remains active and guides choice on the seating task. The current findings could also be attributed to output interference effects, where the initial recall of the stronger practiced neutral traits could have interfered with the later recall output of the weaker unpracticed valenced traits on the final recall test. In the same manner, the behavioural pattern of results on the seating task could be attributed to cue-target association strength in Experiments 5A and 5B, while the behavioural rebound effects exhibited in Experiments 5C and 5D could reflect recency effects of the later recalled valenced traits. In order to test this theory, additional experimentation, which either employs independent or item-specific cues at final test or which cues initial recall of Rp- items prior to Rp+ items, is required.

The question remains why rebound effects occur when the recall test appears before the seating task and why retrieval-induced forgetting effects occur on the seating task when it is administered before the recall task. Rebound effects may be found because participants re-expose themselves to the valenced traits on the recall test prior to the seating task (Experiments 5C and 5D). Storm and colleagues (2008) found that re-exposure through re-learning led to enhanced recall of Rp- items. A similar effect could be occurring in Experiments 5C and 5D when the recall test appears prior to the seating task. Participants may be re-exposed to the Rp- valenced items that they recall on the test leading to the retrievability of these items increasing. When participants come to make a choice on the seating task their choice is guided by highly retrievable valenced items. These findings, therefore, suggest that rebound effects can occur for valenced information through reversing retrieval-induced forgetting or via other indirect measures. Future

experimentation could test this prediction by examining memory for positive and negative traits using implicit memory tests. If retrieval-induced forgetting can cause rebound to occur indirectly then positive and negative Rp- traits should be remembered more than unpracticed control items on implicit tests. Conversely, when the recall test appears after the seating task (Experiments 5A and 5B) participants have not been re-exposed to the valenced traits and accelerated relearning does not occur. In these circumstances the retrieval-induced forgetting effect is able to manifest itself on the seating task. It could also be argued that these findings could be attributed in some way to other factors such as the recall task or the retrieval practice task or simply as even just due to the passage of time between the study phase and the behavioural task. However, in order to test if one of these factors influenced the current pattern of results, additional experimentation needs to be conducted introducing a condition that does not complete any final recall task or receive practice of any kind as a baseline category to compare effects.

8.7. Judgements in Impression Formation

In the present thesis, the underlying processes of how we form judgements of honesty regarding a target individual was examined based on theoretical models in the literature on metacognitive judgements (i.e. the trace access and the inferential models) as well as in the literature on the memory-judgement relationship (i.e. on-line vs. memory-based processing of judgements). The trace access account suggests that metacognitive judgements are made based on direct access to memories (Hart, 1967). Direct access proposes the presence of a specialised mechanism – ‘a storage status indicator’ – which detects the target in memory. Feeling of knowing judgements are, therefore, based on direct access to the memorial representation. If this logic were to hold true for impression judgements of honesty concerning a target individual, then the manipulation of what is recallable about the target individual should accordingly alter the honesty impression of that individual. Conversely, Koriat (1993, 1997) has argued against direct access models and has suggested that metacognitive judgements reflect inferential processes or rule of thumb judgements that judge accessibility but not availability. In other words, cue related information is used to form a judgement about the presence of a target in memory and, therefore, our memory is not directly tapped into when forming a judgement. Thus, if these theories hold true for the formation of impression judgements of honesty regarding

an individual, then the availability of the target's valenced information in memory should have no effect on ratings of honesty concerning that individual.

Research in the area of the relationship between memory and social judgements postulate the presence of a 'judgement-operator' that serves to evaluate information and generate a conclusion on which judgement is based (Hastie & Park, 1986). Five information processing models have been identified in the literature: the *independence model*, which assumes no relationship between memory processes and judgements; the *availability model*, which assumes that availability of information in memory is directly related to the final judgement; the *biased retrieval model*, which assumes that an initial judgement is formed at the time of encoding and that this judgement later biases retrieval of judgement-consistent information from memory on a later recall test; the *biased encoding model*, which assumes that the initial judgement formed at the time of encoding biases or filters subsequent judgement-consistent information into memory; and the *incongruity-biased encoding model*, which assumes that the initial judgement formed at the time of encoding influences processing of later information, where judgement-inconsistent information receives 'special processing' (that enhances its associative links in memory) and thus, is reported at a higher rate as compared to judgement-consistent information on a final recall test (Hastie & Park, 1986). Hastie and Park (1986) proposed that the source of input into the judgement operator may be the key to identifying which of the information processing models described above may be at work when a judgement is called for. They distinguished between memory-based and on-line judgement tasks as sources of input into the judgement operator. *Memory-based judgement tasks* require information to be first retrieved from memory so that the judgement operator can use this information to arrive at a final judgement. *On-line judgement tasks* require the judgement operator to make a final judgement by constantly integrating and updating the judgements based on new information presented from the external environment. Thus, memory-based judgements assume a direct memory-judgement relationship and can be accounted for by the availability model; whereas on-line judgements assume an indirect memory-judgement relationship and can be explained by one or more of the other four theoretical models described above. Subsequent research has demonstrated that on-line judgements are more common with an impression formation goal, lead to evaluation of the target

spontaneously, are recalled quicker, have stronger primacy effects in recall and are not very related to explicit recall from memory as compared to memory-based judgements and have suggested that the underlying mechanism of on-line processing is one of anchoring-and adjustments (as given by Lopes, 1982), where judgements are evaluated and revised on-line by comparing values of the anchor to the new information values encoded (Tversky & Kahneman, 1974; Lopes, 1982; Hastie & Park, 1986, Lopes, 1987).

Based on previous research on memory-based vs. on-line judgements and research conducted by Storm and colleagues (2005) in the area of retrieval-induced forgetting and social metacognitive judgements, the current research predicted that altering the amount of target information available in memory via retrieval-induced forgetting would not influence subsequent judgements accordingly, as the experimental instructions included impression goals to be made of the targets in all five experiments. The findings from all the current experiments confirmed this prediction as retrieval-induced forgetting did not influence subsequent judgements of honesty; that is, retrieval-induced forgetting of positive traits did not make the target appear less honest, and retrieval-induced forgetting of negative traits did not make the target appear more honest. Results of Experiments 1, 2A, 2B and 5A demonstrated that there was a significant overall shift in impression ratings of honesty towards the targets (i.e. male and female, honest and dishonest) being rated as less trustworthy from initial to final times of rating, irrespective of whether their neutral traits had received retrieval practice or not. Results of Experiment 3 demonstrated the opposite trend, where there was an overall shift towards the consistent and inconsistent target professionals being rated as more trustworthy from initial to final times of rating although retrieval practice of the target's neutral traits was not accompanied by the expected retrieval-induced forgetting effect of the target's valenced traits on the final recall test. These results provide evidence against the direct access account of metacognitive judgements and support the inferential model of metacognitive judgements as well as on-line processing of information in impression tasks. Results of Experiment 4 demonstrated that although there was an absence of the retrieval-induced forgetting effect of both negatively and positively associated male and female targets, retrieval practice of the target's neutral traits did influence honesty judgements differentially, where male targets whose neutral traits had received practice were rated as more trustworthy than

male targets whose neutral traits had not received practice; whereas female targets whose neutral traits had received practice were rated as less honest than female targets whose neutral traits had not received practice.

These findings are consistent with Storm and colleagues' failure to find a change in likeability despite the presence of retrieval-induced forgetting for valenced traits (Storm et al., 2005). It can also be said that these results do not provide support for the direct access model of metacognitive judgements, which state that impressions are based on direct access to information about the target in memory. However, they may be consistent with the inferential account of metacognitive judgements that are based on likelihood of accessibility and not on availability of information in memory (Koriat, 1993, 1997). These results are also consistent with research on on-line judgements, where an impression formation task leads participants to revise their judgements on-line as information is encoded in memory and refer to this initial judgement when a later one is called for. Hastie and Park (1986) suggest that the mechanism underlying these on-line judgements is closest to the serial procedural model of anchoring-and-adjustment proposed by Lopes (1982, 1987). This anchoring-and-adjustment model is based on the anchoring-and-adjustment heuristic given by Tversky and Kahneman (1974). Lopes suggests that in on-line processing of information, participants initially scan information and select items to process in order of importance. They then extract the item's scale value on the judgement dimension and subsequently adjust that value to integrate new information to summarise the already-processed items (Lopes, 1982, 1987). Thus, in terms of the current experiments, the availability of the target's valenced information in memory, as altered by retrieval-induced forgetting, had no direct influence on final judgements of honesty, as participants probably referred to the initial judgements that they (i.e. the judgement operator) produced at the time of encoding when a later judgement was explicitly called for. This final judgement would, thus, be representative of a value closer to the anchor value that participants held at the time of encoding and would not be related to the explicit recall on the final recall test.

8.8. Conclusions

The present thesis aimed to examine the relationship between information in memory and the evaluative judgements related to this information. This was achieved by attempting to alter information in memory through retrieval-induced forgetting of an individual's positive and negative traits and examining the judgement ratings of the targets at the beginning and end of the experiments. The findings from the current studies suggest that valenced trait information is susceptible to retrieval-induced forgetting, as retrieval-induced forgetting was found not only for male and female targets, but also for honest and dishonest targets. The retrieval-induced forgetting effects (Experiments 1, 2A, 2B, 5A, 5B, 5C and 5D) and lack of them (Experiments 3 and 4) were explained by the current theories in the field of retrieval-induced forgetting, namely the adaptive account (Attrill & MacLeod, 2004), negativity bias account (Fiske, 1980; Rozin & Royzman, 2001), spreading activation model (Saunders & MacLeod, 2006), inhibitory theories (M.C. Anderson et al., 1994; M.C. Anderson & Spellman, 1995), and non-inhibitory theories, such as the associate blocking account and the context dependent account (Perfect et al., 2004) and the strategy disruption model (Dodd et al., 2006). Findings of Experiment 4, using an independent probe method, emphasised the presence of non-inhibitory processes in the retrieval practice paradigm. Findings also demonstrate that retrieval-induced forgetting of a target's associated valenced trait information can be both, manifested implicitly on a behavioural task and can demonstrate behavioural rebound effects depending on the administration position of the final recall task (Experiments 5A-5D). As expected, judgements of honesty were found to be resistant to retrieval-induced forgetting in all experiments suggesting that, while it may be intuitive to believe that judgements of honesty should be based on what is recallable about an individual we access judgements inferentially or form them spontaneously through integration and revision on-line.

REFERENCES

- Adolphs, R., Tranel, D., & Damasio, A. R. (1998). The human amygdala in social judgement. *Nature*, 393, 470-474.
- AhnAllen, C. G., Nestor, P. G., McCarley, R. W., & Shenton, M. E. (2007). The role of retrieval inhibition in the associative memory impairment of schizophrenia. *Psychiatry Research*, 150(1), 43-50.
- Allen, G. A., Mahler, W. A., & Estes, W. K. (1969). Effects of recall tests on long-term retention of paired associates. *Journal of Verbal Learning and Verbal Behaviour*, 8(4), 463-470.
- Amir, N., Badour, C. L., & Freese, B. (2009). The effect of retrieval on recall of information in individuals with posttraumatic stress disorder. *Journal of Anxiety Disorders*, 23(4), 535-540.
- Amir, N., Coles, M. E., Brigidi, B., & Foa, E. B. (2001). The effect of practice on recall of emotional information in individuals with generalised social phobia. *Journal of Abnormal Psychology*, 110(1), 76-82.
- Anderson, J. R. (1974). Retrieval of propositional information from long-term memory. *Cognitive Psychology*, 6(4), 451-474.
- Anderson, J. R. (1983). *The Architecture of Cognition*. Cambridge, MA: Harvard University Press.
- Anderson, M. C. (2003). Rethinking interference theory: Executive control and the mechanisms of forgetting. *Journal of Memory & Language*, 49(4), 415-445.
- Anderson, M. C., & Bell, T. (2001). Forgetting our facts: The role of inhibitory processes in the loss of propositional knowledge. *Journal of Experimental Psychology: General*, 130(3), 544-570.

References

- Anderson, M. C., & Bjork, R. A. (1994). Mechanisms of inhibition in long-term memory. In D. Dagenbach, & T. Carr (Eds.), *Inhibitory processes in attention, memory and language* (pp. 265-325). San Diego, CA: Academic Press.
- Anderson, M. C., & Green, C. (2001). Suppressing unwanted memories by executive control. *Nature*, *410*(6826), 366-369.
- Anderson, M. C., & Levy, B. J. (2007). Theoretical issues in inhibition: Insights from research on human memory. In D. Gorfein, & C. M. MacLeod (Eds.), *Inhibition in Cognition* (pp. 81-102). Washington, DC, US: American Psychological Association.
- Anderson, M. C., & McCulloch, K. C. (1999). Integration as a general boundary condition on retrieval-induced forgetting. *Journal of Experimental Psychology - Learning, Memory & Cognition*, *25*(3), 608-629.
- Anderson, M. C., & Neely, J. H. (1996). Interference and inhibition in memory retrieval. In E. L. Bjork, & R. A. Bjork (Eds.), *Memory* (pp. 237-313). San Diego: Academic Press.
- Anderson, M. C., & Spellman, B. A. (1995). On the status of inhibitory mechanisms in cognition: Memory retrieval as a model case. *Psychological Review*, *102*(1), 68-100.
- Anderson, M. C., Bjork, E. L., & Bjork, R. A. (2000a). Retrieval-induced forgetting: Evidence for a recall-specific mechanism. *Psychonomic Bulletin and Review*, *7*(3), 522-530.
- Anderson, M. C., Bjork, R. A., & Bjork, E. L. (1994). Remembering can cause forgetting - Retrieval dynamics in long-term memory. *Journal of Experimental Psychology - Learning, Memory & Cognition*, *20*(5), 1063-1087.
- Anderson, M. C., Green, C., & McCulloch, K. C. (2000b). Similarity and inhibition in long-term memory: Evidence for a two-factor theory. *Journal of Experimental Psychology - Learning, Memory & Cognition*, *26*(5), 1141-1159.

- Anderson, N. H. (1981). *Foundations of information integration theory*. New York: Academic Press.
- Arbuckle, T. Y., & Cuddy, L. L. (1969). Discrimination of item strength at time of presentation. *Journal of Experimental Psychology*, *81*, 126-131.
- Artzt, A., & Armour-Thomas, E. (1992). Development of a cognitive-metacognitive framework for protocol analysis of mathematical problem solving in small groups. *Cognition and Instruction*, *9*, 137-175.
- Asch, S. E. (1952). *Social Psychology*. New York: Oxford University Press.
- Aslan, A., Bäuml, K.-H., & Pastötter, B. (2007). No inhibitory deficit in older adults' episodic memory. *Psychological Science*, *18*(1), 72-78.
- Attrill, A. (2005). Retrieval-induced forgetting for self and others. *Unpublished Ph.D. Thesis*. University of St. Andrews, Scotland, UK.
- Attrill, A., & MacLeod, M. D. (2004). Goal-directedness and the occurrence of retrieval-induced forgetting for positive and negative self- and other-referent trait adjectives. *Poster presented at the 5th Annual Meeting of the Society for Personality and Social Psychology*. Austin, Texas.
- Baddeley, A. D. (1997). *Human Memory: Theory and Practice*. Hove, UK: Psychology Press.
- Bajo, M. T., Gómez-Ariza, C. J., Fernandez, A., & Marful, A. (2006). Retrieval-induced forgetting in perceptually driven memory tests. *Journal of Experimental Psychology: Learning, Memory & Cognition*, *32*(5), 1185-1194.
- Baker, L. (1989). Metacognition, comprehension monitoring, and the adult reader. *Educational Psychology Review*, *1*, 3-38.
- Baker, L. (1994). Fostering metacognitive development. *Advances in Child Development and Behaviour*, *25*, 201-239.

References

- Ballew, C. C., & Todorov, A. (2007). Predicting political elections from rapid and unreflective face judgements. *Proceedings of the National Academy of Sciences of the USA*, *104*, pp. 17948-17953.
- Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioural change. *Psychological Review*, *84*, 191-215.
- Baran, B., Wilson, J., & Spencer, R. M. (2010). REM-dependent repair of competitive memory suppression. *Experimental Brain Research*, *203*(2), 471-477.
- Barnes, J. M., & Underwood, B. J. (1959). "Fate" of first-list associations in transfer theory. *Journal of Experimental Psychology*, *58*(2), 97-105.
- Barnier, A., Hung, L., & Conway, M. (2004). Retrieval-induced forgetting of emotional and unemotional autobiographical memories. *Cognition & Emotion*, *18*(4), 457-477.
- Basden, B. H., & Basden, D. R. (1996). Directed forgetting: A further comparison of the list and item methods. *Memory*, *4*(6), 633-653.
- Basden, B. H., & Basden, D. R. (1998). Directed forgetting: A contrast of methods and interpretations. In J. M. Golding, & C. M. MacLeod (Eds.), *Intentional Forgetting* (pp. 139-171). Mahway, NJ: Erlbaum.
- Basden, B. H., Basden, D. R., & Gargano, G. J. (1993). Directed forgetting in implicit and explicit memory tests: A comparison of methods. *Journal of Experimental Psychology: Learning, Memory & Cognition*, *19*(3), 603-616.
- Basden, D. R., & Basden, B. H. (1995). Some tests of the strategy disruption interpretation of part-list cuing inhibition. *Journal of Experimental Psychology: Learning, Memory & Cognition*, *21*(6), 1656-1669.
- Basden, D. R., Basden, B. H., & Galloway, B. C. (1977). Inhibition with part-list cuing. *Journal of Experimental Psychology: Human Learning and Memory*, *3*(1), 100-108.

- Battig, W. F., & Montague, W. E. (1969). Category norms for verbal items in 56 categories: A replication and extension of the Connecticut norms. *Journal of Experimental Psychology Monographs*, 80, Pt. 2.
- Bäuml, K.-H. (1996). Revisiting an old issue: Retroactive interference as a function of the degree of original and interpolated learning. *Psychonomic Bulletin & Review*, 3(3), 380-384.
- Bäuml, K.-H. (1998). Strong items get suppressed, weak items do not: The role of strength in output interference. *Psychonomic Bulletin & Review*, 5(3), 459-463.
- Bäuml, K.-H. (2002). Semantic generation can cause episodic forgetting. *Psychological Science*, 13(4), 356-360.
- Bäuml, K.-H. (2007). Making memories unavailable through the inhibitory power of retrieval. *Zeitschrift für Psychologie - Journal of Psychology*, 215(1), 4-11.
- Bäuml, K.-H., & Hartinger, A. (2002). On the role of item similarity in retrieval-induced forgetting. *Memory*, 10(3), 215-224.
- Bäuml, K.-H., & Kuhbandner, C. (2003). Retrieval-induced forgetting and part-list cuing in associatively structured lists. *Memory & Cognition*, 31(8), 1188-1197.
- Bäuml, K.-H., & Kuhbandner, C. (2007). Remembering can cause forgetting - but not in negative moods. *Psychological Science*, 18(2), 111-115.
- Bäuml, K.-H., Kissler, J., & Rak, A. (2002). Part-list cuing in amnesic patients: Evidence for a retrieval deficit. *Memory & Cognition*, 30(6), 862-870.
- Bäuml, K.-H., Pastötter, B., & Hanslmayr, S. (2010). Binding and inhibition in episodic memory - Cognitive, emotional and neural processes. *Neuroscience and Biobehavioural Reviews*, 34(7), 1047-1054.
- Beer, J. S., Bhanji, J. P., Hughes, B. L., Freedman, G., & Fetterolf, J. (2010). The neural architecture of trustworthiness judgements: Judging a book by its cover and content. *Frontiers in Neuroscience, Volume 4. Article 16*.

References

- Begg, I., Duft, S., Lalonde, P., Melnick, R., & Sanvito, J. (1989). Memory predictions are based on ease of processing. *Journal of Memory and Language*, 28, 610-632.
- Bem, D. J. (1972). Self-Perception Theory. In L. Berkowitz (Ed.), *Advances in Experimental Social Psychology* (pp. 1-62). New York: Academic Press.
- Bizer, G. Y., Tormala, Z. L., Rucker, D. D., & Petty, R. E. (2006). Memory-based versus on-line processing: Implications for attitude strength. *Journal of Experimental Psychology*, 42, 646-653.
- Bjork, E. L., & Bjork, R. A. (1996). Continuing influences of to-be-forgotten information. *Consciousness & Cognition*, 5(1-2), 176-196.
- Bjork, E. L., & Bjork, R. A. (2003). Intentional forgetting can increase, not decrease, residual influences of to-be-forgotten information. *Journal of Experimental Psychology: Learning, Memory & Cognition*, 29(4), 524-531.
- Bjork, R. A. (1970). Positive forgetting: The non-interference of items intentionally forgotten. *Journal of Verbal Learning and Verbal Behaviour*, 9(3), 255-268.
- Bjork, R. A. (1975). Retrieval as a memory modifier: An interpretation of negative recency and related phenomena. In R. L. Solso (Ed.), *Information Processing and Cognition* (pp. 123-144). New York: Wiley.
- Bjork, R. A. (1989). Retrieval inhibition as an adaptive mechanism in human memory. In H. L. Roediger, & F. I. Craik (Eds.), *Varieties of memory and consciousness: Essays in honour of Endel Tulving* (pp. 309-330). Hillsdale, NJ: Erlbaum.
- Bjork, R. A., & Bjork, E. L. (1992). A new theory of disuse and an old theory of stimulus fluctuation. In A. Healy, S. Kosslyn, & R. Shiffrin (Eds.), *From learning processes to cognitive processes: Essays in honour of William K. Estes* (Vol. 2, pp. 35-67). Hillsdale, NJ: Erlbaum.
- Bjork, R. A., & Geiselman, R. E. (1978). Constituent processes in the differentiation of items in memory. *Journal of Experimental Psychology: Human Learning and Memory*, 4(4), 347-361.

- Bjork, R., & Bjork, E. (1992). A new theory of disuse and an old theory of stimulus fluctuation. In A. Healy, S. Kosslyn, & R. Shiffrin, *From learning processes to cognitive processes: Essays in honour of William K. Estes* (Vol. 2, pp. 35-67). Hillsdale, NJ: Erlbaum.
- Blair, I. V., Judd, C. M., & Chapleau, K. M. (2004). The influence of Afrocentric facial features in criminal sentencing. *Psychological Science, 15*, 674-679.
- Blaxton, T. A., & Neely, J. H. (1983). Inhibition from semantically related primes: Evidence of a category-specific inhibition. *Memory & Cognition, 11*(5), 500-510.
- Bodenhausen, G. V., Gabriel, S., & Lineberger, M. (2000). Sadness and susceptibility to judgemental bias: The case of anchoring. *Psychological Science, 11*, 320-323.
- Bond, C. F., Berry, D. S., & Omar, A. (1994). The kernel of truth in judgements of deceptiveness. *Basic and Applied Social Psychology, 15*, 523-534.
- Bower, G. H. (1991). Mood congruity of social judgements. In J. P. Forgas (Ed.), *Emotion and social judgements* (pp. 31-35). Oxford, England: Pergamon Press.
- Bower, G. H. (2000). A brief history of memory research. In E. Tulving, & F. I. Craik (Eds.), *The Oxford Handbook of Memory* (pp. 3-32). Oxford University Press.
- Bray, N. W., Justice, E. M., & Zahm, D. N. (1983). 2 Developmental transitions in selective remembering strategies. *Journal of Experimental Child Psychology, 36*(1), 43-55.
- Butler, K. M., Williams, C. C., Zacks, R. T., & Maki, R. H. (2001). A limit on retrieval-induced forgetting. *Journal of Experimental Psychology: Learning, Memory & Cognition, 27*(5), 1314-1319.
- Camp, G., Pecher, D., & Schmidt, H. G. (2005). Retrieval-induced forgetting in implicit memory tests: The role of test awareness. *Psychonomic Bulletin & Review, 12*, 490-494.
- Camp, G., Pecher, D., & Schmidt, H. G. (2007). No retrieval-induced forgetting using item-specific independent cues: Evidence against a general inhibitory account.

References

- Journal of Experimental Psychology: Learning, Memory & Cognition*, 33(5), 950-958.
- Camp, G., Pecher, D., Schmidt, H. G., & Zeelenberg, R. (2009). Are independent probes truly independent. *Journal of Experimental Psychology: Learning, Memory & Cognition*, 35(4), 934-942.
- Carretta, T. R., & Moreland, R. L. (1983). The direct and indirect effects of inadmissible evidence. *Journal of Applied Social Psychology*, 13(4), 291-309.
- Carrier, M., & Pashler, H. (1992). The influence of retrieval on retention. *Memory & Cognition*, 20(6), 633-642.
- Cervone, D., & Peake, P. K. (1986). Anchoring, efficacy, and action: The influence of judgemental heuristics on self-efficacy judgements and behaviour. *Journal of Personality and Social Psychology*, 50, 492-501.
- Chaiken, S., & Trope, Y. (1999). *Dual-Process Theories in Social Psychology*. New York: The Guilford Press.
- Chan, J. C. (2009). When does retrieval induce forgetting and when does it induce facilitation? Implications for retrieval inhibition, testing effect, and text processing. *Journal of Memory and Language*, 61(2), 153-170.
- Chan, J. C. (2010). Long-term effects of testing on the recall of nontested materials. *Memory*, 18(1), 49-57.
- Chandler, C. C. (1989). Specific retroactive interference in modified recognition tests: Evidence for an unknown cause of interference. *Journal of Experimental Psychology: Learning, Memory & Cognition*, 15(2), 256-265.
- Chandler, C. C. (1993). Accessing related events increases retroactive interference in a matching recognition test. *Journal of Experimental Psychology: Learning, Memory & Cognition*, 19(4), 967-974.
- Chapman, G. B., & Johnson, E. J. (1994). The limits of anchoring. *Journal of Behavioural Decision-Making*, 7, 223-242.

- Chapman, G. B., & Johnson, E. J. (1999). Anchoring, activation and the construction of values. *Organisational Behaviour and Human Decision Processes*, 139, 1-39.
- Ciranni, M. A., & Shimamura, A. P. (1999). Retrieval-induced forgetting in episodic memory. *Journal of Experimental Psychology - Learning, Memory & Cognition*, 25(6), 1403-1414.
- Clore, G. L., & Huntsinger, J. R. (2007). How emotions inform judgment and regulate thought. *Trends in Cognitive Sciences*, 11(9), 393-399.
- Coman, A., Manier, D., & Hirst, W. (2009). Forgetting the unforgettable through conversation: Socially shared retrieval-induced forgetting of September 11 memories. *Psychological Science*, 20(5), 627-633.
- Conroy, R., & Salmon, K. (2006). Talking about parts of a past experience: The impact of discussion style and event structure on memory for discussed and nondiscussed information. *Journal of Experimental Child Psychology*, 95(4), 278-297.
- Conway, M. A., & Fthenaki, A. (2003). Disruption of inhibitory control of memory following lesions to the frontal and temporal lobes. *Cortex*, 39(4-5), 667-686.
- Critcher, C. R., & Gilovich, T. (2008). Incidental environmental anchors. *Journal of Behavioural Decision Making*, 21, 241-251.
- Crowder, R. G. (1976). *Principles of learning and memory*. Hillsdale, NJ and New York: Lawrence Erlbaum Associates.
- DeBruine, L. M. (2002). Facial resemblance enhances trust. *Proceedings of the Royal Society B*, 269, pp. 1307-1312.
- DeBruine, L. M. (2005). Trustworthy but not lust-worthy: Context specific effects of facial resemblance. *Proceedings of the Royal Society, Series B*, 272, pp. 919-922.
- Dehli, L., & Brennen, T. (2009). Does retrieval-induced forgetting occur for emotional stimuli? *Cognition and Emotion*, 23(6), 1056-1068.

References

- Depue, B. E., Banich, M. T., & Currant, T. (2006). Suppression of emotional and nonemotional content in memory: Effects of repetition on cognitive control. *Psychological Science, 17*, 441-447.
- Diana, R. A., & Reder, L. M. (2004). Visual versus verbal metacognition: Are they really different? In D. T. Levin (Ed.), *Thinking and seeing: Visual metacognition in adults and children* (pp. 187-201). Cambridge, MA: MIT Press.
- Dodd, M. D., & Shumborski, S. (2009). Examining the influence of action on spatial working memory: The importance of selection. *Quarterly Journal of Experimental Psychology, 62*(6), 1236-1247.
- Dodd, M. D., Castel, A. D., & Roberts, K. E. (2006). A strategy disruption component to retrieval-induced forgetting. *Memory & Cognition, 34*(1), 102-111.
- Dunn, E. W., & Spellman, B. A. (2003). Forgetting by remembering: Stereotype inhibition through rehearsal of alternative aspects of identity. *Journal of Experimental Social Psychology, 39*(5), 420-433.
- Edgington, T., & Rusted, J. M. (2003). Separate and combined effects of scopolamine and nicotine on retrieval-induced forgetting. *Psychopharmacology, 170*(4), 351-357.
- Ehrlinger, J., & Dunning, D. (2003). How chronic self-views influence (and potentially misled) estimates of performance. *Journal of Personality and Social Psychology, 84*, 5-17.
- Engell, A. D., Haxby, J. V., & Todorov, A. (2007). Implicit trustworthiness decisions: Automatic coding of face properties in human amygdala. *Journal of Cognitive Neuroscience, 19*, 1508-1519.
- Engell, A. D., Todorov, A., & Haxby, J. V. (2010). Common neural mechanisms for the evaluation of facial trustworthiness and emotional expressions as revealed by behavioural adaptation. *Perception, 39*, 931-941.
- Englich, B., & Mussweiler, T. (2001). Sentencing under uncertainty: Anchoring effects in the courtroom. *Journal of Applied Social Psychology, 31*, 1535-1551.

- Englich, B., & Soder, K. (2009). Moody experts - How mood and expertise influence judgemental anchoring. *Judgement and Decision Making*, 4, 41-50.
- Englich, B., Mussweiler, T., & Strack, F. (2005). The last word in court - A hidden disadvantage for the defense. *Law and Human Behaviour*, 29, 705-722.
- Englich, B., Mussweiler, T., & Strack, F. (2006). Playing dice with criminal sentences: The influence of irrelevant anchors on experts' judicial decision making. *Personality and Social Psychology Bulletin*, 32, 188-200.
- Epley, N. (2004). A Tale of Tuned Decks? Anchoring as adjustment and anchoring as activation. In D. J. Koehler, & N. Harvery (Eds.), *The Blackwell Handbook of Judgement and Decision Making* (pp. 240-256). Oxford, UK: Blackwell Publishers.
- Epley, N., & Gilovich, T. (2001). Putting adjustment back in the anchoring and adjustment heuristic: Differential processing of self-generated and experimenter-provided anchors. *Psychological Science*, 12, 391-396.
- Epley, N., & Gilovich, T. (2005). When effortful thinking influences judgemental anchoring: Differential effects of forewarning and incentives on self-generated and externally-provided anchors. *Journal of Behavioural Decision Making*, 18, 199-212.
- Eroglu, C., & Croxton, K. L. (2010). Biases in judgemental adjustments of statistical forecasts: The role of individual differences. *International Journal of Forecasting*, 26, 116-133.
- Fiske, S. T. (1980). Attention and weight in person perception: The impact of negative and extreme information. *Journal of Personality and Social Psychology*, 38, 889-906.
- Flavell, J. H. (1971). Stage-related properties of cognitive development. *Cognitive Psychology*, 2(4), 421-453.
- Flavell, J. H. (1976). Metacognitive aspects of problem solving. In L. Resnick (Ed.), *The nature of intelligence* (pp. 231-236). Hillsdale, NJ: Erlbaum.

References

- Flavell, J. H. (1977). The development of knowledge about visual perception. *Nebraska Symposium on Motivation, 25*, 43-76.
- Flavell, J. H. (1979). Meta-cognition and cognitive monitoring - New area of cognitive-developmental inquiry. *American Psychologist, 34*(10), 906-911.
- Flavell, J. H. (1987). Speculations about the nature and development of metacognition. In F. Weinert, & R. Kluwe (Eds.), *Metacognition, motivation and understanding* (pp. 21-29). Hillsdale, NJ: Erlbaum.
- Ford, R. M., Keating, S., & Patel, R. (2004). Retrieval-induced forgetting: A developmental study. *British Journal of Developmental Psychology, 22*, 585-603.
- Furnham, A., & Boo, H. C. (2011). A literature review of the anchoring effect. *The Journal of Socio-Economics, 40*, 35-42.
- Galinsky, A. D., & Mussweiler, T. (2001). First offers as anchors : The role of perspective-taking and negotiator focus. *Journal of Personality and Social Psychology, 81*, 657-669.
- Garcia-Bajos, E., & Migueles, M. (2009). When stereotype knowledge prevents retrieval-induced forgetting. *Acta Psychologica, 131*(1), 63-71.
- Garcia-Bajos, E., Migueles, M., & Anderson, M. C. (2009). Script knowledge modulates retrieval-induced forgetting for eyewitness events. *Memory, 17*(1), 92-103.
- Geiselman, R. E., & Bagheri, B. (1985). Repetition effects in directed forgetting: Evidence for retrieval inhibition. *Memory & Cognition, 13*(1), 57-62.
- Geiselman, R. E., Bjork, R. A., & Fishman, D. (1983). Disrupted retrieval in directed forgetting: A link with posthypnotic amnesia. *Journal of Experimental Psychology: General, 112*(1), 58-72.
- Gillund, G., & Shiffrin, R. M. (1984). A retrieval model for both recognition and recall. *Psychological Review, 91*(1), 1-67.

- Golding, J. M., Fowler, S. B., Long, D. L., & Latta, H. (1990). Instructions to disregard potentially useful information: The effects of pragmatics on evaluative judgments and recall. *Journal of Memory & Language*, 29(2), 212-227.
- Gómez-Ariza, C. J., Lechuga, M. T., & Pelegrina, S. (2005). Retrieval-induced forgetting in recall and recognition of thematically related and unrelated sentences. *Memory & Cognition*, 33(8), 1431-1441.
- Gómez-Ariza, C. J., Pelegrina, S., Lechuga, M. T., Suarez, A., & Bajo, M. T. (2009). Inhibition and retrieval of facts in young and older adults. *Experimental Aging Research*, 35(1), 83-97.
- Groninger, L. D. (1979). Predicting recall: The "feeling-that-I-will-know" phenomenon. *American Journal of Psychology*, 92, 45-58.
- Groome, D., & Grant, N. (2005). Retrieval-induced forgetting is inversely related to everyday cognitive failures. *British Journal of Psychology*, 96, 313-319.
- Groome, D., & Sterkaj, F. (2010). Retrieval-induced forgetting and clinical depression. *Cognition & Emotion*, 24(1), 63-70.
- Hamilton, D. L., & Sherman, J. S. (1996). Perceiving persons and groups. *Psychological Review*, 103, 336-355.
- Harnishfeger, K. K., & Pope, R. S. (1996). Intending to forget: The development of cognitive inhibition in directed forgetting. *Journal of Experimental Child Psychology*, 62(2), 292-315.
- Harris, C. B., Sharman, S. J., Barnier, A. J., & Moulds, M. L. (2010). Mood and retrieval-induced forgetting of positive and negative autobiographical memories. *Applied Cognitive Psychology*, 24(3), 399-413.
- Hart, J. T. (1965). Memory and the feeling-of-knowing experience. *Journal of Educational Psychology*, 56, 208-216.
- Hart, J. T. (1967). Memory and the memory-monitoring process. *Journal of Verbal Learning & Verbal Behaviour*, 6, 685-691.

References

- Hastie, R., & Park, B. (1986). The relationship between memory and judgement depends on whether the judgement task is memory-based or on-line. *Psychological Review*, 93, 258-268.
- Hastie, R., Schkade, D., & Payne, J. W. (1999). Juror judgement in civil cases : Effects of plaintiff's requests and plaintiff's identity on punitive damage awards. *Law and Human Behaviour*, 23, 445-470.
- Hauer, B. J., Wessel, I., Merckelbach, H., Roefs, A., & Dagleish, T. (2007). Effects of repeated retrieval of central and peripheral details in complex emotional slides. *Memory*, 15(4), 435-449.
- Hicks, J. L., & Starns, J. J. (2004). Retrieval-induced forgetting occurs in tests of item recognition. *Psychonomic Bulletin & Review*, 11(1), 125-130.
- Higgins, E. T., Rholes, W. S., & Jones, C. R. (1977). Category accessibility and impression formation. *Journal of Experimental Social Psychology*, 13, 141-154.
- Hogge, M., Adam, S., & Collette, F. (2008). Retrieval-induced forgetting in normal ageing. *Journal of Neuropsychology*, 2, 463-476.
- Hollingworth, H. L. (1922). *Judging human character*. New York: D. Appleton and Company.
- Hollins, T. S., & Perfect, T. J. (1997). The confidence-accuracy relation in eyewitness memory: the mixed question type effect. *Legal and Criminological Psychology*, 2, 205-218.
- Iglesias-Parro, S., Gómez-Ariza, C. J., & Arias, A. V. (2009). Inhibition as an adaptive mechanism in memory-based choice. *Revista de Psicología Social*, 24(3), 333-347.
- Isaac, C. L., & Mayes, A. R. (1999). Rate of forgetting in amnesia: I. Recall and recognition of prose. *Journal of Experimental Psychology: Learning, Memory & Cognition*, 25(4), 963-977.
- Jacowitz, K. E., & Kahneman, D. (1995). Measures of anchoring in estimation tasks. *Personality and Social Psychology Bulletin*, 21, 1161-1166.

- Jakab, E., & Raaijmakers, J. G. (2009). The role of item strength in retrieval-induced forgetting. *Journal of Experimental Psychology: Learning, Memory & Cognition*, 35(3), 607-617.
- James, W. (1950). *The Principles of Psychology* (Vol. 1). New York: Dover Publications.
- Johansson, M., Aslan, A., Bauml, K.-H., Gabel, A., & Mecklinger, A. (2007). When remembering causes forgetting: Electrophysiological correlates of retrieval-induced forgetting. *Cerebral Cortex*, 17(6), 1335-1341.
- Johnson, S. K., & Anderson, M. C. (2004). The role of inhibitory control in forgetting semantic knowledge. *Psychological Science*, 15(7), 448-453.
- Jones, E. E., & McGillis, D. (1976). Correspondent inferences and the attribution cube: A comparative reappraisal. In J. H. Harvey, W. J. Ickes, & R. F. Kidd (Eds.), *New directions in attribution research* (Vol. 1, pp. 389-420). Hillsdale, NJ: Erlbaum.
- Jones, E. E., Kannouse, D. E., Kelley, H. H., Nisbett, R. E., Valins, S., & Weiner, B. (Eds.). (1972). *Attribution: Perceiving the causes of behaviour*. San Diego: Academic Press.
- Joormann, J., Hertel, P. T., Brozovich, F., & Gotlib, I. H. (2005). Remembering the good, forgetting the bad: Intentional forgetting of emotional material in depression. *Journal of Abnormal Psychology*, 114(4), 640-648.
- Josephson, B. R., Singer, J. A., & Salovey, P. (1996). Mood regulation and memory: Repairing sad moods with happy memories. *Cognition & Emotion*, 10(4), 437-44.
- Juslin, P., Olsson, H., & Winman, A. (1998). The calibration issue: Theoretical comments on Suantak, Bolger and Ferrell (1996). *Organisational Behaviour and Human Decision Process*, 73, 3-26.
- Kelley, C. M., & Lindsay, D. S. (1993). Remembering mistaken for knowing: Ease of retrieval as a basis for confidence in answers to general knowledge questions. *Journal of Memory and Language*, 32, 1-24.

References

- Klein, S. B., & Loftus, J. (1990). Rethinking the role of organisation in person memory: An independent trace storage model. *Journal of Personality and Social Psychology, 59*, 400-410.
- Klein, S. B., Chan, R. L., & Loftus, J. (1999). Independence of episodic and semantic self-knowledge: The case from autism. *Social Cognition, 17*, 413-436.
- Klein, S. B., Loftus, J., & Kihlstrom, J. F. (1996). Self-knowledge of an amnesic patient: Toward a neuropsychology of personality and social psychology. *Journal of Experimental Psychology: General, 125*(3), 250-260.
- Klein, S. B., Loftus, J., & Plog, A. E. (1992). Trait judgments about the self: Evidence from the encoding specificity paradigm. *Personality & Social Psychology Bulletin, 18*(6), 730-735.
- Koessler, S., Engler, H., Riether, C., & Kissler, J. (2009). No retrieval-induced forgetting under stress. *Psychological Science, 20*(11), 1356-1363.
- Koriat, A. (1993). How do we know that we know? The accessibility model of the feeling of knowing. *Psychological Review, 100*, 609-639.
- Koriat, A. (1995). Dissociating knowing and the feeling of knowing: Further evidence for the accessibility model. *Journal of Experimental Psychology, 124*, 311-333.
- Koriat, A. (1997). Monitoring one's own knowledge during study: A cue-utilisation approach to judgments of learning. *Journal of Experimental Psychology: General, 126*(4), 349-370.
- Koriat, A. (1998). Metamemory: The feeling of knowing and its vagaries. In J. G. Adair, & F. I. Craik (Eds.), *Advances in psychological science* (Vol. 2, pp. 461-469). Hove, Sussex: Psychology Press.
- Koriat, A. (2000). The feeling of knowing: Some metatheoretical implications for consciousness and control. *Consciousness and Cognition, 9*, 149-171.
- Koriat, A. (2002). Metacognition research: An interim report. In T. J. Perfect, & B. L. Schwartz (Eds.), *Applied Metacognition* (pp. 261-286). Cambridge: Cambridge University Press.

- Koriat, A. (2007). Metacognition and consciousness. In P. D. Zelazo, M. Moscovitch, & E. Thompson (Eds.), *The Cambridge handbook of consciousness* (pp. 289-325). New York: Cambridge University Press.
- Koriat, A., & Levy-Sadot, R. (1999). Processes underlying metacognitive judgments: Information-based and experience-based monitoring of one's own knowledge. In S. Chaiken, & Y. Trope (Eds.), *Dual-process theories in social psychology* (pp. 483-502). New York, US: Guilford press.
- Koriat, A., & Levy-Sadot, R. (2001). The combined contributions of the cue-familiarity and accessibility heuristics to feelings of knowing. *Journal of Experimental Psychology: Learning, Memory & Cognition*, *21*, 34-53.
- Koriat, A., Bjork, R. A., Sheffer, L., & Bar, S. K. (2004). Predicting one's own forgetting: the role of experience-based and theory-based processes. *Journal of Experimental Psychology: General*, *133*(4), 643-656.
- Koriat, A., Sheffer, L., & Ma'ayan, H. (2002). Comparing objective and subjective learning curves: Judgments of learning exhibit increased underconfidence with practice. *Journal of Experimental Psychology: General*, *131*, 147-162.
- Koutstaal, W., Schacter, D. L., Johnson, M. K., & Galluccio, L. (1999). Facilitation and impairment of event memory produced by photograph review. *Memory & Cognition*, *27*(3), 478-493.
- Krinsky, R., & Nelson, T. O. (1985). The feeling of knowing for different types of retrieval failure. *Acta Psychologica*, *58*, 141-158.
- Kuhbandner, C., Bäuml, K.-H., & Stiedl, F. C. (2009). Retrieval-induced forgetting of negative stimuli: The role of emotional intensity. *Cognition & Emotion*, *23*(4), 817-830.
- Landauer, T. K., & Bjork, R. A. (1978). Optimum rehearsal patterns and name learning. In M. M. Grunneberg, R. E. Morris, & R. N. Sykes (Eds.), *Practical Aspects of Memory* (pp. 625-632). London: Academic Press.

References

- LeBoeuf, R. A., & Shafir, E. (2009). Anchoring on the "Here" and "Now" in time and distance judgements. *Journal of Experimental Psychology*, 35, 81-93.
- Lechuga, M. T., Moreno, V., Pelegrina, S., Gomez-Ariza, C. J., & Bajo, M. T. (2006). Age differences in memory control: Evidence from updating and retrieval-practice tasks. *Acta Psychologica*, 123(3), 279-298.
- Leonesio, R. J., & Nelson, T. O. (1990). Do different metamemory judgments tap the same underlying aspects of memory? *Journal of Experimental Psychology: Learning, Memory & Cognition*, 16, 464-470.
- Lerouge, D., & Smeesters, D. (2008). Knowledge activation after information encoding: Implications of trait priming on person judgement. *Journal of Experimental Psychology*, 44, 429-436.
- Levy, B. J., & Anderson, M. C. (2002). Inhibitory processes and the control of memory retrieval. *Trends in Cognitive Science*, 6(7), 299-305.
- Levy, B. J., McVeigh, N. D., Marful, A., & Anderson, M. C. (2007). Inhibiting your native language: The role of retrieval-induced forgetting during second-language acquisition. *Psychological Science*, 18(1), 29-34.
- Lichtenstein, S., Fischhoff, B., & Phillips, L. D. (1982). Calibration of probabilities: The state of the art to 1980. In D. Kahneman, P. Slovic, & A. Tversky (Eds.), *Judgment under uncertainty: Heuristics and biases* (pp. 306-334). New York: Cambridge University Press.
- Lopes, L. L. (1982). Toward a procedural theory a judgement. *Technical Report. Wisconsin Human Information Processing Program (WHIPP 17)*. Madison, WI.
- Lopes, L. L. (1987). Procedural debiasing. *Acta Psychologica*, 167-185.
- Maass, A., Colombo, A., Colombo, A., & Sherman, S. (2001). Inferring traits from behaviours versus behaviours from traits: The induction-deduction asymmetry. *Journal of Personality and Social Psychology*, 81(3), 391-404.

- MacLeod, C. M. (1975). Long-term recognition and recall following directed forgetting. *Journal of Experimental Psychology: Human Learning and Memory*, 104(3), 271-279.
- MacLeod, C. M., Dodd, M. D., Wilson, D. E., & Bibi, U. (2003). In opposition to inhibition. In B. H. Rodd (Ed.), *The Psychology of Learning and Motivation* (Vol. 43, pp. 163-214). San Diego, CA: Academic Press.
- MacLeod, M. D. (2002). Retrieval-induced forgetting in eyewitness memory: Forgetting as a consequence of remembering. *Applied Cognitive Psychology*, 16(2), 135-149.
- MacLeod, M. D., & Macrae, C. N. (2001). Gone but not forgotten: The transient nature of retrieval-induced forgetting. *Psychological Science*, 12(2), 148-152.
- MacLeod, M. D., & Saunders, J. (2005). The role of inhibitory control in the production of misinformation effects. *Journal of Experimental Psychology: Learning, Memory & Cognition*, 31(5), 964-979.
- MacLeod, M. D., & Saunders, J. (2008). Retrieval inhibition and memory distortion - Negative consequences of an adaptive process. *Current Directions in Psychological Science*, 17(1), 26-30.
- MacLeod, M. D., Bjork, E. L., & Bjork, R. A. (2003). The role of retrieval-induced forgetting in the construction and distortion of memories. In B. Kokinov, & W. Hirst (Eds.), *Constructive Memory*. NBU Series in Cognitive Science. Sophia: New Bulgarian University.
- Macrae, C. M., Bodenhausen, G. V., Milne, A. B., & Ford, R. L. (1997). On the regulation of recollection: The intentional forgetting of stereotypical memories. *Journal of Personality and Social Psychology*, 72(4), 709-719.
- Macrae, C. N., & MacLeod, M. D. (1999). On Recollections Lost: When practice makes imperfect. *Journal of Personality and Social Psychology*, 77(3), 463-473.
- Macrae, C. N., & Roseveare, T. A. (2002). I was always on my mind: The self and temporary forgetting. *Psychonomic Bulletin & Review*, 9(3), 611-614.

References

- Macrae, C. N., Bodenhausen, G. V., Milne, A. B., & Jetten, J. (1994). Out of mind but back in sight: Stereotypes on the rebound. *Journal of Personality and Social Psychology, 67*, 808-817.
- Macrae, C. N., Quinn, K. A., Mason, M. F., & Quadflieg, S. (2005). Understanding others: The face and person construal. *Journal of Personality and Social Psychology, 89*, 686-695.
- Marti, M. W., & Wissler, R. L. (2000). Be careful what you ask for: The effects of anchors on personal injury damages awards. *Journal of Experimental Psychology: Applied, 6*, 91-103.
- Matsuda, T., & Matsukawa, J. (2010). The influence of aging on inhibition and release in retrieval-induced forgetting. *Shinrigaku Kenkyu, 81*(1), 50-55.
- Mazzoni, G., Cornoldi, C., & Marchitelli, G. (1990). Do memorability ratings affect study-time allocation? *Memory & Cognition, 18*, 196-204.
- McConnell, A. R. (2001). Implicit theories: Consequences for social judgements of individuals. *Journal of Experimental Social Psychology, 37*, 215-227.
- McConnell, A. R., Sherman, S. J., & Hamilton, D. L. (1994). On-line and memory-based aspects of individual and group target judgements. *Journal of Personality and Social Psychology, 67*, 173-185.
- McConnell, A. R., Sherman, S. J., & Hamilton, D. L. (1997). Target entitativity: Implications for information processing about individual and group targets. *Journal of Personality and Social Psychology, 72*, 750-762.
- McElroy, T., & Dowd, K. (2007). Susceptibility to anchoring effects: How openness-to-experience influences responses to anchoring cues. *Judgement and Decision Making, 2*, 48-53.
- McGeoch, J. A. (1936). Studies in retroactive inhibition: VII. Retroactive inhibition as a function of the length and frequency of presentation of the interpolated lists. *Journal of Experimental Psychology, 19*, 674-693.

- McGeoch, J. A. (1942). *The Psychology of human learning*. New York: Longmans, Green.
- McGovern, J. B. (1964). Extinction of associations in four transfer paradigms. *Psychological Monographs*, 78(Whole Issue).
- McNamara, T. P., & Altarriba, J. (1988). Depth of spreading activation revisited - Semantic mediated priming occurs in lexical decisions. *Journal of Memory and Language*, 27(5), 545-559.
- Mensink, G. J., & Raaijmakers, J. G. (1988). A model of interference and forgetting. *Psychological Review*, 95(4), 434-455.
- Metcalf, J. (1994). A computational modeling approach to novelty monitoring, metacognition and frontal lobe dysfunction. In J. Metcalfe, & A. P. Shimamura (Eds.), *Metacognition: Knowing about knowing* (pp. 137-156). Cambridge, MA: Bradford.
- Metcalf, J., & Shimamura, A. P. (Eds.). (1994). *Metacognition*. Cambridge, MA: MIT Press.
- Metcalf, J., Schwartz, B. L., & Joaquim, S. G. (1993). The cue-familiarity heuristic in metacognition. *Journal of Experimental Psychology: Learning, Memory & Cognition*, 19, 851-864.
- Miguelés, M., & Garcia-Bajos, E. (2006). Influence of the typicality of the actions in a mugging script on retrieval-induced forgetting. *Psicologica*, 27(1), 119-135.
- Miguelés, M., & Garcia-Bajos, E. (2007). Selective retrieval and induced forgetting in eyewitness memory. *Applied Cognitive Psychology*, 21(9), 1157-1172.
- Montepare, J. M., & Zebrowitz, L. A. (1998). Person perception comes of age: The salience and significance of age in social judgements. *Advances in Experimental Social Psychology*, 30, 93-161.
- Moran, G., & Cutler, B. L. (1991). The prejudicial impact of pretrial publicity. *Journal of Applied Social Psychology*, 21(5), 345-367.

References

- Morris, P. E., & Fritz, C. O. (2000). The name game: Using retrieval practice to improve the learning of names. *Journal of Experimental Psychology: Applied*, 6(2), 124-129.
- Morris, P. E., & Fritz, C. O. (2002). The improved name game: Better use of expanding retrieval practice. *Memory*, 10(4), 259-266.
- Moulds, M. L., & Kandris, E. (2006). The effect of practice on recall of negative material in dysphoria. *Journal of Affective Disorders*, 91(2-3), 269-272.
- Moulin, C. J., Perfect, T. J., Conway, M. A., North, A. S., Jones, R. W., & James, N. (2002). Retrieval-induced forgetting in Alzheimer's disease. *Neuropsychologia*, 40(7), 862-867.
- Mueller, C. W., & Watkins, M. J. (1977). Inhibition from part-set cuing: A cue-overload interpretation. *Journal of Verbal Learning and Verbal Behaviour*, 16(6), 699-710.
- Mussweiler, T., & Englich, B. (2005). Subliminal anchoring: Judgemental consequences and underlying mechanisms. *Organisational Behaviour and Human Decision Processes*, 98, 133-143.
- Mussweiler, T., & Strack, F. (1999). Hypothesis-consistent testing and semantic priming in the anchoring paradigm: A selective accessibility model. *Journal of Experimental Social Psychology*, 35, 136-164.
- Mussweiler, T., & Strack, F. (2001a). Considering the impossible: Explaining the effects of implausible anchors. *Social Cognition*, 19, 145-160.
- Mussweiler, T., & Strack, F. (2001b). The semantics of anchoring. *Organisational Behaviour and Human Decision Processes*, 86, 234-255.
- Mussweiler, T., Strack, F., & Pfeiffer, T. (2000). Overcoming the inevitable anchoring effect : Considering the opposite compensates for selective accessibility. *Personality and Social Psychology Bulletin*, 26, 1142-1150.
- Nelson, T. O. (1996). Consciousness and metacognition. *American Psychologist*, 51(2), 102-116.

- Nelson, T. O. (1997). The meta-level versus object-level distinction (and other issues) in formulations of metacognition. *American Psychologist*, 52(2), 179-180.
- Nelson, T. O., & Dunlosky, J. (1991). When people's judgments of learning (JOL) are extremely accurate at predicting subsequent recall: The delayed-JOL effect. *Psychological Science*, 2(4), 267-270.
- Nelson, T. O., & Leonesio, R. J. (1988). Allocation of self-paced study time and the "labour-in-vain effect". *Journal of Experimental Psychology: Learning, Memory & Cognition*, 14, 676-686.
- Nelson, T. O., & Narens, L. (1990). Metamemory: A theoretical framework and new findings. In G. Bower (Ed.), *The psychology of learning and motivation: Advances in research and theory* (pp. 125-173). New York: Academic Press.
- Nelson, T. O., & Narens, L. (1994). Why investigate metacognition? In J. Metcalfe, & A. P. Shimamura (Eds.), *Metacognition: Knowing about knowing* (pp. 1-27). Cambridge, Massachusetts: MIT.
- Nestor, P. G., Piech, R., Allen, C., Niznikiewicz, M., Shenton, M., & McCarley, R. W. (2005). Retrieval-induced forgetting in schizophrenia. *Schizophrenia Research*, 75(2-3), 199-209.
- Nickerson, R. S. (1984). Retrieval inhibition from part-set cuing: A persistent enigma in memory research. *Memory & Cognition*, 12(6), 531-552.
- Norman, K. A., Newman, E. L., & Detre, G. (2007). A neural network model of retrieval-induced forgetting. *Psychological Review*, 114, 887-953.
- Northcraft, G. B., & Neale, M. A. (1987). Experts, amateurs and real estate: An anchoring-and-adjustment perspective on property pricing decisions. *Organisational Behaviour and Human Decision Processes*, 39, 84-97.
- Odinot, G., Wolters, G., & Lavender, T. (2009). Repeated partial eyewitness questioning causes confidence inflation but not retrieval-induced forgetting. *Applied Cognitive Psychology*, 23(1), 90-97.

References

- O'Doherty, J., Winston, J., Critchley, H., Perrett, D., Burt, D. M., & Dolan, R. J. (2003). Beauty in a smile: The role of medial orbitofrontal cortex in facial attractiveness. *Neuropsychologia*, *41*, 147-155.
- Oosterhod, N. N., & Todorov, A. (2008). The functional basis of face evaluation. *Proceedings of the National Academy of Sciences*, *105*, pp. 11087-11092. USA.
- Oosterhof, N. N., & Todorov, A. (2009). Shared perceptual basis of emotional expressions and trustworthiness impressions from faces. *Emotion*, *9*, 128-133.
- Oram, M. W., & MacLeod, M. D. (2001). Remembering to forget: Modelling inhibitory and competitive mechanisms in human memory. In J. D. Moore & K. Stenning (Eds.). *Proceedings of the 23rd Annual Conference of the Cognitive Science Society* (pp. 738-743). Mahwah, NJ: Erlbaum.
- Paller, K. A. (1990). Recall and stem-completion priming have different electrophysiological correlates and are modified differentially by directed forgetting. *Journal of Experimental Psychology: Learning, Memory & Cognition*, *16*(6), 1021-1032.
- Parker, A., & Dagnall, N. (2009). Effects of retrieval practice on conceptual explicit and implicit consumer memory. *Applied Cognitive Psychology*, *23*(2), 188-203.
- Pennington, N., & Hastie, R. (1988). Explanation-based decision making: The effects of memory structure on judgement. *Journal of Experimental Psychology: Learning, Memory & Cognition*, *14*, 521-533.
- Perfect, T. J. (2002). When does eyewitness confidence predict performance? In T. J. Perfect, & B. Schwartz (Eds.), *Applied Metacognition* (pp. 95-120). Cambridge, Cambridge University Press.
- Perfect, T. J. (2004). The role of self-rated ability in the accuracy of confidence judgments in eyewitness memory and general knowledge. *Applied Cognitive Psychology*, *18*, 157-168.
- Perfect, T. J., & Schwartz, B. (Eds.). (2002). *Applied Metacognition*. Cambridge: Cambridge University Press.

- Perfect, T. J., Moulin, C. J., Conway, M. A., & Perry, E. (2002). Assessing the inhibitory account of retrieval-induced forgetting with implicit memory tests. *Journal of Experimental Psychology: Learning, Memory & Cognition*, 28(6), 1111-1119.
- Perfect, T. J., Stark, L.-J., Tree, J., Moulin, C. J., Ahmed, L., & Hutter, R. (2004). Transfer-appropriate forgetting: The cue dependent nature of retrieval-induced forgetting. *Journal of Memory and Language*, 51(3), 399-417.
- Perrett, D. I., Lee, K. J., & Penton-Voak, I. e. (1998). Effects of sexual dimorphism on facial attractiveness. *Nature*, 394, 884-887.
- Pfeifer, P. E. (1994). Are we overconfident in the belief that probability forecasters are overconfident? *Organisational Behaviour and Human Decision Processes*, 58, 203-213.
- Phenix, T. L., & Campbell, J. I. (2004). Effects of multiplication practice on product verification: Integrated structures model or retrieval-induced forgetting? *Memory & Cognition*, 32(2), 324-335.
- Porter, S., England, L., Juodis, M., Brinke, L., & Wilson, K. (2008). Is the face a window to the soul? Investigation of the accuracy of intuitive judgements of the trustworthiness of human faces. *Canadian Journal of Behavioural Science*, 40(3), 171-177.
- Postman, L. (1962). Transfer of training as a function of experimental paradigm and degree of first-list learning. *Journal of Verbal Learning and Verbal Behaviour*, 1(2), 109-118.
- Postman, L., & Stark, K. (1969). Role of response availability in transfer and interference. *Journal of Experimental Psychology*, 79(1), 168-177.
- Quinn, K. A., Hugenberg, K., & Bodenhausen, G. V. (2004). Functional modularity in stereotype representation. *Journal of Experimental Social Psychology*, 40(4), 519-527.
- Raaijmakers, J. W., & Shiffrin, R. M. (1981). Search of Associative Memory. *Psychological Review*, 88(2), 93-134.

References

- Radvansky, G. A., & Zacks, R. T. (1991). Mental models and the fan effect. *Journal of Experimental Psychology: Learning, Memory & Cognition*, 17(5), 940-953.
- Ratcliff, R., Clark, S. E., & Shiffrin, R. M. (1990). The list-strength effect: I. Data and discussion. *Journal of Experimental Psychology: Learning, Memory & Cognition*, 16(2), 163-178.
- Reder, L. M. (1987). Strategy selection in question answering. *Memory and Cognition*, 19, 90-138.
- Reder, L. M. (1988). Strategic control of retrieval strategies. In G. H. Bower (Ed.), *The psychology of learning and motivation: Advances in research and theory* (Vol. 22, pp. 227-259). San Diego: Academic Press.
- Reder, L. M., & Ritter, F. E. (1992). What determines initial feeling of knowing? Familiarity with question terms, not with the answer. *Journal of Experimental Psychology: Learning, Memory & Cognition*, 18, 435-451.
- Riemann, R., & Angleitner, A. (1993). Inferring interpersonal traits from behaviour: Act prototypicality versus conceptual similarity of trait concepts. *Journal of Personality and Social Psychology*, 64(3), 356-364.
- Robinson, M. D., & Johnson, J. T. (1996). Recall memory, recognition memory and the eyewitness confidence-accuracy correlation. *Journal of Applied Psychology*, 81, 587-594.
- Roediger, H. L. (1974). Inhibiting effects of recall. *Memory & Cognition*, 2(2), 261-269.
- Roediger, H. L. (1978). Recall as a self-limiting process. *Memory & Cognition*, 6(1), 54-63.
- Roediger, H. L., & Neely, J. H. (1982). Retrieval blocks in episodic and semantic memory. *Canadian Journal of Psychology*, 36(2), 213-242.
- Roediger, H. L., & Schmidt, S. R. (1980). Output interference in the recall of categorised and paired associate lists. *Journal of Experimental Psychology: Human Learning and Memory*, 6(1), 91-105.

- Roediger, H. L., Stollon, C., & Tulving, E. (1977). Inhibition from part-set cues and rates of recall. *Journal of Experimental Psychology: Human Learning and Memory*, 3(2), 174-188.
- Ross, L. (1977). The intuitive psychologist and his shortcomings: Distortions in the attribution process. In L. Berkowitz (Ed.), *Advances in Experimental Social Psychology* (Vol. 10, pp. 173-220). New York: Academic Press.
- Rozin, P., & Royzman, E. B. (2001). Negativity bias, negativity dominance, and contagion. *Personality and Social Psychology Review*, 5, 296-320.
- Rudoy, J. D., & Paller, K. A. (2009). Who can you trust? Behavioural and neural differences between perceptual and memory-based influences. *Frontiers in Human Neuroscience*, 3, 1-6.
- Rundus, D. (1973). Negative effects of using list items as recall cues. *Journal of Verbal Learning and Verbal Behaviour*, 12(1), 43-50.
- Rusted, J. M., & Alvares, T. (2008). Nicotine effects on retrieval-induced forgetting are not attributable to changes in arousal. *Psychopharmacology*, 196(1), 83-92.
- Sahakyan, L., & Kelley, C. M. (2002). A contextual change account of the directed forgetting effect. *Journal of Experimental Psychology: Learning, Memory & Cognition*, 28(6), 1064-1072.
- Said, C. P., Baron, S., & Todorov, A. (2009). Nonlinear amygdala response to face trustworthiness: Contributions of high and low spatial frequency information. *Journal of Cognitive Neuroscience*, 21(3), 519-528.
- Sanbonmatsu, D. M., Sherman, S. J., & Hamilton, D. L. (1987). Illusory correlation in the perception of individuals and groups. *Social Cognition*, 5, 1-25.
- Saunders, J. (2003). Inhibitory processes in the misinformation effect: Negative consequences of an adaptive process. *Unpublished Ph.D. Thesis*. University of St. Andrews, Scotland, UK.

References

- Saunders, J., & MacLeod, M. D. (2002). New evidence on the suggestibility of memory: The role of retrieval-induced forgetting in misinformation effects. *Journal of Experimental Psychology: Applied*, 8(2), 127-142.
- Saunders, J., & MacLeod, M. D. (2006). Can inhibition resolve retrieval competition through the control of spreading activation? *Memory & Cognition*, 34(2), 307-322.
- Saunders, J., Fernandes, M., & Kosnes, L. (2009). Retrieval-induced forgetting and mental imagery. *Memory & Cognition*, 37(6), 819-828.
- Scheid, K. (1993). *Helping students become strategic learners: Guidelines for teaching*. Cambridge, MA: Brookline Books.
- Schnotz, W. (1992). Cognitive procedures in knowledge restructuring. *International Journal of Psychology*, 27(3-4), 108.
- Schwartz, B. L. (1994). Sources of information in metamemory: Judgments of learning and feeling-of-knowing. *Psychonomic Bulletin & Review*, 1, 357-375.
- Schwartz, B. L., & Metcalfe, J. (1992). Cue familiarity but not target retrievability enhances feeling-of-knowing judgments. *Journal of Experimental Psychology: Learning, Memory & Cognition*, 18, 1074-1083.
- Schwartz, B. L., & Perfect, T. L. (2002). Introduction: Toward an applied metacognition. In T. J. Perfect, & B. L. Schwartz (Eds.), *Applied Metacognition* (pp. 1-14). Cambridge University Press.
- Schwartz, B. L., & Smith, S. M. (1997). The retrieval of related information influences tip-of-the-tongue states. *Journal of Memory and Language*, 36, 68-86.
- Secord, P. F. (1958). Facial features and inference processes in interpersonal perception. In R. Tagiuri, & L. Petrullo (Eds.), *Person perception and interpersonal behaviour* (pp. 300-315). Stanford, CA: Stanford University Press.
- Shaw, J. S., Bjork, R. A., & Handal, A. (1995). Retrieval-induced Forgetting in an Eyewitness-Memory Paradigm. *Psychonomic Bulletin and Review*, 2(2), 249-253.

- Shepherd, J. (1989). The face and social attribution. In A. W. Young, & H. D. Ellis (Eds.), *Handbook of research on face processing* (pp. 289-320). Elsevier Science Publishers.
- Sherman, J. W., & Klein, S. B. (1994). The development and representation of personality impressions. *Journal of Personality and Social Psychology*, *67*, 972-983.
- Skowronski, J. J., & Carlston, D. E. (1987). Social judgment and social memory: The role of cue diagnosticity in negativity, positivity, and extremity biases. *Journal of Personality and Social Psychology*, *52*(4), 689-699.
- Skowronski, J. J., & Carlston, D. E. (1989, Jan). Negativity and extremity biases in impression formation: A review of explanations. *Psychological Bulletin*, *105*(1), 131-142.
- Slamecka, N. J. (1968). An examination of trace storage in free recall. *Journal of Experimental Psychology*, *76*(4), 504-513.
- Slamecka, N. J. (1975). Intralist cuing of recognition. *Journal of Verbal Learning and Verbal Behaviour*, *14*(6), 630-637.
- Sloman, S. A., Bower, G. H., & Roher, D. (1991). Congruency effects in part-list cuing inhibition. *Journal of Experimental Psychology: Learning, Memory & Cognition*, *17*(5), 974-982.
- Smith, E. E., Adams, N., & Schorr, D. (1978). Fact retrieval and paradox of interference. *Cognitive Psychology*, *10*(4), 438-464.
- Smith, E. R., & Zárate, M. A. (1992). Exemplar-based model of social judgment. *Psychological Review*, *99*, 3-21.
- Smith, R. E., & Hunt, R. R. (2000). The influence of distinctive processing on retrieval-induced forgetting. *Memory and Cognition*, *28*(4), 503-508.
- Son, L. K., & Metcalfe, J. (2000). Metacognitive and control strategies in study-time allocation. *Journal of Experimental Psychology: Learning, Memory & Cognition*, *26*, 204-221.

References

- Son, L. K., & Schwartz, B. L. (2002). The relation between metacognitive monitoring and control. In T. J. Perfect, & B. L. Schwartz (Eds.), *Applied Metacognition* (pp. 15-38). Cambridge University Press.
- Soriano, M. F., Jimenez, J. F., Roman, P., & Bajo, M. T. (2009). Inhibitory processes in memory are impaired in schizophrenia: Evidence from retrieval-induced forgetting. *British Journal of Psychology*, *100*, 661-673.
- Spitzer, B., & Bäuml, K.-H. (2007). Retrieval-induced forgetting in item recognition: Evidence for a reduction in general memory strength. *Journal of Experimental Psychology: Learning, Memory & Cognition*, *33*(5), 863-875.
- Spitzer, B., & Bäuml, K.-H. (2009). Retrieval-induced forgetting in a category recognition task. *Journal of Experimental Psychology: Learning, Memory & Cognition*, *35*(1), 286-291.
- Spitzer, B., Hanslmayr, S., Opitz, B., Mecklinger, A., & Bäuml, K.-H. (2009). Oscillatory correlates of retrieval-induced forgetting in recognition memory. *Journal of Cognitive Neuroscience*, *21*(5), 976-990.
- Strull, T. K., & Wyer, R. S. (1979). The role of category accessibility in the interpretation of information about persons: Some determinants and implications. *Journal of Personality and Social Psychology*, *37*, 1660-1672.
- Starns, J., & Hicks, J. L. (2004). Episodic generation can cause semantic forgetting: Retrieval-induced forgetting of false memories. *Memory & Cognition*, *32*(4), 602-609.
- Stone, N. J. (2000). Exploring the relationship between calibration and self-regulated learning. *Educational Psychology Review*, *12*(4), 437-475.
- Storm, B. (2010). Retrieval-induced forgetting and the resolution of competition. In A. S. Benjamin (Ed.), *Successful Remembering and Successful Forgetting: A Festschrift in honour of Robert A. Bjork* (pp. 89-105). New York: NY: Psychology Press.
- Storm, B. C., & Nestojko, J. F. (2010). Successful inhibition, unsuccessful retrieval: Manipulating time and success during retrieval practice. *Memory*, *18*(2), 99-114.

- Storm, B. C., & White, H. A. (2010). ADHD and retrieval-induced forgetting: Evidence for a deficit in the inhibitory control of memory. *Memory, 18*(3), 265-271.
- Storm, B. C., Bjork, E. L., & Bjork, R. A. (2005). Social metacognitive judgments: The role of retrieval-induced forgetting in person memory and impressions. *Journal of Memory and Language, 52*(4), 535-550.
- Storm, B. C., Bjork, E. L., & Bjork, R. A. (2006). Is retrieval success a necessary condition for retrieval-induced forgetting? *Psychonomic Bulletin & Review, 13*(6), 1023-1027.
- Storm, B. C., Bjork, E. L., & Bjork, R. A. (2007). When intended remembering leads to unintended forgetting. *Quarterly Journal of Experimental Psychology, 60*(7), 909-915.
- Storm, B. C., Bjork, E. L., & Bjork, R. A. (2008). Accelerated relearning after retrieval-induced forgetting: The benefit of being forgotten. *Journal of Experimental Psychology: Learning, Memory & Cognition, 34*(1), 230-236.
- Strack, F., & Mussweiler, T. (1997). Explaining the enigmatic anchoring effect: Mechanisms of selective accessibility. *Journal of Personality and Social Psychology, 73*, 437-446.
- Susskind, J., Maurer, K., Thakkar, V., Hamilton, D. L., & Sherman, J. W. (1999). Perceiving individuals and groups: Expectancies, dispositional inferences and causal attributions. *Journal of Personality and Social Psychology, 76*(2), 181-191.
- Tandoh, K., & Naka, M. (2007). Durability of retrieval-induced forgetting. *Shinrigaku Kenkyu, 78*(3), 310-315.
- Todorov, A., & Duchaine, B. (2008). Reading trustworthiness in faces without recognising faces. *Cognitive Neuropsychology, 25*, 395-410.
- Todorov, A., & Engell, A. D. (2008). The role of the amygdala in implicit evaluation of emotionally neutral faces. *Social Cognitive and Affective Neuroscience, 3*(4), 303-312.

References

- Todorov, A., Baron, S., & Oosterhof, N. N. (2008a). Evaluating face trustworthiness: A model based approach. *Social, Cognitive and Affective Neuroscience*, 3, 119-127.
- Todorov, A., Pakrashi, M., & Oosterhof, N. N. (2009). Evaluating faces on trustworthiness after minimal time exposure. *Social Cognition*, 27(6), 813-833.
- Todorov, A., Said, C. P., Engell, A. D., & Oosterhof, N. N. (2008b). Understanding evaluation of faces on social dimensions. *Trends in Cognitive Sciences*, 12, 455-460.
- Todorov, A., Said, C., & Verosky, S. (in press). Personality impressions from facial appearance. In *Oxford handbook of face perception*. Oxford University Press.
- Todres, A. K., & Watkins, M. J. (1981). A part-set cuing effect in recognition memory. *Journal of Experimental Psychology: Human Learning and Memory*, 7(2), 91-99.
- Tomlinson, T. D., Huber, D. E., Riethb, C. A., & Davelaarc, E. J. (2009). An interference account of cue-independent forgetting in the no-think paradigm. *Proceedings of the National Academy of Sciences*, 106(37), 15588-15593.
- Tormala, Z. L., & Petty, R. E. (2001). On-line versus memory-based processing: The role of "need to evaluate" in person perception. *Personality and Social Psychology Bulletin*, 27, 1599-1612.
- Tsukimoto, T., & Kawaguchi, J. (2004). Study of the inhibitory mechanism in retrieval-induced forgetting with the explicit/implicit memory paradigm. *Shinrigaku Kenkyu*, 75(2), 125-133.
- Tulving, E., & Arbuckle, T. Y. (1963). Sources of intratrial interference in immediate recall of paired associates. *Journal of Verbal Learning and Verbal Behaviour*, 1, 321-334.
- Tulving, E., & Thomson, D. M. (1973). Encoding specificity and retrieval processes in episodic memory. *Psychological Review*, 80(5), 352-373.
- Tversky, A., & Kahneman, D. (1973). Availability: A heuristic for judging frequency and probability. *Cognitive Psychology*, 5(2), 677-695.

- Tversky, A., & Kahneman, D. (1974). Judgement under uncertainty: Heuristics and biases. *Science*, *185*, 1124-1130.
- Underwood, B. J. (1948a). 'Spontaneous Recovery' of verbal associations. *Journal of Experimental Psychology*, *38*, 429-439.
- Underwood, B. J. (1948b). Retroactive and proactive inhibition after five and forty-eight hours. *Journal of Experimental Psychology*, *38*, 29-38.
- Underwood, B. J. (1965). False recognition produced by implicit verbal responses. *Journal of Experimental Psychology*, *70*(1), 122-129.
- Underwood, B. J. (1966). Individual and group predictions of item difficulty for free learning. *Journal of Experimental Psychology*, *71*, 673-679.
- van 't Wout, M., & Sanfey, A. G. (2008). Friend or foe: The effect of implicit trustworthiness judgements in social decision-making. *Cognition*, *108*(3), 796-803.
- Veenman, M. V., Van Hout-Wolters, B. H., & Afflerbach, P. (2006). Metacognition and learning: Conceptual and methodological considerations. *Metacognition and Learning*, *1*, 3-14.
- Veling, H., & van Knippenberg, A. (2004). Remembering can cause inhibition. Retrieval-induced inhibition as a cue independent process. *Journal of Experimental Psychology: Learning, Memory & Cognition*, *30*(2), 315-318.
- Vernon, D., & Usher, M. (2003). Dynamics of metacognitive judgments: Pre- and post-retrieval mechanisms. *Journal of Experimental Psychology: Learning, Memory & Cognition*, *29*, 339-346.
- Watkins, M. J. (1975). Inhibition in recall with extralist "cues". *Journal of Verbal Learning and Verbal Behaviour*, *14*(3), 294-303.
- Watkins, M. J. (1978). Engrams and cuegrams and forgetting as cue-overload: A cueing approach to the structure of memory. In C. R. Puff (Ed.), *The Structure of Memory* (pp. 347-372). New York: Academic Press.

References

- Watkins, M. J., & Gardiner, J. M. (1982). Cued Recall. In C. R. Puff (Ed.), *Handbook of research methods in human memory and cognition* (pp. 173-195). New York: Academic Press.
- Wegener, D. T., Petty, R. E., Blankenship, K. L., & Detweiler-Bedell, B. (2010). Elaboration and numerical anchoring: Implications of attitude theories for consumer judgement and decision making. *Journal of Consumer Psychology, 20*, 5-16.
- Wegener, D. T., Petty, R. E., Detweiler-Bedell, B., & Jarvis, W. B. (2001). Implications of attitude change theories for numerical anchoring: Anchor plausibility and the limits of anchor effectiveness. *Journal of Experimental Social Psychology, 37*, 62-69.
- Wegner, D. M., Schneider, D. J., Carter, S. R., & White, T. L. (1987). Paradoxical effects of thought suppression. *Journal of Personality and Social Psychology, 53*, 5-13.
- Wells, G. L., & Murray, D. M. (1984). Eyewitness confidence. In G. L. Wells, & E. F. Loftus (Eds.), *Eyewitness Testimony: Psychological Perspectives* (pp. 155-170). New York: Cambridge University Press.
- Wells, G. L., Lindsay, R. C., & Ferguson, T. J. (1979). Accuracy, confidence and juror perceptions in eyewitness identification. *Journal of Applied Psychology, 64*, 440-448.
- Wessel, I., & Hauer, B. J. (2006). Retrieval-induced forgetting of autobiographical memory details. *Cognition & Emotion, 20*(3-4), 430-447.
- Whitmer, A. J., & Banich, M. T. (2010). Trait rumination and inhibitory deficits in long-term memory. *Cognition & Emotion, 24*(1), 168-179.
- Williams, C. C., & Zacks, R. T. (2001). Is retrieval-induced forgetting an inhibitory process? *American Journal of Psychology, 114*(3), 329-354.
- Willis, J., & Todorov, A. (2006). First impressions: Making up your mind after 100 ms exposure to a face. *Psychological Science, 17*, 592-598.

- Wilson, T. D., Houston, C. E., Etlong, K. M., & Brekke, N. (1996). A new look at anchoring effects: Basic anchoring and its antecedents. *Journal of Experimental Psychology: General*, *125*, 387-402.
- Wimber, M., Bäuml, K.-H., Bergstrom, Z., Markopoulos, G., Heinze, H. J., & Richardson-Klavehn, A. (2008). Neural markers of inhibition in human memory retrieval. *Journal of Neuroscience*, *28*(50), 13419-13427.
- Wimber, M., Rutschmann, R. M., Greenlee, M. W., & Bäuml, K.-H. (2009). Retrieval from episodic memory: Neural mechanisms of interference resolution. *Journal of Cognitive Neuroscience*, *21*(3), 538-549.
- Winkielman, P., Schwarz, N., Fazendeiro, T. A., & Reber, R. (2003). The hedonic marking of processing fluency: Implications for evaluative judgment. In J. Musch, & K. C. Klauer (Eds.), *The psychology of evaluation: Affective processes in cognition and emotion* (pp. 189-217). Mahwah, NJ: Erlbaum.
- Winman, A., & Juslin, P. (2005). "I'm m/n confident that I'm correct": Confidence in foresight and hindsight as a sampling probability. In K. Fiedler, & P. Juslin (Eds.), *Information sampling and adaptive cognition* (pp. 440-456). Cambridge, UK: Cambridge University Press.
- Winne, P. H. (1996). A metacognitive view of individual differences in self-regulated learning. *Learning and Individual Differences*, *8*(4), 327-353.
- Winne, P. H. (2001). Self-regulated learning viewed from models of information processing. In B. J. Zimmerman, & D. H. Schunk (Eds.), *Self-regulated learning and academic achievement: Theoretical perspective* (pp. 153-189). New York: Longman.
- Winne, P. H., & Jamieson-Noel, D. (2002). Exploring students' calibration of self-reports about study tactics and achievement. *Contemporary Educational Psychology*, *27*, 551-557.

References

- Winston, J., Strange, B., O'Doherty, J., & Dolan, R. (2002). Automatic and intentional brain responses during evaluation of trustworthiness of faces. *Nature Neuroscience*, 5, 277-283.
- Wyer, R. S., & Srull, T. K. (1989). *Memory and cognition in its social context*. Hillsdale, NJ: Erlbaum.
- Yzerbyt, V. Y., Lories, G., & Dardenne, B. (Eds.). (1998). *Metacognition: Cognitive and social dimensions*. Thousand Oaks, CA: Sage.
- Zebrowitz, L. A., Voinescu, L., & Collins, M. A. (1996). "Wide-eyed" and "crooked-faced": Determinants of perceived and real honesty across the life span. *Personality and Social Psychology Bulletin*, 22, 1258-1269.
- Zellner, M., & Bäuml, K.-H. (2005). Intact retrieval inhibition in children's episodic recall. *Memory & Cognition*, 33(3), 396-404.

APPENDIX I

Four target pictures and names used in Experiment 1



JOHN



RYAN



JANE



KATE

APPENDIX II

List of traits and their associated likeability rating (Anderson, 1968) used in Experiments 1 and 4

Neutral	L. Rating	Positive	L. Rating	Negative	L. Rating
Forgetful	224	Trustful	504	Phony	27
Emotional	283	Helpful	492	Rude	76
Choosy	272	Honest	555	Jealous	104
Dependent	254	Kind	520	Greedy	72
Proud	358	Happy	514	Annoying	84
Average	284	Humourous	505	Conceited	74
Talkative	352	Clever	496	Nosey	102
Critical	243	Gentle	503	Mean	37
Blunt	287	Loyal	547	Selfish	82
Aggressive	304	Friendly	519	Shallow	118
Cautious	334	MEAN	515.5	MEAN	77.6
Bold	336				
Quiet	311				
Shy	291				
Moderate	351				
Lucky	352				
Excitable	317				
Persuasive	374				
Timid	222				
Bashful	279				
MEAN	301.4				

APPENDIX III

Four (two honest and two dishonest) target pictures and names used in Experiments 2A, 2B and 4



JOHN
(DISHONEST TARGET)



RYAN
(HONEST TARGET)



JANE
(DISHONEST TARGET)



KATE
(HONEST TARGET)

APPENDIX IV

List of traits and their associated likeability rating (Anderson, 1968) used in experiments 2A and 2B

Neutral	Likeability Rating
Tense	215
Casual	411
Ordinary	266
Proud	358
Average	284
Blunt	287
Cautious	334
Quiet	311
Moderate	351
Timid	222
MEAN	303.9

Negative	Likeability Rating
Liar	26
Rude	76
Malicious	52
Greedy	72
Insincere	66
Conceited	74
Cruel	40
Mean	37
Selfish	82
Spiteful	72
MEAN	59.7

APPENDIX V

List of traits and their associated likeability rating (Anderson, 1968) used in Experiment 3

Neutral	L. Rating	Positive	L. Rating	Negative	L. Rating
Casual	411	Sincere	573	Rude	76
Consistent	411	Understanding	549	Insolent	78
Orderly	399	Dependable	536	Heartless	78
Serious	379	Considerate	527	Underhanded	86
Ordinary	266	Warm	522	Offensive	88
Normal	362	Responsible	505	Hostile	91
Moderate	351	Clever	496	Ill-mannered	95
Reserved	348	Efficient	482	Impolite	103
Prudent	348	Competent	447	Prejudiced	106
Persistent	347	Modest	428	Disagreeable	134
Average	284	MEAN	506.5	MEAN	93.5
Conventional	260				
Meek	238				
Passive	223				
Talkative	352				
Blunt	287				
Quiet	311				
Shy	291				
Lucky	358				
Persuasive	374				
MEAN	330				

APPENDIX VI

Experiment 4 recall test: This is a word fragment completion task. Words will be presented with some letters missing. The aim of the task is to fill in the missing letters to form words. Only some of the word fragments relate to traits that you studied during the experiment about the 4 targets.

- | | |
|----------------------|-----------------------|
| 1. C _ O _ S _ | 41. _ U _ O _ ROUS |
| 2. D _ EN _ ANT | 42. T _ N _ R _ N _ |
| 3. PRO _ _ | 43. S _ _ W _ _ _ _ Y |
| 4. _ E _ F _ _ | 44. M _ L _ R _ _ |
| 5. _ _ ND | 45. M _ G _ _ |
| 6. _ A _ P _ | 46. B _ _ N _ |
| 7. TA _ _ ATI _ E | 47. _ ONE _ T |
| 8. _ R _ TI _ AL | 48. E _ _ P _ N _ |
| 9. _ L _ NT | 49. E _ OT _ O _ AL |
| 10. A _ RE _ SI _ E | 50. W _ _ S _ _ T _ H |
| 11. C _ E _ ER | 51. S _ AL _ O _ |
| 12. _ EN _ LE | 52. C _ F _ _ _ NK _ |
| 13. _ O _ AL | 53. E _ _ R _ G _ |
| 14. H _ G _ H _ G | 54. B _ _ C _ L _ _ |
| 15. B _ _ T _ E | 55. P _ _ R _ _ |
| 16. _ A _ TI _ US | 56. PE _ S _ ASI _ E |
| 17. _ OL _ | 57. C _ NCE _ _ ED |
| 18. B _ _ KB _ _ D | 58. _ O _ ET _ UL |
| 19. _ U _ ET | 59. J _ _ G _ _ |
| 20. _ H _ | 60. P _ R _ _ _ G _ L |
| 21. MO _ E _ AT _ | 61. _ RI _ N _ LY |
| 22. P _ _ NE _ | 62. C _ _ T _ N |
| 23. N _ _ _ R Y | 63. C _ _ _ N _ L |
| 24. _ EALO _ _ | 64. L _ G _ T _ |
| 25. _ UC _ Y | 65. A _ ERA _ E |
| 26. E _ _ I _ A _ LE | 66. E _ _ _ GN |
| 27. B _ S _ FU _ | 67. PR _ _ T |
| 28. NO _ E _ | 68. B _ H _ |
| 29. _ E _ N _ | 69. _ REE _ Y |
| 30. S _ _ K _ | 70. M _ _ K _ |
| 31. G _ _ T _ _ | 71. U _ _ L _ L _ |
| 32. T _ _ ID | 72. D _ _ C _ N |
| 33. A _ NO _ IN _ | 73. R _ _ N |
| 34. V _ _ L _ _ | 74. F _ _ H |
| 35. S _ L _ I _ _ | 75. P _ _ S _ NT |
| 36. S _ _ _ R | 76. H _ R _ _ |
| 37. T _ _ _ P _ T | 77. S _ U _ R _ _ |
| 38. D _ _ M _ | 78. W _ _ _ _ |
| 39. O _ _ NG _ | 79. G _ K _ |
| 40. R _ _ E | 80. _ RU _ T _ UL |

APPENDIX VII

List of traits and their associated likeability ratings used in Experiments 5A – 5D (M.C.
Anderson, 1968)

NEUTRAL	L. Rating	NEGATIVE	L. Rating	POSITIVE	L. Rating
Casual	411	Cruel	40	Kind	520
Ordinary	266	Offensive	88	Helpful	492
Prudent	348	Mean	.37	Clever	496
Normal	362	Impolite	103	Loyal	547
Shy	291	Insincere	66	Friendly	519
Moderate	351	Prejudiced	106	Sincere	573
Blunt	287	Selfish	82	Understanding	549
Passive	223	Rude	76	Warm	522
Average	284	Heartless	78	Efficient	482
Quiet	311	Liar	26	Modest	428
MEAN	313.4	MEAN	66.5	MEAN	512.8